ANALYSES AND PROJECTIONS OF ECONOMIC DEVELOPMENT

VI

THE INDUSTRIAL DEVELOPMENT OF PERU

UNITED NATIONS

ANALYSIS AND PROJECTIONS OF ECONOMIC DEVELOPMENT

VI. The Industrial Development of Peru

Prepared by the Secretariat of the Economic Commission for Latin America

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PRELIMINARY NOTE

The present study was initiated in response to a request expressly formulated by the Government of Peru and taken up with particular interest by the secretariat of the Economic Commission for Latin America, not only because of the request itself but also because, in carrying it out, the secretariat was complying with several resolutions adopted by ECLA at its various sessions.[1]

At the end of 1956, the Government invited the Executive Secretary of ECLA and other senior officials of the United Nations to investigate, in conjunction with the Peruvian authorities and representatives of private institutions in Peru, the possibilities of obtaining more assistance from the United Nations in analysing the problems of the Peruvian economy, with special reference to industrialization and its prospects. As a result of these conversations, the Government asked ECLA to send a group of specialists in industrial development to Peru. It also applied to the Technical Assistance Administration for the help of several experts in specific aspects of industry to work in close contact with the ECLA Group, and to the United Nations Food and Agriculture Organization for the co-operation of specialists in agricultural problems.

During 1957, several members of the ECLA secretariat staff proceeded to Peru. There they spent as much time as was essential for the fulfilment of their respective assignments. Direct contact was thus established, *inter alia*, with many leading figures in both the public and private sectors. The group paid visits to a large number of industrial establishments and was thus able to profit from the experience and knowledge of industrialists themselves. The group likewise had access to studies and background information prepared or compiled by various institutions (governmental, parastatal and connected with private enterprises and associations). All these data and opinions were then systematically classified and analysed at the headquarters of the Commission for the purpose of drafting a provisional draft of the study which was submitted to Peruvian industrialists and other specialists for discussion and comment. Several changes were made in the study on the basis of their opinions and are incorporated in the present version.

From the outset, the secretariat bore in mind two circumstances, by virtue of which the report's possible interest for officials and entrepreneurs in the country immediately concerned could be extended to a wider circle through the inclusion of certain experiences that might be of value to other Latin American countries.

In the first place, the conditions attending Peru's industrial development, at any rate during the last eight years of the period considered, were rather unusual for a Latin American country. As from 1949, Peru's economic policy was characterized by a marked tendency towards the liberalization of foreign trade, accompanied by a highly simplified exchange system, a relatively moderate customs tariff and a very limited use of other forms of import controls and restrictions. It therefore seemed of general interest to analyse the characteristics of industrial growth under these conditions in fuller detail. The second circumstance—admittedly of much more limited interest—relates to specific aspects of the methods which the ECLA secretariat has been applying in its studies of the Latin American economies. While most of the earlier country studies [2] comprised an analysis of the economy as a whole and of each of its main sectors, this time the specific pattern of development of manufacturing industry was to be examined. But the methods so far applied had shown that it was impossible to form a proper impression of the growth and outlook of any given sector in isolation, without reference to over-all problems, and the necessary steps had to be taken to determine what was the minimum additional research that would be required in this particular case, where the main concern was industry.

It was probably this latter aim that gave rise to most of the practical problems encountered in the course of the research. Even when the limitations of the available statistical information on industry—among which special mention must be made of the lack of an industrial census—were successfully overcome by means of indirect methods and estimates, difficulties were created by the serious gaps in the background data to hand on a number of other key aspects of the Peruvian economy.[3] It is therefore not surprising that much of the time spent on this research had to be devoted to the preparation of purely statistical instruments and data. For the same reason, the present study includes two statistical annexes, detailing the sources and methods utilized for the corresponding estimates, so that

1 See in particular resolution 48 (V).

2 See the studies on Colombia (E/CN.12/365/Rev.1), Brazil (E/CN.12/364/Rev.1), Bolivia (E/CN.12/430 and Add.1) and Argentina (E/CN.12/429) in the series *Analyses and projections of economic development*, prepared by the secretariat.

3 It is sufficient to mention, *inter alia*, the fact that there are no demographic statistics to show urban and rural population trends, nor employment statistics whereby changes in the distribution of the labour course by activities could be traced; the lack of estimates of the evolution of national income in real terms; the want of quantum indices of production in industry and other sectors; the absence of estimates of the stock of capital in the Peruvian economy, etc.

these can more easily be revised, corrected and brought up to date by research workers in a position to follow the phenomena concerned more closely.

Many of these difficulties would have been insuperable but for the generous co-operation which the secretariat officials met with in a wide variety of circles in Peru. The Ministry of Finance offered not only material facilities in the shape of offices and secretariat staff, but also the timely assistance and technical advice of its highest-ranking officials. The National Industrial Association *(Sociedad Nacional de Industrias)* actively collaborated in the whole of the preparatory phase of the study, organized meetings between the secretariat officials and groups of industrialists representing the most important branches of manufacturing activity and facilitated first-hand visits to numerous establishments, in addition to the invaluable direct assistance rendered by its permanent staff. Much of the study is based on the background research on Peru's national income which the *Banco Central de Reserva* has been systematically carrying out; furthermore, the officials of this institution were always ready to supply additional information, including unpublished material, and generously gave their time to discussing numerous problems with the members of the secretariat group. The preparation of some of the basic statistics utilized in the study was possible thanks to the co-operation of the National Statistical Service *(Dirección Nacional de Estadística)*, especially its Mathematical Statistics and Research Department; the population estimates and quantum indices of industrial production constituting the statistical appendices attached to the present text are the outcome of this collaboration. Aggregate statistics on registered industry are almost exclusively based on the tabulations prepared by the Department of Industry and Electricity of the Ministry of Development, whose officials were always ready to add considerably to such data as are periodically tabulated, in order to provide as complete and detailed a picture as could reasonably be expected from the industrial statistics available for 1955. No less generous was the help afforded by the *Banco Industrial del Perú* and many other official agencies. The most important part of the study—that dealing strictly with the current situation and prospects of the principal branches of industry—could not have been carried out without the unfailing co-operation of enterpreneurs, who not only arranged for visits to their establishments but whose opinions also contributed to a better planning of the study and a more accurate appraisal of the problems of industry. Lastly, the secretariat officials benefited from the personal contacts—only one facet of the generous co-operation they received—which they were able to establish with a number of Peruvian professionals, university professors and students of the Peruvian economy.

The present study is also largely the result of close collaboration between the ECLA secretariat officials and the experts of the United Nations Technical Assistance Administration and Food and Agriculture Organization stationed in Peru. The initial over-all impressions which the members of the ECLA staff were able to formulate at the outset of their mission facilitated the demarcation of specific fields in which the intervention of technical assistance seemed most urgently necessary and most likely to be beneficial. They also provided a general background against which the work of experts visiting the country as a result of these recommendations could be better planned; in its turn, the present study embodies many of the findings of the more detailed research subsequently carried out by the experts in question.[4]

It will probably be useful to stress the ultimate aim of this report, which is confined to a preliminary examination of the development and prospects of Peruvian industry. The relatively long sections analysing other over-all aspects were included solely because industry must necessarily be studied in relation to the basic problems of the Peruvian economy, rather than in isolation from other economic activities. Hence, the only purpose of such sections is to provide a general background against which the position of the industrial sector can be more satisfactorily visualized. The analysis is therefore far from complete, and the statistical instruments used are limited and subject to fairly wide margins of error.

In essence, apart from its possible interest from a purely descriptive standpoint and as a survey of past experience, the study aims at assembling the necessary data on which to base the answer to three questions: *(a)* at what rate would Peruvian industry have to grow in the future for its development to prove compatible with the satisfactory growth of the economy as a whole?; *(b)* what changes would have to take place in the composition of industrial production, in terms of the greater or lesser development of given branches or specific sectors of manufacturing activity?; and *(c)* by what means, with what resources, and through what improvements on the nature and method of utilization of the resources at present employed could the industrial growth and changes in composition referred to be achieved?

The first of these questions cannot be answered without fairly accurate knowledge of the lines along which the Peruvian economy has been developing in recent years, of the main factors which have stimulated or retarded its growth and of their probable behaviour. On this basis certain alternative hypotheses can be formulated as to the possible rate of growth, in the light of which industrialization requirement can be assessed. In view of the present characteristics of the Peruvian economy, such requirements might derive from the contribution that industry would be called upon to make in order to raise the over-all level of *per capita* income; from the prospects relating to the capacity to import and the demand for imports, that

[4] Particularly so in the case of the sections of the study dealing with chemicals, textiles and forest products.

is, from the greater or lesser degree of intensity which will presumably characterize the import substitution problem; and last, but not least, from the predictable growth of the labour force and the capacity of industry and other sectors to provide the necessary opportunities of productive employment for the steady increase in the active population. These three factors, which are of course closely interrelated, may be considered up to a point as the key elements for estimating the rate of future industrial growth compatible with a reasonably ambitious improvement in the living conditions of the population.

The changes in the composition of industrial production which would have to accompany the growth of industry as a whole are essentially dependent upon the characteristics of demand for the various types of manufactured goods, as well as upon the opportunities offered in the different industrial branches for the economic substitution of domestic production for manufactured goods at present imported.

Consequently, a careful examination must be made of the present composition of Peruvian industry and of the relative shares of domestic production and imports in total supplies of each type of manufactured goods needed to meet the country's current requirements, while future demand for these goods must be projected in terms of the over-all rate of growth and import prospects.

Finally, the third question has a specific bearing on the actual measures that would have to be adopted in order to ensure the growth and qualitative changes deemed necessary for the industrial sector. The study does not aim, however, at giving a conclusive list of measures to be adopted or at defining specific patterns. What it does attempt is to identify some of the existing shortcomings and demarcate possible fields of action, where it will be the experience of industrialists themselves and of the Peruvian authorities that will best be able to indicate the appropriate measures. Accordingly, an attempt is made to evaluate industry's working capital resources; the extent to which they are efficiently utilized; the factors that may account for deficiencies in this respect; the various techniques applied and their bearing on current production levels; the employment, training and productivity of manpower; and the factors by which such productivity is affected. Finally, consideration is given to the whole set of components making up the environment in which industrial growth takes place. These include, in particular, tax and credit policy, the patterns and purport of protectionist policy, methods of financing the development of manufacturing enterprises, etc.

Even at the risk of presenting an over-simplified picture, it seems desirable, prior to the analysis proper, to make a brief summary of the contents and main conclusions of the study which will be discussed in detail in the subsequent chapters, and at the same time, to include some of the principal observations referring to the preliminary version of the study, which were made when it was submitted to a series of round-table discussions attended by Peruvian industrialists and other specialists, even though many others, which helped to improve certain parts of the analysis or to correct errors, are not mentioned specifically.

SUMMARY AND PRINCIPAL CONCLUSIONS

I. GENERAL PROBLEMS RELATING TO INDUSTRIAL DEVELOPMENT AND THE ECONOMY AS A WHOLE

Main characteristics of the economy in 1955

In 1955, Peru's economy showed the characteristics typical of an undeveloped country. The level of *per capita* income (some 190 dollars annually) probably represented no more than two thirds of the Latin American average. About 60 per cent of the population was living in the rural areas and a similar percentage of the total labour force was engaged in agricultural activities. However, this sector, because of its relatively low productivity, generated only 30 per cent of the national income. By contrast, there was one sector of high productivity—the extractive industry—which nevertheless contributed only 7 per cent towards the national income and employed less than 2 per cent of the active population. The share of manufacturing activities as a whole in total income (17 per cent) was generated partly by industry proper, which is still relatively new, and largely by artisan types of production. In the services sector development was varied. The most important branch was trade, with a share of total income higher even than that of industry proper.

Apart from these aggregate figures, the marked contrasts in the various parts of the economy should be stressed. In fact, two different economies—that of the coastal belt and that of the sierra—exist side by side. They are linked together only to a very small extent and the differences in their *per capita* income are probably in the ratio of one to three. Similar contrasts may be observed within the productive sectors themselves. For example, a modern export agriculture is counterbalanced by a subsistence agriculture which is very backward technologically, while an efficient and concentrated industry is offset by scattered artisan activities in which four times as many persons are employed.

The relative importance of the external sector was rather high: the import coefficient reached the figure of 18 per cent. Exports amounted to some 5 100 million soles, equivalent to about 30 dollars per person, a very unfavourable figure when compared with that registered in other Latin American countries.

On the other hand, Peru enjoyed a rich supply of natural resources, a relatively high investment coefficient and a high rate of economic growth.

Economic growth during the decade 1945-55

Throughout the ten-year period between 1945 and 1955, the gross product expanded at an annual average cumulative rate of 2.9 per cent *per capita*, which compared very favourably with that registered in most Latin American countries during the same years. Its continuance would not only bring about a gradual rise in the people's level of living, but would also enable Peru to go on improving its relative position in Latin America as regards national income.

The increase in the gross product was also accompanied by certain fairly marked structural changes. The total population grew by 34 per cent, although the rural and urban increments were very different, the former being 23 per cent and the latter 52 per cent. The agricultural sector expanded its output in real terms by 47 per cent, while its relative share in the total national income fell from 33.5 to 30.2 per cent. The manufacturing industry almost doubled its volume of production but its relative share of the national income rose only slightly (from 15 to 17 per cent). The share of the extractive industries remained almost unchanged.

Other advantages allowed a still greater expansion of the goods and services available for consumption and investment. These were the terms of trade, which were positive throughout the decade, and an increase in the net influx of foreign capital which changed a surplus of exports to one of imports. (While in 1945 available goods and services came to 1 000 million soles less the gross product, in 1955 they exceeded it by more than 350 million soles.)

Another favourable factor—an appreciable improvement in the product-capital ratio—made possible an increase in the gross product without an investment effort of similar intensity. At the same time, there was a substantial contribution from foreign investment, which represented 20 per cent of aggregate investment in 1951-55.

These factors definitely enabled consumption to expand at a swifter rate than the national product: its average rate of increase was 3 per cent annually *per capita*.

The rise in the import coefficient from 13 per cent in 1945 to 18 per cent in 1955 shows that the external sector played a very dynamic role. However, the marked expansion in imports (120 per cent in real terms

throughout the decade) was not accompanied either by a favourable change in their structure or a comparable expansion of exports (only 40 per cent). The trends registered during the period also reveal a very high elasticity of demand for imported consumer goods which amounted to 2.0 over the whole period and 1.57 between 1948 and 1955. Incidentally, while manufacturing output almost doubled in real terms, its expansion was not intensive enough to increase or even maintain the share of domestic industry in the total supply of manufactures. In this sense, it is possible to speak of a relative decline in industrial growth because domestic industry did not seize all the opportunities of expansion offered by the enlargement of domestic demand.

In short, the Peruvian economy expanded very considerably between 1945 and 1955 to judge from the annual rate of increase in the gross product and in *per capita* consumption (2.9 and 3 per cent respectively). However, this expansion was the result not only of internal efforts, but also of the concurrence of certain favourable factors including a comparatively moderate rise in population, an increase in available goods and services relatively higher than that of the gross product (thus facilitating a more rapid expansion of consumption), an improvement in the terms of trade, a marked rise in the product-capital ratio and a higher import coefficient.

Development prospects for the economy as a whole

It is now pertinent to express the problem in other terms and consider whether the concurrence of such factors will be equally favourable in the future, or, otherwise, what must be done to maintain a similar rate of economic growth in the years to come.

One of the factors which seems to have changed somewhat as compared with the trends of former years is demographic growth. Between 1940 and 1955, the population increased at the average rate of just below 2 per cent per year. However, towards the end of the period, it was apparent that it was tending to grow vegetatively, mainly as a result of a fall in the death rate. According to the available data, the population should increase by about 2.5 per cent annually between 1955 and 1965. In other words, the total population in these ten years would rise by about 2.5 million and amount to almost 11.5 million in 1965. This increase in the active population would mean the addition of 1 million persons to the existing labour force. Undoubtedly, all these developments will have a marked effect upon the prospects for economic growth and will also make it harder to maintain the rate of increase in the gross product and in *per capita* consumption.

In recent years, the terms of trade have already fallen below the 1955 level. Any hypothesis which assumes that they will follow a trend similar to that of the previous decade may be considered somewhat optimistic.

Nor does there seem much hope for an eventual improvement in the product-capital ratio although it is difficult to speculate about this factor because its future magnitude depends on many conflicting elements.

Thus, considering the changes which have already taken place or which are likely to occur in the future, it seems unlikely that Peru can maintain a similar tempo and pattern of development as in the previous decade, particularly in the external sector. A significant potential deficit in the balance of payments as well as a heavy demand for foreign capital and imports are therefore to be expected.

Foreign capital needs may be more clearly appreciated with the help of some illustrative figures resulting from a series of calculations in which allowance is made for the limitation already mentioned. It may be concluded that in order to increase total consumption from 26 200 million soles in 1955 to 45 400 in 1965 (an annual *per capita* average rate of 3 per cent), with a simultaneous rise in the gross product from 32 000 to 54 600 million soles (a *per capita* growth of 2.9 per cent per year), a surplus of available goods and services of 3 780 million soles in excess of the gross product would be required. This sum could only be obtained if there were a net inflow of foreign capital.

Discounting the high import elasticity registered in the decade 1945-55 (2.0) and assuming the more moderate figure of 1.57 corresponding to the period 1948-55, the demand for imports in 1965 would still amount to some 14 000 million soles at 1955 constant prices (as compared with only 5 700 million soles in 1955).

Would it be reasonable to expect that both foreign capital and import requirements can be met? According to the information available, the total foreign capital invested in Peru amounted to some 590 million dollars in 1955. Gross investment in that year totalled about 71 million dollars and remittances abroad under various heads—amortization, profits, interest—were almost 59 million. The net inflow was thus only 12.2 million. If future prospects are assessed on the basis of the estimate made in certain circles that total foreign capital will probably amount to about 1 000 million dollars in 1965, and if the probable changes in the rates of amortization, investment and interest are rather carefully analysed, it may be concluded that a gross influx of new capital amounting to 90 million dollars will be accompanied by a net outflow of foreign capital amounting to about 28 million dollars. Only with a total capital of 1 200 million dollars and a gross investment volume greater than 100 million dollars per year would it be possible to establish a balance between total receipts and the total outflow of foreign capital. However, unless exceptional circumstances arise, it would seem that the attainment of a net inflow of 3 780 million soles is out of the question.

A study of the potential demand for imports leads to an equally negative conclusion according to the detailed projections on agricultural and mining exports

presented in the report. As regards the former, it is assumed as an initial working hypothesis, that the cultivated area could be increased by between 400 000 and 500 000 hectares, a considerable expansion over the present total of 2.5 million hectares. In view of the rise in population and its higher income level, it is estimated that the increase in the production of those goods in which Peru is now self-sufficient might require 360 000 hectares and the replacement of those imports which are at present most important (also allowing for heavier future demand) would require some 195 000 hectares. There would thus remain 140 000 hectares available for the increase in export crops, which would mean in the aggregate an expansion in production of 40 per cent over the present volume of export items. In the case of the extractive industry, the relevant estimates are based on the principal plans of the enterprises concerned. It is assumed, for example, that in 1965 exports of copper will amount to 210 000 tons, of lead 151 000, of zinc 286 000, of iron ore almost 7 millions tons, etc. This implies that the present levels of such exports would rise by 148 per cent in real terms.

In short, the volume of total exports might double between 1955 and 1965, reaching in the latter year some 10 000 million soles (at constant purchasing power equal to that of 1955). But this would still be insufficient to meet the potential demand for imports which were estimated at about 14 000 million soles.

In the light of these considerations, it seems highly unlikely that the same rate and pattern of growth as in the previous period can be maintained. Hence, the most probable hypothesis put forward in the study assumed briefly (*a*) that, as a starting point, the aim is to maintain the rate of expansion of the gross *per capita* product (2.9 per cent per year); (*b*) that an increase of the same intensity would be registered in available goods and services since additional favourable factors are not likely to arise; and (*c*) that, as a result, the increment in consumption will have to be somewhat less than the rise in the gross product (2.2 per cent annually *per capita*). In their turn, these hypotheses imply at least two requirements: (i) that the investment coefficient can be raised from 19.2 to 23.7 per cent; and (ii) that the income-elasticity of demand for imports can be reduced from 2.0 or 1.57 to only 1.2 while additional changes must be made in their structure.

Both requirements appear feasible. The investment coefficient had already reached, although in isolated years, figures very close to those indicated. To maintain them consistently at this relatively high level would undoubtedly require a strenuous effort, but it does not appear beyond Peru's possibilities. As regards the reduction in the income-elasticity of demand for imports, even in these circumstances, a somewhat more rapid increase in imports than in the gross product is assumed. In this respect, the problem in Peru is likely to be much less serious than in the other Latin American countries where the anticipated capacity to import remains far below any reasonable rate of increase in *per capita* income.

The contribution required of industrial development

The general frame of reference provided by the aggregate projections make it possible to examine with some care the possible expansion needs of the manufacturing industry in the light of the hypotheses put forward. At least two factors emerge which are of decisive importance for intensifying the industrialization process: (*a*) the role of industry in the absorption of manpower and (*b*) its contribution to import substitution.

The first factor will undoubtedly acquire considerable significance. The increase in the labour force during the next decade will be extremely large not only in absolute terms—1 million active persons—but also relatively, since it will represent an increment of 27 per cent over the present level of employment. This factor itself might constitute a serious problem which may well be aggravated by the tendency, already observable in various economic sectors, to economize manpower as far as possible. (For example, expansion plans in the mining industry provide for considerable increases in output, which in many cases will be accompanied by only a very small rise in employment.) This tendency is also to be expected in sectors which must continually strive to improve their competitive position in the world market or in those branches of domestic industry which are facing stiffer competition from imports. But it may well be asked whether, in all these cases, the relative manpower and capital resources available in Peru are ideally distributed.

The additional agricultural production necessary to meet the growth of domestic demand, to replace many of the present imports and to increase exports, may well represent an increase of 46.2 per cent over existing levels. In view of the present low level of farm productivity, the pressure of population in certain zones and the inevitable adoption of certain modern techniques, it must be admitted that some improvement in output is bound to occur. Assuming that it represents on the average 20 per cent during the ten years, agriculture would be in a position to absorb 490 000 persons, which would still leave 500 000 persons to find employment in non-agricultural activities. If industry increased its share of such activities to a very moderate extent (merely from 40.5 to 42 per cent), it would have to absorb 230 000 persons. Of these, not less than 100 000 would probably have to be engaged in industry proper, which in 1955 employed a total of just over 120 000 persons.

Its task would be no less arduous as regards import substitution needs. As will be recalled, such needs in the aggregate might amount to some 4 000 million soles by 1965. Assuming that Peru itself can meet all its agricultural requirements, except for a deficit in

wheat and a very low level of fruit imports—and bearing present petroleum prospects in mind—it may be concluded that more than three-quarters of these total substitution requirements will have to be met by manufacturing production. Considering the secondary needs which would arise from this substitution, it may be estimated that the industrial expansion required for this purpose alone would represent an output value of some 4 400 million soles or about 30 per cent of the total value of manufacturing production in 1955.

In short, remembering the need to increase employment and replace imports while at the same time bearing in mind the pressure of expanding domestic demand and the balance which must be preserved between the growth of industry as well as of other economic periods, the authors of the report concluded that the volume of industrial production would practically have to double between 1955 and 1965. For this purpose, the present stock of capital would also have to be twice as large and not less than a quarter of Peru's total gross investment would have to be channelled into industry. Only thus could industry play a positive role in the task of maintaining the tempo of economic development. At the same time, the relative position of industry proper (or registered industry) would be strengthened, the average productivity of this sector would be increased by about 58 per cent, and its share in the national income as a whole would rise to more than 20 per cent.

The pattern of industry and possible changes in it

Of course, industrial development on the scale assumed in this hypothesis cannot be maintained with the same intensity in all branches of manufacturing production. The different demand-elasticities for the various classes of manufactured products and the different import substitution possibilities which appear to exist for each one of them would undoubtedly involve changes in the output pattern and in productive capacity.

A cursory glance at the present structure of Peruvian industry reveals that it is concentrated around three industrial branches: processed foodstuffs, beverages and textiles. These absorb more than half of total industrial employment and represent almost 60 per cent of the value of production, while the joint output of the chemical and metal transforming industries constitutes less than 10 per cent of the total. From another angle, more than two thirds of production is of consumer goods while capital goods represented less than 5 per cent. This is actually a normal stage in the industrialization process at which efforts are made to cover first the lines of production which as a rule are technically less complex and which call for a small capital outlay. However, in the course of very rapid industrial development, such as occurred in former periods, there are no very marked changes aimed at producing increased diversification. For example, between 1948 and 1955 the share of consumer goods in the total dropped merely from 60 to 58.5 per cent and there were no such changes in the structure of productive capacity. In 1955, the three branches mentioned represented some 63 per cent of the book value of available assets and accounted for 60 per cent of the total purchases of machinery and equipment.

Another important observation concerns the share of domestic supply covered by the various branches of Peruvian industry. In 1955, imports of manufactured goods (expressed in c.i.f. values, which implies that they were to some extent undervalued) represented a quarter of total requirements for such goods. Although imports were registered for practically all manufacturing branches, two were of particular importance: chemicals and products of the metal transforming and metallurgical industries. They represented 69 per cent of the total imports of manufactured goods. The share of imports was also quite appreciable in the supply of goods from the pulp and paper industries (50 per cent), timber (30 per cent), rubber (25 per cent) and non-metallic minerals (22 per cent). On the other hand, it was relatively small for processed foodstuffs, beverages, textiles, footwear and ready-made clothing, but even these amounted to 804 millions soles, i.e. they represented about 15 per cent of Peru's total capacity to import. Generally speaking, no notable improvements were recorded in this respect. On the contrary, between 1948 and 1955, total availabilities of manufactured goods in Peru rose by 71 per cent as a result of an increase of 90 per cent in imports and only 67 per cent in domestic production.

If these two factors are considered jointly in the light of the hypothetical projections presented in the study, the trend and magnitude of the changes which might take place between 1955 and 1965 will become apparent. The relevant estimates show for example, that, although all the branches increased their volume of production in varying proportions, the relative importance of the food industries would decline from 36.4 to 28.2 per cent and that of textiles from 11.0 to 10.6 per cent. By contrast, there would be an increase in that of the chemical industries (from 3.7 to 5.5 per cent), the metal transforming industries (from 4.6 to 7.5 per cent) and the basic metals industries (from 7.2 to 13.1 per cent), etc.

The problems of financing, protecting and encouraging industrial development

Increased domestic demand, import substitution requirements and the need to absorb manpower make it essential to achieve a certain tempo of industrial expansion and to effect a series of changes in the production pattern by industrial branches. This involves the enlargement and diversification of productive capacity and the consequent financing and effective channelling of investment. Can Peruvian industry carry

through this over-all expansion? This is another of the problems examined in the report, although no attempt has been made to go into detail. Some of the existing facts and certain information that could form the subject of special research are briefly analysed.

Once the expansion needs of production have been established, the investment effort required will depend to a large extent on the manner in which the present stock of capital is used, i.e. on the product-capital ratio achieved in industry. The practical analysis of this specific problem is not at all easy, because there are hardly any reliable statistics on the actual amount of capital invested in the sector. All that is available is partial information about the book value of assets, which is of little real use because it relates to investments accumulated in different periods and depreciated according to book-keeping rather than realistic criteria. However, an attempt at indirect measurement led to the conclusion that total fixed capital—depreciated at replacement cost—employed in industry in 1955 was probably about 13 000 million soles. This would mean a fairly favourable product-capital ratio: 0.41 as compared with only 0.33 in 1945. In other words, the phenomenon noted for the economy as a whole, whereby a prior improvement of the product-capital ratio subsequently relieved the pressure on investment, was repeated in a more marked degree. However, the favourable level of 1955 should not be construed as indicating that capital already invested was being utilized with any great intensity—on the contrary, there was still plenty of room for improvement in that respect—but should be attributed rather to the large share of artisan and small-scale industries (with very limited capital resources) and to the predominance of industrial branches of less capital intensity. In the future, the increased relative importance which industry proper will undoubtedly continue to acquire and the more marked growth of industrial branches of higher capital intensity will tend to lower the product-capital ratio. The only remedy would be to ensure a better utilization of the present stock of capital, a task which depends mainly on what can be done within the enterprises themselves.

Even if the product-capital ratio is maintained, the main problem will be the incentives which can be offered for the enlargement and diversification of investments. As a result, two basic questions, (*a*) methods of financing and (*b*) industrial protection, will assume greater importance.

Adequate consideration of the first aspect would require a detailed analysis of the possibilities of enlisting resources both within and outside the enterprises. If some of the developments during the period 1947-55 are examined, it may be observed, from a very broad though variable sample of enterprises, that their total assets rose from 1 500 to 9 000 millions soles. Almost 40 per cent of this increment was the result of capital gains, a resource which cannot be considered as altogether external to the enterprises because it is derived to a large extent from the issue of bonus shares, i.e. a form of re-investments of profits. A sixth of this expansion was financed with such typical internal resources as increases in reserves. A small proportion was financed with temporary resources and almost 40 per cent with typically external resources. In short, the information available is such that no very firm conclusions may be drawn. In other words, this is one of the further problems which merits more detailed inquiry. In the meantime, the analysis confines itself to a very cursory examination of some of the principal ways of mobilizing resources for industrial investment.

One of the sources which might acquire considerable importance not only for the enlargement but also for the diversification of industrial investment is the capital market. At the moment, most enterprises are legally constituted as limited companies. Neverthless, there is no control of such companies, nor are there any bodies with sufficient power to supplement the somewhat restricted activities of the stock exchange. Furthermore, under the existing system, most securities are not quoted at all on the exchange, where apparently only a very small proportion of total transactions take place. Thus, for example, while in 1956 the total new capital registered was 776 million soles and capital gains amounted to 247 million, the total movement of securities on the stock exchange was valued at barely 14.8 million.

The ploughing back of profits will undoubtedly play an important part in the future expansion of industrial productive activity. During the period 1947-55, the total net profits of registered industrial enterprises amounted to some 2 500 million soles. Of this sum, less than 25 per cent was capitalized, a proportion which would probably be much lower if allowance were made for the large number of minor establishments not included in the statistics.

Of course, the scale on which profits are re-invested depends on many factors which are outside the immediate scope of the study. Suffice it here to make brief mention of only two: tax policy and the constitution of depreciation reserves. The first factor does not appear to offer very powerful incentives for reinvestment because there is no differentiation for tax purposes between distributed and undistributed profits. Even more important is the policy followed with regard to the constitution of depreciation reserves. Calculations are based on the original rather than the replacement cost of assets. Since insufficient reserves would thus be formed, they are supplemented with additional reserves, which thus become liable to tax as though they were actual profits.

However great the investment effort made with internal funds, the necessary expansion of industrial productive capacity could probably not be embarked upon without adequate provision of credit resources. On 31 December 1955, total bank credit granted to industry amounted to 1 154 million soles or less than 10 per cent of the assets of the manufacturing enter-

prises. About 95 per cent of this credit came from commercial banks which used for this purpose roughly a quarter of their lending capacity. This represented a slight improvement in the share of industry as compared with the years immediately before. The situation was different in the case of development banks. Of the total credits granted by them (898 million soles), less than 10 per cent went to the industrial sector, as compared with more than 40 per cent in 1945. These changes in the relative magnitude of the credit sources available to industry have both a qualitative and a quantitative significance because of the different interest rates and above all the differences in the terms of amortization which are applied to each case.

Finally, there are other sources of financing whose relative importance has been somewhat restricted in the past. For example, in 1955 total public investment amounted to 1 764 million soles, of which only 70 million could be considered as directly related to industrial development. Foreign investment in manufacturing, on the other hand, has increased considerably—from 14.9 million dollars in 1951 to 26.8 million in 1955—but its volume is still very slight as compared with that of total industrial investment or with the share which foreign capital represents in other economic activities.

In addition to these factors, which principally affected the various financial aspects of industrial expansion, there remains a whole series of incentives which may be be offered through protective and development measures. Although there is no direct participation by the public sector in industrial activities, the Government can, of course, exert a powerful influence in their development, not only by providing the basic social capital—transport, energy, etc.—essential for industrial growth, but also by providing numerous incentives many of which are already contained in a general industrial bill now being given favourable consideration.

One particular important aspect is the protection of domestic industry against competition from imports. Since 1949, when direct import controls were lifted, the protection machinery has been mainly confined to the customs tariff. This however is framed for fiscal purposes rather than for the deliberate purpose of protection or industrial development. In 1955, total customs duties represented 11 per cent of the value of imports, a relatively low proportion compared with that of other Latin American countries. A more detailed comparison with the tax systems in force in Colombia, Chile and Venezuela shows, moreover, that in Peru customs duties are relatively lower for consumer goods and intermediate goods and very similar in the case of capital goods. Sometimes, the tax is heavier on goods produced by very complex industrial processes, while it is relatively lighter on other goods which could be replaced very soon by domestic production. However, this is a very difficult problem to assess in general terms because of the conflicting elements which must be taken into account. For example, the low level of production may have discouraged the establishment of new import substitution industries, while at the same time, competition with imports has made domestic firms more concerned with productive efficiency than is normally apparent in other Latin American countries. Perhaps the most important problem is how to achieve enough flexibility to meet varying future conditions and to ensure that Peru's industrial development goes ahead at the required speed.

Certain comments on the projections and the extent to which they may affect the basic conclusions of the study

At a series of meetings held jointly with ECLA economists a group of Peruvian industrialists, economists, officials and other authorities made certain comments on the initial draft of the study. Although many of them were incorporated in the final text or were used to correct specific parts of the analysis, those relating to two basic aspects of the chapters concerned with the Peruvian economy as a whole seem to merit special emphasis.

The first of these comments refers to export prospects. It was generally agreed that it would be difficult to achieve an increase in the export quantum of the magnitude foreseen in the study. Actually, three years have passed since the period taken as the basis for the projections (1955) and during this time the growth in exports registered in former periods has been far from being attained. At the same time, international market conditions have by no means encouraged a more rapid development of productive capacity in the export sector. Hence, there seems little likelihood of a recovery of sufficient momentum to exceed the 1955 level by the wide margin foreshadowed in the study's working hypotheses.

Although these opinions may prove correct and although the increase in the capacity to import may turn out to be lower than that anticipated in the projections, the study would still at least provide the methodological outline necessary for evaluating the consequences of the situation projected. Generally speaking, it is easy to foresee the two alternatives facing the Peruvian economy: (*a*) that of carrying the import substitution process much further than the limits anticipated or (*b*) that of accepting a rate of economic growth of less intensity than that postulated in the study's hypotheses and hence less than that achieved in the previous decade.

The second observation concerns the projections of demographic growth. As no population census was held after 1940, any projection of the future increase in the number of inhabitants remains highly doubtful. The study embodied the partial data which seemed most trustworthy but doubtless this is not the only information available nor is it sufficiently conclusive. Various comments were made to the effect that population growth would probably not be so intense as

that assumed in the hypotheses and that consequently the requirements of subsequent development would not be so rigorous, particularly from the point of view of employment.

Naturally, any change in this respect would, to some extent, alter the projections which have been made. However, this by no means signifies that the *qualitative* conclusions reached by the study are impaired. Not only are they based on very large quantities—so that slightly more accurate figures would make no difference to their validity—but they are also justified statistically.

Two examples may be quoted. The doubts about the projections of future growth are based largely on the contention that the hypotheses used in the report presuppose a sharp decline in the mortality rate, whereas such a phenomenon would normally be more gradual. No doubt this observation is well-founded but a more careful analysis of the problem would very probably yield the conclusion that in former periods the decline had already set in without being taken into account in estimates of population growth up to 1955. In other words, the error perhaps lies not so much in the future hypotheses as in the statistics which have been used for the latter years of the previous period. The projection constructed in the study definitely indicates for 1965 a total number of inhabitants lower than the average population estimate worked out by United Nations demographic experts.[1]

Almost the same might be said about the projections of active population. Several of the coefficients relating to the break-down of this demographic sector by age groups may well be considered very high. However, the pertinent corrections would affect the 1955 figures in the same way as those for 1965. Hence, the *relative growth* of the labour force would be very similar to that given in the report. Moreover, if lower coefficients were applied to other population projections which assume a more rapid demographic growth—for example, the average estimate made by the United Nations—even the *absolute growth* of the labour force would approach very closely to that foreseen in the study.

In short, both the methods used and the hypotheses put forward in the study are undoubtedly susceptible of revision and improvement but any possible changes are very unlikely to modify the general picture, especially as regards those problems which the report is basically trying to solve.

[1] See United Nations, Bureau of Social Affairs, Population Studies, No. 21, "Future population estimates by sex and age", Report II, *The population of South America 1950-1980* (ST/SOA/SER.A/21), United Nations publication, Sales No.: 1955.XIII.4.

II. MAIN BACKGROUND DATA AND PROSPECTS OF INDUSTRIAL GROWTH

From what has been said so far it may be concluded that, in order to achieve a satisfactory rate of economic development, Peru must (*a*) at least double its manufacturing production between 1955 and 1965; (*b*) increase the number of workers employed in manufacturing proper by 100 000 before 1965; (*c*) effect import substitution to a point where foreign exchange requirements do not exceed 9 310 million soles for purchases of manufactured goods and 11 660 million for total imports; and (*d*) modify the structure of industrial production in such a way as to improve substantially the share of intermediate and capital goods.

This document will now examine the existing industrial situation in order to relate the possibilities of increasing production to the needs of economic development.

General characteristics of existing installations

Existing industries may be divided into five broad groups. The first comprises those activities based primarily on a large export market, such as sugar production, metal-refining and fish-canning. They are characterized by their marked efficiency, their high degree of utilization of productive capacity (in nearly all cases) and their excellent productivity, even when judged by the strictest standards of the industrialized countries.

Secondly, factories producing tyres, cement, glass bottles, welded tubing, aluminium shapes, insulated electric conductors, articles of fibre cement, edible oils and fats, and evaporated milk are examples of industries which have been recently established with modern machinery and techniques, foreign technical aid and high standards of quality. While their labour productivity is generally good the degree of utilization of their equipment is low on the average. They are designed to satisfy those sectors of the Peruvian market which only recently have represented a demand big enough to justify efficient and economic installations.

Generally speaking, the third group is made up of industries which are artisan by origin. In some cases, they have become modernized and have completely changed their methods but, in many other instances, they have preserved intact their administrative structure and even some of their production techniques. In other words, they are still run by their owners almost without intermediate staff. They have not instituted additional shifts in order to expand their utilization of capacity through failure to delegate authority and through lack of technicians capable of taking charge of the extra operations involved. Precisely because of their artisan type of organization it has proved impossible to train such supervisory personnel. The main components of this group are footwear and ready-made clothing, leather and certain metal transforming industries.

Fourthly, textiles form a group on their own because their size and characteristics are quite different from those of the remaining industries. They are not artisan

by origin although there is a fairly large wool industry of that type. Nevertheless, they are characterized by over-employment. About 60 per cent of their machinery is out of date—76 per cent in the case of yarns and 48 per cent in that of fabrics—and though they are run by highly efficient managerial staff, the basic organization is generally very unsatisfactory because equipment is out of date and there are too many workers per productive unit. As a result, productivity is very low compared with what might be achieved in modern and well-organized factories. (The proportions are respectively reckoned to be 36 and 55 per cent in spinning and weaving mills operating with cotton; 19 and 36 per cent in those using wool; 36 and 49 per cent in those employing cut fibre; and 50 per cent in weaving factories based on filament.)

Fifthly, much of what has been called industry is really of the artisan type, especially in the case of metal-transforming, furniture and fixtures, footwear and ready-made clothing, and foodstuffs. The fact that certain activities are so predominantly artisan in character—furniture, men's shoes, some glass containers and chemicals—is a sign of backwardness because market conditions no longer justify the survival of their antiquated production techniques. Much manpower is wasted and the finished article can no longer compete with that turned out by mechanized installations.

On the other hand, certain artisan sectors still flourish in an economic climate like that of Peru because they are quick to adapt themselves to stylistic changes in specified consumer products and because they can produce economically articles which require a heavy labour input and little mechanization. Into this group fall many foodstuffs, leather products, women's shoes, luxury glassware and ornamental ironwork.

Of the total value of industrial output, which in 1955 was 16 795 million soles, about 19 per cent corresponds to the export industries (including their production for the domestic market), 8 per cent to recently established industries that are not artisan by origin, 27 per cent to those that were originally artisan but were converted into manufacturing industries proper, 11 per cent to the textile industry and 35 per cent to purely artisan activities. The relative share of each of these groups would be different if the criterion adopted were the value added instead of the gross value of production.

Contribution of industry to the domestic supply of manufactured goods

Industries may be classified into three groups according to the present margin of import substitution. The first group would include most of the food industries, beverages, tobacco, textiles, footwear, printing and publishing, cement and other construction materials, leather and leather goods, petroleum and coal derivatives, and non-ferrous metals. All these industries satisfy a large proportion of demand (more than 80 per cent in most cases). Hence, although they still leave a certain margin for import substitution, this is no serious obstacle to their development. The main problem is how to channel artisan activities into the manufacturing sector proper so as to increase productivity and improve quality. In this way, the domestic market for such products will be amplified because in nearly every case there is a big gap between real and potential demand. One outstanding example is the production of canned fish, which could do much to relieve the shortage of protein foods but which must be reduced in price and boosted in other ways, if consumption is to rise among certain sectors of the population. Another is that of wool textiles and footwear. In this case, price cuts would produce a proportionately much greater increase in domestic demand.

So far as the satisfaction of the home market is concerned, the second group of industries would comprise those which potentially could meet requirements because they have sufficient raw materials and outlets broad enough to justify installations of economic scale. Nevertheless, and for other reasons —particularly quality and cost—such industries have been unable to cope with foreign competition and cover a very low proportion of demand (between 50 and 70 per cent). They include ready-made clothing, china, majolica, ceramics, timber, paper manufactures and some rubber products (except vulcanized footwear and tyres). This is probably the group where it is hardest to remedy deficiencies because it is often necessary to modify existing organizations, introduce new techniques, change or improve raw materials and even overcome traditions and prejudices. Nevertheless, it is perhaps the group where, because of the wide margin of idle productive capacity, larger increases in output may be secured with a relatively smaller outlay.

The third group covers those industries whose development is negligible or rudimentary primarily because of the lack of industrial enterprise and, to a lesser extent, because no incentives have been offered for their growth, including some degree of protection during their initial years. Most metal-transforming and many chemical industries would come into this category. A few years ago, this group might also have included the iron and steel industry whose first mill is already in operation and will undoubtedly stimulate further development. By definition, these industries have a very low production compared with the absorption possibilities of the market. At the same time they provide ample opportunities for accelerated development. Indeed, it will be seen later that most of the development prospects analysed in the third part of the study concern this group.

Development possibilities consequent upon increased satisfaction of the people's basic needs

Demographic growth and increases in *per capita* income levels, coupled with the relatively high elasticity

shown as a rule by the demand for manufactured goods, will bring about in the next decade a very marked increase in the supply needs of the domestic market. This fact is implicit in the assessments and comments made in the following pages.

Particular emphasis should be laid on those primary needs of the population which are far from being satisfied and which represent a potential demand not revealed in the statistics. The food sector is probably the most important in this respect. Here, the Government must take further action because the possibilities of expanding food production are impeded by certain obstacles, particularly as regards the supply of raw materials.

In their development plans the authorities responsible for industrial promotion should establish vigorous incentives designed to augment cattle-slaughtering, the manufacture of milk products and the production of edible oils and fats. In the first two cases, the complete solution of the problem of raw material supplies would require a period of time which goes beyond the limit set for this study. Production incentives would have to be initiated as soon as possible but the development expected for 1965—an increase in meat output of 56 per cent and in milk products of 53 per cent—is very unsatisfactory. The production of edible oils and fats of agricultural origin may be developed over a relatively shorter period; it depends to what extent farmers are encouraged to plant more oil-bearing crops. (The study assumes an increase of 156 per cent in the period 1955-65.)

Another important sector where it is possible to assume a demand heavier than that shown in the statistics is the production of canned fish. In view of the lack of protein in the people's diet, output might be encouraged if this product were popularized and if the industry strove to reduce its costs. As explained later, this seems feasible.

An opportunity for industrial development in response to a potential repressed demand might also be seized by the textile industry, principally wool. The needs of the Peruvian people in this respect are far from being met because prices are usually high as a result of inefficient installations, out-of-date machinery and over-employment. Hence, there is a wide margin for an increase in production (122 per cent in the manufacturing textile industry during 1955-65) although development is impeded by certain problems which must be solved immediately.

A final example of a line of production which could help to meet the basic needs of the population—although in this case indirectly—would be the manufacture of synthetic fertilizers in sufficient quantities to bring about a substantial increase in agricultural food production, especially in the sierra. According to a relatively conservative hypothesis, it has been assumed that by 1965 Peru would need some 89 000 tons of nitrogen and 67 000 tons of phosphoric acid. As the production of guano is expected to remain relatively constant and to represent about 38 000 tons of nitrogen and 40 000 tons of phosphoric acid, a considerable industrial effort would be required to bridge the gap with chemical fertilizers. However, it would probably reap a bigger economic yield because it would do much to improve the population's diet.

Development prospects in export industries

Another sector which may be explored for possibilities of industrial development is that of exports which, as part of a suitable policy of promotion, should take first place as regards incentives, protection and assistance. The biggest expansion as regards both tempo and value of production would undoubtedly occur in non-ferrous metallurgy, especially copper and zinc. For various reasons, which are explained in detail in the relevant chapter, output is expected to increase when the expansion plans of the undertakings concerned are put into effect. During the period under review, such plans will probably raise production from 1 212 million (the 1955 figure) to 2 860 million, the biggest advance recorded by the industry in terms of output value.

The development of sugar production is likely to be much less dynamic because the cultivated area, like that planted to cotton, is expected to increase very slowly and at the cost of large-scale investment designed to provide irrigation for additional land. Most of the production increment would be absorbed by the additional domestic consumption. Hence, by 1965 Peru would have only 722 000 tons of sugar for export, which would mean a rise of 50 per cent in production for this purpose.

Canned fish for export is one of the sectors most in need of bolstering against a probable decline. Recently it has been very hard pressed by foreign competition. However, a careful examination shows that its economic basis is for the most part just as good or even better than that of its rivals abroad and that it could compete with them successfully provided it could cut production costs. This might be feasible so far as expenditure on the fish itself is concerned if supplies could be stabilized by building large cold storage plants in the bigger fishing ports. The cost of containers might be reduced too if a large proportion of Chimbote's capacity for producing flat sheet were set aside for this purpose.

Exports of timber products—at least in so far as present shipments from Iquitos are concerned—hold out few prospects of expansion. Other production sites, such as the state of Pará (Brazil) and certain Central American republics, can compete with Peru on more favourable terms because they are nearer to consumption centres. The only line of defence might be increased industrialization, particularly as regards veneers made of cedar, mahogany and other Peruvian woods which so far remain untried. There are also possibilities in the production of plywod overlaid with veneers of finer timber. With a higher value per unit of weight

and volume, this type of product, when produced on a more industrialized scale, would be better able to compete on foreign markets.

Another sector in which there are excellent prospects of industrial expansion based on exports is that of long-staple cotton textiles. The fact that the extension of the cotton acreage is becoming increasingly difficult presupposes that the relative share of this product in exports will tend to diminish. However, since the cotton in question is of remarkably high quality, Peru should make the most of such a valuable raw material by processing at least part of the export crop, in the form of yarn, thread, or fine all-purpose cloth, such as poplin. The same might be said of alpaca hair, a raw material even more exclusive than long-staple cotton because it is produced only in a relatively small area of the Andes. For these reasons and because of the need for cutting costs in the production of textiles for domestic consumption, so as to increase demand and do more to satisfy the people's needs, the study has recommended a complete renovation of the textile industry, both as regards its installations and its techniques. In monetary terms, this would require an investment of 675 million soles during the period under review. In addition—a still harder task—other industries would need to absorb at least 7 000 workers who would have become redundant by 1965 upon completion of the modernization programme.

Development prospects made possible by channelling artisan production into the manufacturing sector proper

Another possible way of promoting development is to guide artisan activities into strictly manufacturing channels. Opportunities vary greatly from branch to branch. For example, most metal-transforming activities could be re-organized and become part of industry proper, which would then expand by 427 per cent during the period 1955-65 while artisan production would rise by only 11 per cent. The making of leather articles lies at the opposite extreme. Indeed, since such products require neither mechanization nor repetitive processes but nevertheless absorb considerable labour, there would be more room for expansion in artisan than in industrialized operations. Between these two extremes lies a varied range of possibilities of transforming artisan work into manufacturing industry. For example, although artisan-produced textiles enjoy a well-deserved reputation in Peru, they are unlikely to forge ahead because they cannot compete with the large-scale manufacture of commonly used articles. If they appear to do so it is only at the expense of labour employed at ridiculously low wages.

After metal-transforming, the artisan activity which seems best suited for transformation into an industry proper is the production of furniture and fixtures because it involves a smaller proportion of workshops and because in this branch artisan methods offer no real advantages over manufacturing techniques, except in isolated and inaccessible markets.

A third example, which is also very important, is the production of footwear and ready-made clothing. In this branch, certain activities which still have a dynamic artisan production are mixed with others that should fairly soon be placed on an industrial footing. Artisan workers turning out women's shoes, for example, are well equipped to compete with industrial output, especially because they react quickly to changes in style and operate with tiny production series. The case of men's shoes is different because standardization and mechanization yield considerable economic benefits in this branch. A final example is the production of good-quality suiting which, except for luxury tailoring, no longer has any chance of surviving as an artisan activity.

Industrial development made possible by bringing artisan activities within the manufacturing sector proper may be assessed by comparing the rates of growth assumed in this study. While industry in the strict sense is expected to increase production by 137 per cent, artisan activities will expand by only 37 per cent; and while the former will boost its value by 14 800 million soles the latter's will rise by no more than 2 200 million. The authorities responsible for planning industrial development should therefore remember that the transformation of artisan activities offers a fruitful field for economic progress. It should therefore be encouraged and where necessary provoked. However, they should also bear in mind that it is not necessary in all cases because some artisan sectors can still preserve their dynamic character. For example the artisan production of ordinary bricks, luxury glass products, ornamental ironwork, high-class ready-made clothing, fancy leather goods, and silverware will without doubt continue to develop vigorously and offer little scope for industrialization.

Possibilities of development through import substitution

An assessment of industrial development possibilities through import substitution should not consider merely the increased contribution likely to be made by aggregate domestic production towards the satisfaction of demand. The need to boost imports, especially of machinery and equipment as well as of certain raw materials and intermediate products, is part and parcel of the actual process of industrialization which is to be encouraged. Indeed, although Peruvian industry will strive to substitute domestic output for many of the goods now imported, the extent to which it will help satisfy demand, expressed as a percentage, would rise only from 76.0 to 78.5. An accurate evaluation of the substitution effort must be based on the projections of many important items and products which are analysed in the study. However, the following figures give a rough idea: the ratio between production

and demand would grow from 88 to 91 per cent in the case of consumer goods, from 26 to 35 per cent in that of capital goods and from 72 to 77 per cent in that of raw materials and intermediate products.

Like many other Latin American countries, Peru has much leeway to make up in import substitution. The decisions adopted regarding the amount of substitution which can actually be effected are of course influenced by the usual financial and technical factors. But at the same time the criteria followed for carrying out a specific development policy play a very important role. For example, it may seem over-ambitious for Peru to seek to substitute domestic production of fertilizers for its imports, now valued at 60 million soles, and increase this figure by 340 million before 1965. This is hardly a conservative target but, as part of an organic plan, it would provide an answer to the vital problem of producing more foodstuffs of agricultural origin. In a similar although more limited way, the report has examined the possibilities of replacing many other imports, such as iron and steel products, timber items and certain machinery and equipment, while bearing in mind implicitly the aim of promoting industrialization in certain sectors which are organic or basic for others types of development.

In working out the possible and desirable relationships between domestic production and demand, in the period up to 1965, the study has tried to analyse many different criteria and particularly those of national interest. They were not all applied in every case because often there was a basic reason for the decision without need for further considerations. Generally speaking, they took account of: (*a*) the amplitude of the market, as compared with the minimum economic scale of industrial installations, a factor which immediately disqualified many manufactures not yet suitable for domestic production; (*b*) the fact that the product might be used as a raw material for another industry or that its manufacture might be based on items turned out by an already established industry, particularly if the latter needed to boost its output to secure more economic operation; (*c*) that industry in general might utilize certain domestic resources or add value to them by additional processing; (*d*) that a specific industry might contribute directly or indirectly to the generation and distribution of electric power or to the production and distribution of fuels; (*e*) that it might help to expand transport services and reduce their costs; (*f*) that it might manufacture construction materials or equipment for this purpose and (*g*) that it might turn out capital goods, especially agricultural and artisan tools, machine parts and spares, as well as machinery and equipment for industry, mining and agriculture.

As may be seen in the relevant chapters of the study, more than 200 items of products were analysed. It would therefore be difficult to summarize here the conclusions reached. The following paragraphs deal with the activities which are considered most important, either because of the volume of additional production they are expected to achieve or because they serve as an example in the application of certain criteria.

The reasons for encouraging additional output of cheaper textiles for general consumption have already been explained. It also seems likely that, given proper organization and the replacement of obsolete equipment, the industry may produce articles of the quality necessary to effect import substitution on a large scale. For example, during the period under review, the ratio between production and demand for flat textiles of cotton, wool and filament might rise to 92 or 93 per cent from the present figure of 83 to 84 per cent. The 7 or 8 per cent assigned to imports would be more than enough to purchase abroad certain products which it is either impossible or uneconomic to manufacture in the relatively small quantities needed by the Peruvian market. Cut-fibre textiles, output of which now covers barely 62 per cent of demand, might expand on a still greater scale than other textiles, because the intensive use of mixtures of different types of fibre (including natural fibre) would confer considerable flexibility on this branch of production and enable it to meet the various applications or requirements of fashion. In order to achieve this increased flexibility, no attempt should be made to reach a very high percentage in the domestic production of the raw material. Hence, a slight decline has been assumed in the ratio between output and demand as regards the artificial fibre industry.

As an activity supplementing textiles, the ready-made clothing industry would have ample opportunities for import substitution. Indeed, its contribution towards the satisfaction of total demand might rise from 56 to 86 per cent; in other words, by 1965, domestic production would have increased by more than 500 million soles.

Although Peru has vast forest resources, it imports 40 per cent of the timber it consumes. The main problems concern the reduction of costs, logging and removal, the saw-mills and transport across the cordillera. Their solution requires a vigorous and clear-cut Government policy implemented by bodies which can take long-term action. However, much can be done now in the way of import substitution. With better organization, saw-mill costs can be reduced and more value added to the timber in the forest itself so as to cut freight expenditure in relative terms. One way of achieving this latter aim would be to manufacture particle boards. This could even be done on the coast with veneers from the forest and sugar-cane bagasse.

If the manufacture of pulp for paper-making on the basis of bagasse were developed, Peru could substitute domestic output for more than 70 per cent of its imports, valued at some 42 million soles. To increase the import substitution of pulp the problem of obtaining supplies of the raw material necessary for long-fibre cellulose would have to be solved. This would

take longer than the period to which this study related.

The manufacture of tinplate merits special attention. If it were produced economically, fish canneries could reduce the cost of their containers. It has already been seen that this move would boost exports. Hence, the model showing the hypothetical development of the iron and steel industry is based implicitly on the proposal that Chimbote should assign a higher priority to tinplate than to galvanized sheet. Imports of the latter may be replaced with asbestos-cement or fibre-cement sheets which Peru can turn out efficiently and economically. It has also been assumed that preference would be given to the production of those sheets most commonly used in the metal-transforming industry, such as all those employed in stamping, including deep inlaying. Imports of tinplate might be completely replaced in 1965 with a domestic output of about 16 000 tons. If Chimbote doubled its flat-product capacity some 6 250 tons of galvanized sheet and 7 900 tons of other sheet for metal-transforming could be produced. In this way, the total import substitution of flat products would amount to some 123 million soles by 1965. The contribution of domestic output to the satisfaction of demand would thus rise from nil in 1955 to 76 per cent in 1965.

One of the iron and steel products which most lends itself to import substitution is rod, used mainly for construction. By 1965 Peru would be able to satisfy all its requirements and achieve an import substitution worth 136 million soles. However, the development model for the iron and steel industry presupposes that Chimbote will have to devote its bars and shapes section to products of greater value per unit of weight, such as light shapes for metal-transforming, and that the production of rod for construction will have to be developed in a new factory (or factories) sited possibly in the Lima area, near to the most important market for this product and the main source of its raw material (scrap). Because of their economic scale, these establishments would be better equipped than a completely integrated mill to turn out this kind of steel.

The import substitution prospects as regards other bars, shapes, thick wire and plate would be very limited should the domestic production of the wide variety of types and sizes required by the market prove to be uneconomic. Consequently, although it has been assumed that Chimbote's steel-making capacity will be enlarged, which would also mean that more bars and shapes could be rolled, in 1965 it might devote only some 28 000 tons of its capacity to the production of various bars, shapes and plates for the metal-transforming industry and with its surplus capacity manufacture some 22 000 tons of constructional rod. In short, by 1965 Peru's own output would replace imported bars, shapes and plates to the value of some 209 million soles and thus satisfy 73 per cent of demand in this particular branch.

As regards import substitution, the sector which merits its closest study is undoubtedly that of machinery and equipment for industry, agriculture and mining. The greater this substitution, the easier it will be to fulfil one of the conditions of economic development, namely, that the structure of production should be modified in favour of capital goods as well as raw materials and intermediate products. However, hasty decisions made without prior and careful analysis may lead to the establishment of capital goods industries which are economically and technically deficient. These might prejudice the remainder of industry if an attempt were made to impose the utilization of their products with the help of protection measures. The projections of import substitution contained in the model constructed in the report are not the result of such detailed study and hence must be construed merely as an indication of what is possible. However, in order to determine the share of domestic production which may be considered compatible with demand, a more intricate set of criteria than that applied to the products of other industries was used. In addition, certain numerical indices were taken into account. They related to the value added to the metal, which was roughly estimated as the difference between the c.i.f. price per kilogramme of the product and the basic metal machinery and equipment needs, expressed as the percentage ratio between investment in this type of assets and the total fixed assets required; and the number of highly skilled workers which would have to be employed. Allowance was also made for other factors, such as the diversity of products, the complexity of manufacture, the rate of growth of demand and domestic raw material needs.

The following are some of the more significant estimates for import substitution by 1965: water pumps —60 per cent and 45 million soles; air compressors— 35 per cent and 60 millions soles; transmission equipment for mechanical energy (mainly pulleys)—78 per cent and 20 million; electric motors of less than 25 h.p. —70 per cent and 20 million; transformers of less than 100 kVA—70 per cent and 24 million soles. The less common types of these capital goods, as well as components which are too complex or specialized to be made in Peru, would be imported.

The metal-transforming industries could also achieve a fair amount of import substitution in certain straightforward manufactures, such as tinplate containers (production equivalent to 87 million soles or 82 per cent of demand by 1965), iron accesories and other hardware (11 million or 50 per cent), steel furniture (26 million or 80 per cent) and cutlery (6 million or 40 per cent). There would also be plenty of room for import substitution in the manufacture of certain consumer durables, like refrigerators, the production of which might rise to a value of 46 million soles in 1965 (60 per cent of demand) and bicycles which might bring in 47 million soles (90 per cent of assumed consumption).

Possibilities of development through industrial integration

Finally, there remains what might be called the integration of industrial activities. Development in this field would take the form of promoting certain types of industry whose establishment would be justified not so much because they would facilitate import substitution, satisfy repressed demand or increase exports, but because they would make possible—or more economic—the development of other industries.

Apart from basic chemicals and iron and steel products, already dealt with in connexion with import substitution, typical examples of Peruvian industries which lend themselves to this type of integration would be chemical activities based on chlorine, smelting and forging in the iron and steel sector, together with die-making and the production of motor-vehicle spare parts in the metal-transforming industries.

The manufacture of caustic soda cannot be developed exclusively with electrolytic processes because they leave a chlorine surplus which is difficult to dispose of and which, for the moment, other industries cannot absorb. It is therefore vital for Peru to establish industries which absorb large quantities of this subproduct, such as insecticides and plastics. Industrialization would therefore be expedited by the manufacture of polyvinyl chloride which, besides its applications in making cable insulators, treating textiles and turning out floor tiles and various moulded articles —all important industries for Peru—could be used to produce different types of tubes, especially those which are being increasingly used in modern irrigation systems. For similar reasons, it was also felt that a programme of industrial development might include installations for manufacturing 225 tons of DDT and 450 tons of BHC per year.

On the other hand, a study of the equipment and raw materials needed by the metal-transforming industry to achieve the output proposed led to the conclusion that many industries would require cast steel but very few of them in sufficient quantities to justify mechanized and modern installations, with all the components necessary for the technical control of operations. The situation with regard to forging is somewhat similar. Many of the manufactures suggested could profitably employ this process but probably none would justify, from the economic point of view, the installation of presses, particularly for heavy forging. These are two typical examples of operations which, as part of a rational policy of industrial development, should be centralized among a small number of establishments built for the specific purpose of serving the other industries.

Die-making for the metal-transforming industries would offer similar opportunities for integration. As it requires highly skilled labour and precision equipment it could be carried on in centralized establishments. Individual factories would not then have to supply their own requirements. In any case, this is a wasteful procedure because most of them cannot maintain dies in constant operation. An even stronger argument is the lack of qualified technicians throughout Peruvian industry.

Industrialization—and import substitution too—might also be furthered by the integrated manufacture of vehicle spare parts. Industrial development institutes could give immediate consideration to this possibility as part of a programme for the gradual integration of the whole motor industry. A sound organization might comprise some degree of protection for the incipient industry in exchange for the observance of strict standards of quality and adherence to a specific industrialization programme calculated to ensure rational progress towards more economic techniques and installations. Later, it would be easy to adapt the factories in such a way as to enable them to supply certain parts to the assembly plants as part of a gradual "nationalization" of vehicle production.

A start might be made with relatively simple articles —gears, king pins, brackets for springs, petrol pump diaphragms, steering ends, clutch collars, radiators, exhaust pipes and certain rubber items, such as radiator hoses, engine brackets and fan belts. Subsequently, other more complex parts such as pistons, piston rings, connecting rods, cam-shafts and gaskets might be produced.

Possibilities of economic development as a whole

To sum up, the possibilities of aggregate industrial development during the period 1955-65 would signify an increase of 100 per cent in production, which is equivalent to some 17 000 million soles at 1955 prices. Within this increase the manufacturing share would represent 14 800 million (137 per cent) and the artisan share only 2 200 million (37 per cent).

The following manufacturing industries would stand out for their accelerated rate of growth: metal-transforming (427 per cent), chemicals (322 per cent), basic metals (266 per cent), steel furniture (238 per cent) and rubber (225 per cent). The branches expected to achieve the largest volume of added production during the period under review are basic metals (3 230 million soles), foodstuffs (2 350 million), metal-transforming (1 700 million), textiles (1 540 million) and chemicals (1 430 million).

The fact that this study has considered a period of development between 1955 and 1965 in no way implies that it is believed or hoped that all the industries will have succeeded in attaining the levels proposed by 1965. The report has utilized a model showing a given type and rate of development but many others could have been constructed for attaining the same objectives. In the final analysis, the assumed increases might be applied, with certain adjustments, to another decade beginning after 1955.

The development proposed would remain within the limits necessary for imports of manufactured goods;

they would not exceed 9 310 million soles in 1965. Nor would it cause the total foreign exchange requirements to exceed the figure of 11 600 million soles assumed for the economy as a whole.

The requirement laid down, that development should help to modify the structure of industrial production in favour of intermediate and capital goods, would actually be fulfilled because, within the total manufacturing output for the domestic market, the share of such goods would increase during the period under review from 28.9 to 36.6 per cent, while the proportion of consumer goods would fall from 70.6 to 63.3 per cent.

Labour, electric power and investment requirements

So far, consideration has been given to the possibilities of industrial development based on projections of demand and on the extent to which industry could or should satisfy it. The technical problems involved, the scale of production and, above all, the national interest were constantly borne in mind. It now remains to relate the various requirements of this development to Peru's ability to meet them.

As regards financing, Peru would have to invest an additional 14 600 million soles in industry by 1965. Added to the industrial stock of capital existing in 1955, this would give a total of 29 540 million soles, an amount slightly lower than that estimated at the beginning of the study. It was then assumed that the product-capital ratio of industry would remain constant (and equal to 0.41). The average depreciation of such a stock of capital (at the rate of 4 per cent per year) and the growth of the industrial gross product at a tempo reckoned at 6.5 per cent annually in 1965, would mean that by that year industry would require a gross annual investment of 3 100 million soles (at 1955 prices). Peru would therefore have to make quite a strenuous effort but it is undoubtedly equipped financially to bring it off since the figure quoted would represent 23.1 per cent of the gross investment for the economy as a whole. This ratio, compared with that of 19 per cent registered in 1955, represents a reasonable displacement of resources from other sectors into industry. Such a transfer would be fully justified by the changes to be made in the structure of the gross product in favour of industrial activities. Moreover, it will very probably be carried out without financing difficulties if, as is hoped, the changes in the organization and machinery of the capital market, as well as in the credit policy followed with respect to manufacturing industry, referred to in previous pages, are successfully put into effect.

It is hoped that the supply of electric power will not retard industrial growth. The national electrification plan includes projects for the expansion of generating capacity by 254 per cent in 10 years, while industrial needs would increase only by 119 per cent during the same period. This latter figure is relatively low in spite of the fact that the production increment assumed is large and that increased mechanization would result in an additional consumption of electric power per unit of product. To complete the comparison, the probable total demand for electric power for all uses would be some 5 500 million kWh. The satisfaction of this demand would require an increase in installed capacity of some 910 000 kW, a figure lower than that of 913 000 which represents the capacity added by the projects included in the national electrification plan.

The industrial development planned would secure the fulfilment of one of the conditions regarding manpower laid down for the achievement of balanced economic progress, namely, that by 1965 manufacturing industry would absorb an additional 100 000 workers. The aggregate needs of all industrial branches amounts to a total of 96 620 workers, in spite of the fact that the calculation was made with assumed or implicit increases in labour productivity equivalent on the average to 25 per cent during the period under review.

The most serious problem for industrial development is the shortage of skilled manpower. Peruvian industry would have to increase its supply of such labour by roughly 42 000 workers. Before 1965 it would therefore have to train a little over 50 000. A very rapid inquiry revealed that only 13 500 workers could become qualified during the period under review in workers' training centres and in women's vocational institutes, assuming that such establishments do not increase their present capacity. Industry would also have to employ an additional 4 000 engineers and technicians. In other words, it would have to train about 5 000. At the five Peruvian universities, with their present capacity, only 3 000 engineers and technicians could qualify before 1965.

This comparison between the number of qualified staff needed and the country's present capacity for training them gives an idea of the gravity of the problem. It might well impede Peru's industrial development if immediate measures are not taken to boost training capacity. Considering the effects on the Peruvian economy of any delay in industrial development, one of the most profitable economic investments which the country can and must make is to establish and amplify training centres for skilled workers and to grant additional facilities to vocational institutes.

PART ONE

PERUVIAN INDUSTRY IN RELATION TO THE NATIONAL ECONOMY AS WHOLE

Chapter I

CHARACTERISTICS AND BASIC TRENDS OF THE PERUVIAN ECONOMY

The characteristics displayed by the Peruvian economy in 1955 were those typical of an under-developed country. So low was the figure for average *per capita* income, even in comparison with that registered in most of the other Latin American countries, that it was less than two-thirds of the estimated average for the region as a whole. Nearly 60 per cent of the total population—estimated at some 9 million inhabitants—were living in rural areas, and a very similar proportion of the active population (about 3.6 million persons) was employed in crop and stock farming. These latter activities contributed over 30 per cent of national income and comprised two widely differing types of organization and farm management. In the coastal belt, agriculture was conducted on modern lines, mainly with a view to production for export, and the rate of productivity was high; in the sierra, subsistence farming prevailed, methods were primitive and productivity was very low indeed. A similar distinction could be drawn in the case of manufacturing activities, shared out as they were between a relatively new industry, with fairly large establishments, the great majority of which were concentrated in the Lima-Callao area, and a substantial number of people engaged in what might be more accurately termed handicraft and cottage industries. Mining and petroleum extraction, in full process of development, accounted for a significant proportion of foreign exchange resources and for a considerable inflow of capital from abroad, although their contribution to national income and their share in total employment were much smaller than is often supposed. The remainder of the national income accrued from services of various kinds; outstanding among these was trade, which played a role relatively more important than that of the extractive industries and even that of manufacturing proper (defined as equivalent to what in Peru is called "registered industry"). Exports represented 16 per cent of the gross product, while imports constituted over 18 per cent of Peru's total availabilities of goods and services for consumption and investment. The marked disparities between farming on the coast and inland, the high degree to which industry was concentrated in the metropolitan area of Lima-Callao and the large proportion of the national territory which was still almost uninhabited and virtually unexploited, betrayed a characteristic lack of national integration. These discrepancies between one area and another were of course reflected in the distribution of the national income; even if densely-populated urban centres like the Lima-Callao district are left out of the comparison, the average level of *per capita* income throughout the whole of the coastal belt was almost three times as high as that registered in the sierra, and as much higher again than in the *selva* (jungle lying to the east of the cordillera and including part of the Amazon basin). Income distribution among the different social groups probably also showed a marked tendency towards concentration, although here the disparities cannot be assessed with the same degree of accuracy. But, in contrast with some of these unfavourable factors, Peru's rate of economic growth had been reasonably satisfactory during the preceding decade, and its investment coefficient relatively high in comparison with that of other Latin American economies.

These were probably the most distinctive features of the Peruvian economy in 1955. However, more careful consideration must be given to each of these factors, with a view to assembling the essential background data from which a clearer idea can be formed of development prospects and of the part that the industrial sector will be called upon to play in maintaining a satisfactory rate of growth.

1. *Composition and growth of the population*

The 1940 census registered a total population (excluding estimates of the sylvan population) of 6 673 000 inhabitants. Official estimates prepared since that date would seem to indicate an average annual rate of vegetative growth fluctuating between 19.0 and 19.9 per mil throughout the period 1940-55, which would mean that in this last year the population figure had reached 8 941 000.

This rate of growth was in turn determined by a high fertility rate (with a birth rate of 43 per mil) and a heavy death rate (23 to 24 per mil, implying that the approximate expectation of life is 40 years).

Nevertheless, the demographic indices registered in more recent years suggest that certain significant changes have taken place in population growth trends, the annual rate of increase having climbed so high as to exceed 25 per mil, probably partly in consequence of a simultaneous rise in the birth rate and fall in the death rate. The former seems to be clearly reflected in the birth registration statistics; it should be remembered, however, that the already high level of fertility

revealed by the 1940 census makes it very unlikely that the apparent increase has actually taken place. Probably the increment only reflects greater efficiency in the registration of births. On the other hand, higher income levels and more hygienic living conditions have no doubt helped to bring about a real reduction of the death rate.

Thus, even if quite moderate hypotheses are adopted, the conclusions seems inevitable that the future rate of growth of the population will be higher than that registered during the last 15 or 17 years. This fact alone will exert an important influence on Peru's economic prospects. On the one hand, if the rate of development, defined in terms of improvement of the level of *per capita* income, is to be much the same as in earlier periods, the total gross product will have to increase more rapidly, so as to offset the larger population increment. On the other hand, the annual rate of growth of the labour force will have accelerated, and the need to create opportunities of productive employment for the additional potentially active population will therefore be proportionately greater.

It is thus worth while to present certain basic statistics as exactly as possible so that a retrospective study can then be made of economic trends in Peru and hypotheses for the future can more easily be discussed. The relevant estimates show (see table 1) that in the decade between 1955 and 1965 the Peruvian population will increase by nearly 2.5 million inhabitants; by the end of the same period, the rate of vegetative growth will have risen to about 25.6 per mil, owing to the maintenance of the birth rate (43 per mil) and to a significant decline in the death rate (17.4 per mil, equivalent to life expectancy of just over 47 years).

Another aspect deserving of mention is that related

Table 1

PERU: ESTIMATES OF TOTAL POPULATION AND MAIN DEMOGRAPHIC INDICES

A: POPULATION [a]
(Thousands of inhabitants)

Year [b]	Male	Female	Total
1940	3 291	3 392	6 683
1945	3 633	3 699	7 332
1950	4 027	4 063	8 090
1955	4 466	4 475	8 941
1960	5 049	5 033	10 082
1965	5 751	5 713	11 464

B: DEMOGRAPHIC INDICES
(Gross rates per mil)

Period	Birth	Death	Natural increment
1940–45. . . .	43.0	24.5	18.5
1945–50. . . .	43.0	23.3	19.7
1950–55. . . .	43.0	23.0	20.0
1955–60. . . .	43.0	19.0	24.0
1960–65. . . .	43.0	17.4	25.6

SOURCE: Estimates based on official data.
a Excluding the sylvan population, estimated at some 350 000 persons in 1940.
b As on 30 June.

Table 2

PERU: ESTIMATES OF POPULATION STRUCTURE

A: BREAK-DOWN BY URBAN AND RURAL SECTORS

Year	Thousands of inhabitants		Percentage composition	
	Urban	Rural	Urban	Rural
1940	2 405	4 258	36.1	63.9
1955	3 612	5 329	40.4	59.6

B: ECONOMICALLY ACTIVE POPULATION
(Thousands of inhabitants)

Year	Male	Female	Total
1940	1 732	933	2 665
1945	1 928	1 025	2 953
1950	2 172	1 136	3 308
1955	2 439	1 257	3 696
1960	2 756	1 405	4 161
1965	3 115	1 577	4 692

SOURCES: Estimates, prepared in collaboration with the Statistical Service, Department of Mathematical Statistics, of Peru. For the estimates of active population use was made of specific coefficients taken from Edith C. Adams, *Age Structure and Labour Supply*, monograph presented by the United Nations Population Division at the World Population Conference 1954, sixteenth meeting, E/CONF.13/415, page 585.

to the break-down of the population by urban and rural centres, the proportional distribution in 1940 having been 36.1 and 63.9 per cent respectively. Although no accurate data are available, there are fairly solid grounds for estimating that this distribution had considerably altered by 1955, in which year urban dwellers apparently came to represent somewhat more than 40 per cent of the total population.[1] In other words, during 1940-55 widely differing trends in population distribution would seem to have been registered: while the total population increased by 34 per cent, the urban sector grew by 52 per cent and the rural by 23 per cent only (see table 2).

Some of the features of this rapid urban growth are patent, a case in point being the marked inflow of population into what is termed the "Lima-Callao zone". The establishment and expansion of industrial, commercial and other similar activities, mainly concentrated as they are in these urban centres, has undoubtedly constituted an inducement to rural workers attracted by the hope of better wages. Probably, however, this

1 The estimates referred to were prepared in collaboration with the Statistical Service, Department of Mathematical Statistics. The calculations concerned covered the following principal phases and hypotheses. The estimated increment in the total population and its distribution by departments was adopted as a base; the Statistical Service's estimates of population growth in the departmental capitals and other large towns were taken into account; it was assumed, as a reasonable hypothesis, that the departmental capitals and the other large towns deserving of consideration would have steadily maintained the same proportional relationship to the urban population of each department as was registered in 1940; and lastly, the urban population was estimated in this way for Peru as a whole, while the rural population was obtained by subtraction. The unavoidable margins of error inherent in such a procedure may very probably have led to underestimation of the growth of the urban population, and consequently changes in percentage distribution may have been more marked than those indicated here. At all events, it seemed preferable to utilize estimates of this kind rather than to go on assuming, as has been the practice in various studies, that the same break-down as was registered in the 1940 census would be maintained.

internal population shift has not been entirely due to requirements deriving directly from the growth of the activities mentioned; the fact that opportunities of productive employment in the rural areas were insufficient to absorb the local population increment, and even fortuitous phenomena, such as the drought which recently scourged southern Peru, may have carried the urbanization process farther than was justified by the economic growth of the centres in question. This would account for the perpetuation of extremely low standards of living among such migrants in the urban centres, as well as for the "squatting" observable in Lima and its surroundings. This is another factor which must be borne in mind in addition to the progressive rise in aggregate demographic indices when, at a later stage, industrial expansion requirements are considered.

These changes in the break-down of the population by urban and rural sectors are largely related to similar changes in the distribution of the active population among agricultural and non-agricultural activities. First, however, the over-all trend registered for the active population must be cursorily reviewed.

The 1940 census recorded an economically active population of 2 665 000 persons. With due regard to the composition of the present population by sex and age groups, and on the assumption that the proportion of active persons remained unchanged in each of these specific categories,[2] the conclusion will be reached that by 1955 the total active population presumably rose to 3 696 000 persons. This in turn would imply a more rapid rate of increase for the economically active population than for the population as a whole, i.e., an annual growth rate of 20.5 per mil at the beginning and over 22 per mil by the end of the period.

To judge from such estimates of the possible future trends of the active population increment as might be formulated in the light of these background data, this rate of growth will tend to accelerate in the next few years, although without becoming as highly intensive as that previously cited for the total population. In accordance with this assumption, the active population would amount to 4 161 000 persons by 1960 and 4 692 000 by 1965. Hence it should be noted for purposes of the subsequent analysis that, during the decade 1955-65, the Peruvian economy's available labour force will increase by practically 1 million persons. Upon the extent to which the various economic activities, especially manufacturing industry, prove able to provide productive employment for this new active population, will undoubtedly depend the intensity and the pattern of Peru's economic development (see again table 2).

The break-down of the labour force by economic activities is more difficult to estimate. In 1940, 62.5 per cent of the active population was employed in agriculture and related activities. Among the non-agricultural activities which provided employment for the remaining 37.5 per cent, the most outstanding were manufacturing industry (15.5 per cent, although this included a high proportion of what might more properly be termed artisan activities), services of various kinds (11.3 per cent) and trade (4.4 per cent). Other activities such as public administration and the extractive industries absorbed smaller proportions. Should it be assumed that from then onwards the trends of rural and urban growth, on the one hand, and employment in agricultural and non-agricultural activities, on the other, ran more or less parallel, the resulting conclusion would be that by 1955 the latter must have increased their relative share in total employment to not less than 41 per cent. Other independent estimates would seem to suggest in addition that all the non-agricultural sectors, with the single exception of the extractive industries, were involved in this development (see table 3).

Table 3

PERU: ESTIMATES OF BREAK-DOWN OF ACTIVE POPULATION

	1940	*1955*
Total (thousands of active persons)	2 665	3 696
Percentage composition:		
Agricultural	62.5	58.9
Non-agricultural	37.5	41.1
Mining and petroleum	1.8	1.7
Industry	15.5	16.6
Construction	2.1	2.3
Trade	4.4	4.7
Miscellaneous services	11.3	12.3
Finance	0.1	0.3
Government	2.3	3.2

SOURCE: The figures for some of the sectors given were taken directly from the publications of the *Banco Central de Reserva*; estimates relating to trade, services and manufacturing industry were prepared with the co-operation of the Statistical Service, Department of Mathematical Statistics, of Peru.

To sum up, the demographic phenomena of most significance for purposes of the forthcoming analysis comprise a marked increase in the rate of vegetative growth of the total population; a decided trend towards a population shift from rural areas to urban centres; and a rising rate of growth of the active population, which, in the course of a decade, will be reflected in the incorporation of one million persons into Peru's available labour force.

2 The following are the statistics referred to. Some of the census figures were revised where it seemed desirable:

Age groups	Proportion of active population	
	Male	Female
10–14	22.8	20
15–19	53.0	40
20–24	92.6	45
25–34	96.7	45
35–44	97.2	45
45–54	96.5	45
55–60	95.3	45
60–64	95.3	40
65 and over	82.6	35

It should be noted that the break-down of the population by age groups in 1940 shows a relatively low proportion of persons over 15 years old in comparison with the number of children registered in the census as between 5 and 14 years of age.

2. *Level, composition and trends of national income*

(a) *The gross product and its origin by sectors*

The gross product—that is, the sum of all end goods and services produced in Peru—amounted to some 32 048 million soles in 1955. If this figure is related to population estimates for the same year (8 941 000 inhabitants, excluding the sylvan population) a *per capita* gross product of 3 584 soles, that is, the equivalent of some 187 dollars, is obtained. This figure in turn indicates that Peru's income level was far lower than that already attained by a considerable number of other Latin American countries, and even fell below the average *per capita* product for the region as a whole (see table 4).[3]

As regards the distribution of the gross product by economic activities, it should be pointed out that the agricultural sector was the source of about one-third of the whole; manufacturing activities contributed over 17 per cent, shared out in proportions of approximately two to one between "registered industry" and unregistered and artisan industry;[4] the extractive activities, mainly represented by petroleum production and mining for export, accounted for about 7 per cent; while among services the most outstanding were trade (11 per cent), public administration (about 8 per cent) and transport (7 per cent) (see table 5).

If this sectoral break-down of the gross product is considered in relation to the manpower employed in each of the sectors concerned, striking differences in productivity become apparent in the various branches of economic activity. In the economy as a whole, the gross product per active person amounted to some 8 700 soles, while the corresponding sectoral figures ranged from about 4 500 soles in the case of the agricultural sector to an average of 35 500 soles for the extractive industries.

The relatively low product per active person registered in the agricultural sector, which in 1955 provided employment for not less than 58 per cent of the total active population, means that from the standpoint of the improvement of productivity in the over-all economy, special importance attaches to manpower shifts towards the urban centres, in so far as the development of the other sectors suffices to absorb such manpower without ill effects in the form of disguised unemployment. It should be borne in mind that the low figure for the product per active person in crop and

Table 4

PER CAPITA GROSS PRODUCT LEVELS IN PERU AND OTHER LATIN AMERICAN COUNTRIES, 1955

(Dollars at 1955 prices)

Under 100	*100–200*	*200–300*	*300–400*	*Over 400*
Haiti	Bolivia Ecuador El Salvador Guatemala Honduras Nicaragua Paraguay *Peru*	Brazil Colombia Dominican Republic Mexico	Latin America (total 314) Chile Costa Rica Cuba Panama	Argentina Uruguay Venezuela

SOURCE: ECLA estimates and reports of the United Nations Statistical Office based on official data.

[3] See annex I which describes the sources and concepts and methods used in estimating the gross product and other macro-economic measurements. The figures quoted are of relative validity because most of them are subject to varying margins of error. The reservations with which they should be interpreted are particularly applicable in the case of international comparisons because of the numerous factors affecting them which cannot always be taken sufficiently into account.

[4] It is worth while to elucidate this distinction since it will be frequently used in this study. "Registered industry" comprises some 2 900 establishments which periodically supply statistical data to the appropriate bodies and probably include almost all industries of a certain size. The term excludes a few large establishments and most small-scale industry, as well as a wide variety of artisan activities which are of considerable importance, at least from the point of view of employment of manpower. The figures given for these two groups of manufacturing activity are of a very different nature: in the first case, they are obtained from more or less complete tabulations prepared by reliable official bodies; in the second, they are approximate estimates, worked out by indirect methods on the basis of information from heterogeneous sources.

Table 5

PERU: COMPOSITION OF THE GROSS PRODUCT AND BREAK-DOWN OF THE ACTIVE POPULATION, 1955

Sector	*Gross product (Million of soles)*	*Active population (Thousands of persons)*	*Gross product per active person (Soles)*	*Composition of the gross product (Percentage)*
Agriculture and animal husbandry	9 693	2 176.0	4 455	30.2
Extractive industry	2 199	62.8	35 501	6.9
Manufacturing industry	5 551	616.0	9 026	17.3
Registered industry	(3 397)	(120.6)	(28 167)	(10.6)
Unregistered and artisan industry	(2 154)	(495.4)	(4 348)	(6.7)
Construction	1 180	84.0	14 047	3.7
Transport	2 243	136.2	16 468	7.0
Trade	3 519	175.0	20 109	11.0
Finance	711	11.6	64 285	2.2
Property income	1 249	—	—	3.9
Miscellaneous services[a]	3 189	316.8	10 066	10.0
Government	2 514	117.6	21 378	7.8
Total	*32 048*	*3 696.0*	*8 671*	*100.0*

SOURCE: See annex I.
a Including electricity.

stock farming as a whole masks a striking difference between agriculture in the coastal belt, with its advanced techniques and production mainly for export, and farming in the sierra, which serves the needs of domestic consumption and in which very rudimentary production techniques are applied. A more strictly accurate measurement of the gross product per active person, differentiating between these two branches of agriculture, would bear out this opinion, as is suggested by the fact that farming in the coastal belt employs only a small fraction of the total agricultural labour force, while accounting for almost one-third of the gross product of the entire sector.

In manufacturing industry, too, average productivity is relatively low (some 9 000 soles per active person in 1955, a figure barely exceeding the average for the economy as a whole). But once again a distinction must be drawn here between two kinds of activity with very different rates of productivity. The first is what has been called registered industry, in which 120 000 persons are employed and the *per capita* gross product is equivalent to more than three times the average for the Peruvian economy; while the second comprises small-scale unregistered industries and artisan activities, with an employment figure of about 500 000 persons and a gross product per active person comparable to that of the agricultural sector. From these figures it can be inferred that, as far as the improvement of Peru's over-all level of economic activity is concerned, the gradual incorporation of part of this substantial artisan labour force into industry proper is quite as significant as the transfer of rural population. The net effect of this manpower reserve, already situated in the urban centres, is to enhance still further the importance of industry's future role in the absorption of the active population. This factor may constitute one of the crucial problems affecting Peru's economic prospects.

In the year under consideration, the gross product per active employed person was highest in the extractive industries, with a *per capita* figure of over 35 500 soles, i.e., more than 4 times the average for the economy as a whole and almost 8 times the figure for the agricultural sector and exceeding that registered for manufacturing industry proper. The share of these industries in total employment amounted to less than 2 per cent of the total active population, but they accounted for about 7 per cent of the gross product. This sector has probably the most promising growth prospects. To judge from the information available, it is also likely that this growth will take the form not only of a larger share in the total gross product but also of an even greater disproportion between the figures for the product per person employed and those for other activities. Indeed everything seems to indicate that the gross product generated by the extractive industries will increase substantially in the next few years, but that this increment will derive mainly from heavy investment in capital goods, which will expand production while limiting the extent to which additional manpower can be absorbed.

The services sectors show figures for the gross product per active person which, broadly speaking, exceed the average for the economy as a whole, except in the case of a large number of persons employed in domestic service and included in the group "Miscellaneous services".

(b) *Rate of growth of the product*

Although the figures given above are broadly illustrative of the current phase of development of the Peruvian economy, it must to some extent be viewed in the light of past events if the degree of rapidity with which changes have come about is to be assessed.

The first point worth noting in this context is that,

Table 6

PERU: INDICES OF THE GROSS PRODUCT, 1945-55

(1945 = 100)

Sector	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Total gross product	*104*	*106*	*110*	*118*	*124*	*134*	*139*	*150*	*157*	*163*
Annual rate of growth: 1945-55 = 5.0 per cent										
Agricultural and animal husbandry	102	103	108	116	121	128	131	141	147	147
Extractive industries	88	86	86	102	111	126	133	149	164	162
Manufacturing industry	101	109	117	128	132	124	151	165	182	192
Construction	120	123	136	135	151	203	223	290	256	287
Transport	108	120	120	130	155	169	178	208	219	240
Trade	105	110	112	122	127	145	148	158	161	170
Property income	105	111	115	119	121	125	126	129	133	137
Finance	104	88	75	83	99	121	137	167	179	195
Miscellaneous services	103	106	109	112	115	118	121	126	131	136
Government	116	119	122	125	128	130	130	133	135	138
Per capita gross product	*101*	*102*	*104*	*109*	*113*	*119*	*121*	*128*	*131*	*133*
Annual rate of growth: 1945-55 = 2.9 per cent; 1945-50 = 2.5 per cent; 1950-55 = 3.4 per cent										

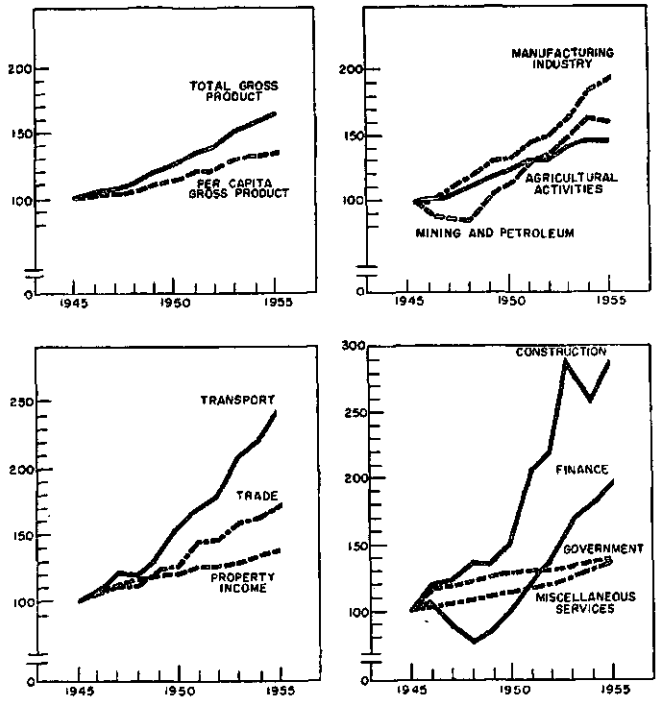
SOURCE: See annex I.

although the level of the gross product was low in 1955 in comparison with that registered in other Latin American countries, it represented a substantial increment in relation to that prevailing ten years earlier. In fact, during the period 1945-55 Peru's rate of economic development was more or less satisfactory, although rather erratic, with annual growth rates showing fairly intensive fluctuations.

As the rate of development was, on the whole, relatively moderate in 1946-50 and more rapid during the following five years, the gross product expanded in the whole course of the decade by some 63 per cent, that is, at a cumulative average annual rate of 5.0 per cent. If the population increment during the same period is taken into account, the inference is that the average annual rate of increase of the *per capita* gross product reached about 2.9 per cent, by virtue of yearly growth rates of 2.5 per cent during the first half of the period and 3.4 per cent in the second (see table 6 and figure I).

Figure I

PERU: INDICES OF THE GROSS PRODUCT IN REAL TERMS, 1945-55
(1945 = 100)



Such a rate of increase, maintained throughout an entire decade, compares favourably with that registered in the other Latin American countries, even in those where development is more intensive. If a similar rate is kept up in the future, Peru will gradually improve its relative position. The conditions in which this development took place and the foreseeable difficulties that may hamper its continuance during the next few years will be discussed later.

It is of interest to note how the main branches of economic activity helped to promote this upward trend in the gross product, and the resultant changes in its composition by sectors.

Agricultural production expanded in real terms during the decade under consideration by 47 per cent. As this rate was lower than that registered for the economy as a whole, the relative share of agriculture in the total gross product fell from 33.5 per cent in 1945 to 32.8 per cent in 1950 and 30.2 per cent in 1955. At the same time the active population employed in agriculture increased by only 19 per cent, so that a fairly intensive improvement took place in the productivity of the sector. A decline in the relative importance of agricultural activities is unquestionably a phenomenon characteristic of development, so that the above situation does not necessarily indicate that the evolution of agriculture was unsatisfactory. It should be noted, however, that this average growth was the outcome of widely dissimilar trends in two types of production. Agricultural production for export showed the more striking progress (59 per cent), while production for domestic consumption increased by only 35 per cent during the entire period, which implied an annual increment in *per capita* consumption of barely 1 per cent. Unless the income-elasticity of demand for foodstuffs is assumed to have been extremely low, which seems unlikely in a country such as Peru where serious dietary deficiencies exist, the contrast between so moderate a rate of growth and the marked increase in total *per capita* income was bound to be reflected in heavier import requirements of goods of this type.

Manufacturing industry developed much more intensively; its output almost doubled in real terms between 1945 and 1955. This expansion continued practically without interruption throughout the whole period, except in the years 1946 and 1950, when it tended to level off, probably in consequence of heavy imports of manufactured goods attributable, in the one case, to the reopening of markets immediately after the war and, in the other, to a change in Peru's foreign trade policy. Thus manufacturing activity as a whole raised its share in the total gross product from 14.7 per cent in 1945 to 17.3 per cent in 1955 (see tables 6 and 7).

Part Two of the present study will include a fairly thorough analysis of the characteristics of this industrial expansion, the nature of the contribution made by each of the principal branches of manufacturing activity, etc., and of the extent to which the development described can be considered satisfactory. At this juncture it is sufficient to mention that, although the progress achieved by industry was very marked in absolute terms, it did not succeed in keeping pace with demand, and the result was a weakening of its relative position in comparison with imports as a source of supply for the domestic market concerned.

The extractive industries—mining and petroleum production—showed an understandable decline in the first few years, from which they did not recover until 1949; they expanded rapidly later, under the stimulus

Table 7

PERU: CHANGES IN THE COMPOSITION OF THE GROSS PRODUCT BY SECTORS

(Percentage of total gross product)

Sector	1945	1950	1955
Agricultural and animal husbandry	33.5	32.7	30.2
Extractive industries	6.9	6.2	6.9
Manufacturing industry	14.7	15.5	17.3
Construction	2.1	2.5	3.7
Transport	4.7	5.9	7.0
Trade	10.5	10.8	11.0
Finance	1.9	1.5	2.2
Property income	4.6	4.5	3.9
Miscellaneous services	11.9	10.9	10.0
Government	9.2	9.5	7.8

SOURCE: See annex I.

of better world market prices and the favourable conditions offered by a new mining code, which helped to strengthen the inflow of foreign capital to this sector. Between 1945 and 1955, the gross product deriving from the extractive industries rose by 62 per cent, not less than two-thirds of this increment being registered from 1950 onward. Even so, the increase barely sufficed to maintain this sector's relative share of about 7 per cent in the aggregate gross product.

Construction activities expanded to a notable extent, largely as the result of a relatively high level of investment during the decade under review. Owing to such factors as the installation of new industrial plants, building activities deriving from the opening-up of new mines, extensive public works programmes and the rate of residential building, the gross product generated by this sector almost trebled between 1945 and 1955, thus showing a more striking expansion than any other economic activity.

Almost equally intensive was the increase in the gross product registered in the transport sector. Apart from the over-all development of economic activity, the chief determinant of this growth was the improved integration of Peru's road network and the consequent heavy lorry traffic. The railway system also expanded, on a lesser scale but still significantly, largely in connexion with the transport of ores and metals to the ports of embarkation.

Trade also increased its contribution to the total gross product—although but slightly—because the increment in the volume of transactions was proportionately larger in the case of imports than in that of domestically-produced goods. By contrast, the relative importance of the other services sectors—property income, finance, miscellaneous services and public administration—showed downward trends, with the exception of financial activities.

All in all, there were no radical changes in the composition of the gross product by sectors during the course of the decade under review. In greater or lesser degree, all branches of economic activity expanded in absolute terms, although in specific instances their growth may not have sufficed to meet the requirements deriving from the intensive rate of increase of the total gross product. Probably the most significant cases in point were the slow development of agricultural production for domestic consumption and the weakening of the relative share of domestic industry in total supplies of manufactured goods.

(c) *The gross product and the availability of goods and services*

In an economy like that of Peru, where the external sector plays a very important role, it is essential that measurements of the gross product be supplemented by other concepts which afford a more accurate impression of the supplies of goods and services that were effectively at the disposal of the Peruvian population. Such concepts are mainly the effects of fluctuations in the terms of trade[5] and the net balance of export and import movements (see table 8).

[5] Relationship between the export and import price indices. For fuller details on the calculation and interpretation of these concepts, see the article on concepts and methods used by ECLA, in the *Economic Bulletin for Latin America*, Vol. I, No. 2, September 1956.

Table 8

PERU: GROSS PRODUCT AND AVAILABILITIES OF GOODS AND SERVICES, 1945–55

(Values in millions of soles at constant 1955 prices)

Year	Gross product	Foreign trade balance on current account	Available goods and services	Financing of balance on current account	
				Terms-of-trade effect [a]	Other items [b]
1945	19 698	+1 138	18 560	— 395	+ 743
1946	20 394	+ 322	20 072	— 340	— 18
1947	20 973	−1 451	22 424	— 220	−1 231
1948	21 765	+ 73	21 692	— 129	— 56
1949	23 308	+ 116	23 192	— 482	— 366
1950	24 477	— 560	25 037	181	— 379
1951	26 422	−1 976	28 398	1 157	— 819
1952	27 327	−1 091	28 418	179	— 912
1953	29 629	— 511	30 140	— 314	— 825
1954	30 950	+ 321	30 629	— 19	+ 302
1955	32 048	— 346	32 394	0	— 346

SOURCE: See annex I.

a Although reference is made in the text to variations in the terms of trade in comparison with 1945, it was thought preferable here to measure their effect in relation to 1955, in order to facilitate comparison with other series and keep measurements uniform at the latter year's prices.

b Mainly the balance of foreign capital movements.

Peru's terms of trade improved in relation to 1945 in every subsequent year up to and including 1955, with the single exception of 1949. Hence the result of the domestic production effort—measured in terms of the gross product—was supplemented by an additional increase in Peru's purchasing capacity, thanks to which it was possible for the volume of available goods and services to expand more rapidly, proportionally speaking, than the gross product. The terms-of-trade effect was especially important in the years 1950-52, when export prices rose most sharply to the point where the decline registered in subsequent years did not completely wipe out the margin of profit accruing from the price boom during the hostilities in Korea.

Conditions like these, favourable to an expansion of available goods and services proportionally even greater than the already marked increment in the gross product, were enhanced by a striking change in the situation as regards the balance of payments on current account. During the early years of the period, Peru had to maintain an excessively large flow of exports, in order to finance an unfavourable balance in foreign capital movements; in other words, part of the gross product was exported without the domestic economy's receiving the benefit of an equivalent inflow of imported goods. In subsequent years on the other hand, the situation was reversed, and an import surplus began to be registered, mainly as the result of a greater inflow of foreign capital. Hence it was possible for the rate of increase of available goods and services to be accelerated, and the simultaneous expansion of consumption and investment was consequently facilitated.

These points will be reverted to in later sections, since they are important for explaining economic development characteristics in the past and the possible outlook for the next few years. It is unlikely that the two factors concerned can continue to exert an equally favourable influence. To begin with, the terms of trade have deteriorated since 1955, and to assume first a recovery and later a persistent improvement calculated to ensure positive effects, would be a very risky supposition. The case is probably still clearer with respect to the inflow of foreign capital; in recent years, both direct and portfolio investment reached fairly high levels, with deferred amortization and reinvestment of profits in the earlier part of the period which greatly reduced the relative importance of the remittances abroad. Yet these remittances must ultimately assume larger proportions. In other words, the maintenance of a favourable balance in the capital account, in face of an increasing volume of remittances abroad, would call for a permanent inflow of new capital greater than can reasonably be expected. In short, for the Peruvian economy to achieve a future rate of increase of available goods and services similar to that registered in the past, the domestic production effort would have to be proportionally much greater, since it would no longer be possible to rely on the favourable influence of the factors mentioned, while, on the contrary, their negative effects would probably have to be offset.

(d) *Income distribution*

The data available are not accurate enough to allow a reasonably thorough survey to be made of the distribution of the national income among Peru's various population groups. Yet this aspect is one of great importance, especially when an attempt is made to analyse the market for various kinds of manufactures, or the possible behaviour of demand for imported goods, etc. It is therefore worth while, even at the risk of forming judgments that are not completely realistic, to endeavour to draw some conclusions from the few background data—some of them very indirect—that are at present to hand.

A first general indication can be deduced from data on the gross product per person employed in the different branches of economic activity. According to the relevant figures, set forth in table 5, very marked disparities in productivity are registered in Peru, the levels attained being very low in at least two sectors which in the aggregate employ more than three-quarters of the total labour force, namely, agriculture on the one hand, and on the other, small-scale unregistered industries and artisan activities. The case of the first of these sectors must be briefly discussed, even though only on very conjectural lines. On an average, the gross product per active person in 1955 amounted to some 4 500 soles. If the proportion corresponding to the coastal belt with its agricultural production for export is excluded, the figure for the remainder will probably not be far from 3 000 soles annually per active person, from which the income of a small number of entrepreneurs and landowners farming on a relatively large scale might still be deducted. In short, in the whole vast sector constituted by smallholders and agricultural wage-earners in the sierra, perhaps representing a total population (dependents included) of some 4 million persons, i.e. about 45 per cent of the Peruvian population, the average *per capita* income would seem to be so small as virtually to exclude any form of consumption other than the barest subsistence requirements.[6] Such circumstances as these have doubtless inspired the remark so frequently heard in Peru to the effect that in reality two economies exist there side by side, with completely dissimilar methods of production and patterns of consumption. In any event, for purposes of the present study, what must for the moment be stressed is the great future influence that might be exerted by the gradual incorporation of this vast population sector into demand for manufactured goods. This would imply a progressive expansion of the domestic market for local industry.

[6] It is astonishing that the attempts to measure this income level give monthly figures as low as 4 or 5 dollars *per capita*. However, great the margin of error in these calculations may be, and leaving aside the various factors which should be taken into account in interpreting them, it is quite obvious that this conclusion holds good from the quantitative aspect.

Although less acute, the situation is not fundamentally very different in the case of the population partly dependent on the half million active persons employed in artisan activities, where again productivity is very low.

In contrast, the extractive industries, manufacturing industry proper, transport, construction and certain services which employ a very modest proportion of the active population generate two-thirds of the total gross product. Within these same sectors, a further distinction ought to be drawn between the share of the factors of production—owners, shareholders and entrepreneurs, on the one hand, and wage-earners, on the other—in the income generated. In this context, however, the background data available are scanty; among them may be cited the fact that in the economy as a whole the salaries and wages paid out do not amount to as much as 40 per cent of the value added, and that as regards registered industry, total salaries and wages represent on an average only some 30 per cent of the value added in this branch of activity.

These general characteristics of income distribution do not seem to have undergone any significant change between 1945 and 1955. It is true that the rate of growth of consumption was quite intensive (see table 9) and even outstripped that of the gross product thanks to the improvement in the terms of trade and the inflow of foreign capital. This might indicate a greater relative participation of the lower-income sectors, but this is not the conclusion to be drawn to judge from the kinds of consumer goods of which availabilities increased in the highest proportion. As was seen earlier, agricultural production for domestic consumption expanded at an annual *per capita* rate of barely 1 per cent, which at the same time implied a very moderate increment in the gross product in the lower-income sector of the rural population, and a relatively small increase in domestically-produced availabilities of the volume of goods comprising a major share of the wage-earning sectors' total consumption. In contrast, the much more marked expansion of imports doubtless meant that the supply of durable and other high-quality consumer goods was substantially greater.

Table 9

PERU: BREAK-DOWN OF AVAILABLE GOODS AND SERVICES BY CONSUMPTION AND INVESTMENT, 1945-55

(Values in millions of soles at constant 1955 prices)

Year	*Available goods and services*	*Consumption*	*Investment*
1945	18 560	15 938	2 622
1946	20 072	15 024	5 048
1947	22 424	18 497	3 927
1948	21 692	18 507	3 185
1949	23 192	19 219	3 973
1950	25 037	21 188	3 849
1951	28 398	22 246	6 152
1952	28 418	22 401	6 017
1953	30 140	23 196	6 944
1954	30 629	25 291	5 338
1955	32 394	26 254	6 140

SOURCE: See annex I.

Statistics on the evolution of the salaries and day-wages paid in specific economic activities may also provide some indication of the lines along which distribution of productivity increments during the period under review developed. An example is the result obtained if the data on nominal salaries and wages and the employment concerned, as given in official national income statistics,[7] are deflated by the cost-of-living index. Even if only registered industry is taken into account, where better levels and more stable systems of remuneration are usually to be found, real *per capita* salaries were lower in 1955 than in 1947 in all sectors except trade, the reduction being particularly severe in agricultural activities and manufacturing industry. Consequently, not only did this employment category fail to increase its share in the improvements in productivity recorded in the corresponding sectors, but it did not even succeed in maintaining its real income at the same level. As regards wages, the situation was apparently much more favourable, since considerable real improvements were registered here; nevertheless, even these increases do not seem, save in exceptional cases, to have been equivalent to the increments in the aggregate gross product per active person recorded in the sectors concerned.

To sum up, income distribution does not seem to have changed for the better in the course of the period under review. This tentative conclusion should be borne in mind, however frail the objective data which support it, because it may largely account for the slower growth shown, within industrial activity as a whole, by those branches that are most closely linked to demand in the lower-income sectors, as is the case, for example, with the cotton textile industry.[8]

3. *Investment and production capacity*

The Peruvian economy displays very sharp contrasts as regards the intensity with which capital resources are utilized in the several branches of economic activity. The most striking contrast is provided by a comparison between the extractive industries, with their very high capital intensity, and farming for domestic consumption, where any form of investment in fixed capital is virtually non-existent. These disparities in the stock of capital per employed person in different activities determine the disequilibria in productivity to which reference was made earlier.

The complete lack of any systematic information on the stock of capital will once again entail the use of

[7] *Banco Central de Reserva, Renta Nacional del Perú*, 1955.

[8] The observation, made at the talks held in Peru with various institutions and individuals regarding the preliminary version of this study, to the effect that more thorough research should be undertaken on income distribution is very pertinent. Professor Bruno Moll, in particular, stressed the great importance of this from the point of view of the subsequent economic development of Peru.

Table 10

PERU: GROSS PRODUCT AND ESTIMATES OF STOCK OF CAPITAL, 1955

(Values in millions of soles)

Sector	Gross product	Stock of capital	Product-capital ratio
Agriculture and animal husbandry	9 693	16 802	0.58
Extractive industries [a]	2 427	8 345	0.29
Manufacturing industry [b]	5 323	12 942	0.41
Transport	2 243	7 235	0.31
Energy	663	7 367	0.09
Property income	1 249	10 408	0.12
Other sectors	10 450	17 624	0.59
Total	32 048	80 723	0.40

SOURCE: See annex I.
a Including refining of petroleum and metals.
b Excluding refining of petroleum and metals.

very rough estimates, prepared on the basis of indirect criteria and partial statistics (see table 10). Consideration will first be given to the three most important sectors of production: agriculture and animal husbandry, the extractive industries and manufacturing.

In the first of these sectors, an evaluation of accumulated investment in soil improvement, building, installations and fences, permanent plantations, livestock and agricultural equipment would give, for 1955, an estimated total stock of capital (depreciated and at replacement cost) of about 17 000 million soles. Livestock accounts for practically half this figure, while the value of agricultural equipment does not represent more than 8 per cent of the whole. The high product-capital ratio (0.58) thus shown by the farming sector is attributable to a variety of factors. Firstly, in a large proportion of Peru's agricultural activities current practices can be described as pre-capitalistic; practically no use is made of machinery and equipment, fences are few and far between, the area under artificial pasture is very small, etc. Secondly, only small amounts are invested in clearing, a task already dealt with to a large extent in Inca times, or in rural housing, where mild weather conditions reduce essential requirement to a minimum. Lastly, in the sector where capital formation can really be said to have taken place—agricultural production for export—mechanized equipment is utilized with a high degree of intensity and efficiency.

On the other hand, the extractive industries sector comprises activities characterized by the high capital intensity required for operation; it is thus not surprising that, however efficiently they are run, they register one of the lowest ratios between the capital utilized and the gross product generated. Special attention must be drawn to the low product-capital ratio in this sector because of the future effects of its substantial prospective development on the corresponding ratio for the economy as a whole. In so far as the relative importance of the capital applied in such activities and the corresponding gross product increase, the aggregate ratio will in fact tend to decline, even if there is an improvement in the ratio of this individual sector.

An opportunity will later arise for more careful study of this question in relation to manufacturing industry. Suffice it to state here that the product-capital ratio in this sector is relatively high for activities of this kind (0.41), even slightly exceeding the corresponding figure for the economy as a whole. This might lead to the conclusion that industry has achieved intensive utilization of its installations and equipment.[9] But this is not the case, as will later be apparent from the data on the percentage of utilization of installed capacity recorded in many establishments. The high product-capital ratio seems rather to be mainly attributable to two factors. One of these is the large proportion of the gross product generated in this sector which is accounted for by small-scale industry and artisan activities, whose stock of capital is very limited. In the second place, some influence is no doubt exerted by the present composition of manufacturing activity by branches of industry, in which the share of sectors characterized by a relatively high capital intensity, like the engineering and metallurgical industries, is still only small. In brief, the valuation of capital taken into account here relates mainly to "registered industry", which has unquestionably accumulated a large stock of machinery, equipment and installations, and, taken by itself, would show a much lower ratio, if the relevant figures could be separated from the aggregate.

Hence it is no easy matter to hazard any fairly well-grounded forecast as to the future evolution of the product-capital ratio in industry. While more efficient utilized installation of installed capacity would tend to raise it, if the relative importance of industry proper were increased, as against artisan activities, and new branches with higher capital intensity were to grow more rapidly, the present ratio would probably be reduced.

If the other economic activities are added to the three sectors mentioned,[10] a total domestic capital figure of 80 000 million soles is reached, and a product-capital ratio of 0.40 for the economy as a whole—still relatively high as compared with that recorded in other Latin American countries.

Of greater interest than the absolute level of this ratio is the way it varied between 1945 and 1955.

The relevant figures are summed up in table 11. They are based on the 1955 estimate just mentioned, on annual gross investment figures and on a reasonable depreciation hypothesis. According to these cal-

9 It should be noted that the measurement of the stock of capital takes into account only "fixed capital", excluding inventories and other forms of circulating capital.

10 The other activities account for more than half of the total stock of capital. But the corresponding figures were obtained not by direct measurement, but by approximate estimates based on more or less subjective criteria of comparison with other Latin American countries. Any commentary on their individual level would therefore hardly be worth while. Even so, mention should be made of the significance of capital in the transport and energy sectors, which generally show very low ratios and comprise a major share of what is termed "basic social capital".

culations, the stock of capital would seem to have been less than 58 000 million soles in 1945 and to have expanded relatively slowly up to 1951, but much more rapidly from that time onwards, until it exceeded the 80 000 million soles estimated for 1955. In the aggregate, this increment was smaller than that of the gross product during the same period; in other words, the growth of the latter was not always accompanied by a similarly intensive investment effort, but was largely promoted by a steady improvement in the product-capital ratio. This rose from 0.34 in 1945 to 0.39 in 1951, and from then onwards remained more or less stationary until 1955.[11]

It is striking that the product-capital ratio increased during the period when the gross product was expanding most slowly, while it remained stagnant when the development of the product was most intensive. These dissimilar trends reflect a notable change in the level of the investment coefficient. Between 1945 and 1950, this coefficient was, broadly speaking, moderate, except for the high figure registered in 1946; consequently, net investment was also relatively limited, and even the slower expansion achieved by the gross product was largely attributable to a more intensive utilization of available capacity. Between 1951 and 1953, on the other hand, the investment coefficient climbed very high, reaching 22-24 per cent, only to fall again in the following two years. The heavy investment effected during this three-year period was partly accounted for by the improvements in the terms of trade and the increased inflow of foreign capital.

During 1951-55 the share of foreign capital in total investment amounted to about 20 per cent, so that, by 1955, 15 per cent of the total fixed capital operating in Peru was foreign-owned.

The expansion of the investment coefficient during recent years enabled a far-reaching programme of public works to be put into execution. Despite the scale of these undertakings, private investment represented about four-fifths of total investment; only in 1955, and then mainly because private investment remained stationary, did public investment come to account for nearly 30 per cent of the total.

More detailed consideration of the sources and uses of investment funds is beyond the scope of the present study. What may be stressed as of immediate importance is the fact that in previous years Peru has demonstrated its ability to attain a distinctly high investment coefficient, while at the present time there is nothing to suggest that comparable levels could not be maintained in the near future. On the other hand, it is highly doubtful whether the product-capital ratio could also be expected to continue rising as it did after 1955; in other words, the maintenance of a similar rate of increase of the gross product would require a more energetic investment effort than in the past.

4. *The role of the external sector*

(a) *Relative importance of foreign trade*

Foreign trade played a very important role in Peru's economic development during the decade ending in 1955, in the course of which exports and imports increased substantially. Up to 1949, the institutional framework within which this trade was conducted was very similar to that existing in most of the other Latin American countries and was characterized by a variety of direct and indirect controls and restrictions. After that date, governmental policy in this field altered radically and an extremely liberal system was introduced. A detailed study of the consequences of this policy from the aspect of over-all economic develop-

11 These estimates may be subject to a wide margin of error which will affect absolute levels rather than the qualitative conclusion regarding the trends of the product-capital ratio. Actually these trends were confirmed by means of hypothetical calculations of extreme absolute levels—one very high and the other very low—for the initial period and by estimating the capital that would have existed in the subsequent periods according to each hypothesis. The conclusions were the same in both cases as regards the relative increase in the product-capital ratio.

Table 11

PERU: PRODUCT-CAPITAL RATIO AND INVESTMENT COEFFICIENT TRENDS, 1945-55

(Values in millions of soles at constant 1955 prices)

Year	*Gross product*	*Gross investment*	*Stock of capital* [a]	*Product-capital ratio*	*Investment coefficient* [b]
1945	19 698	2 622	57 658	0.34	13.3
1946	20 394	5 048	60 294	0.34	24.7
1947	20 973	3 927	61 751	0.34	18.7
1948	21 765	3 185	62 438	0.35	14.6
1949	23 308	3 973	63 857	0.37	17.0
1950	24 477	3 849	65 102	0.38	15.7
1951	26 422	6 152	68 513	0.39	23.3
1952	27 327	6 017	71 664	0.38	22.0
1953	29 629	6 944	75 585	0.39	23.4
1954	30 950	5 338	77 811	0.40	17.2
1955	32 048	6 140	80 723	0.40	19.2

SOURCE: See annex I.

a Series obtained on the basis of the estimate for 1955 and the amount of annual net investment; to calculate the latter, depreciation, estimated at 4 per cent of the stock of capital, was deducted from gross investment.

b Gross investment as a percentage of the gross product.

ment would therefore be of great interest; but it is not in accordance with the aims of the present study, which will deal only with the most outstanding features of the incidence of the external sector, with a view to considering some of its effects on the expansion of manufacturing industry.

In 1955, imports amounted to about 5 748 million soles and exports to 5 105 million; if they are related to the population, these figures represent 643 and 571 soles *per capita*, equivalent to 34 and 30 dollars respectively. It should be emphasized that *per capita* exports to a value of 30 dollars do not place Peru in a very favourable position as compared with that of other Latin American countries in the same year. On the contrary, this level must rather be considered unsatisfactory because it is barely superior to that of Bolivia (29 dollars *per capita*) and far below that of countries like Argentina (49 dollars), Chile, (70 dollars) or Colombia (46 dollars).

These figures show that, contrary to what is generally supposed, Peru's *per capita* exports are far from satisfactory. The fact that, in the course of the period under review, this trend did not give rise to problems as serious as those confronting some other Latin American countries seems to be due to a combination of different factors. In the first place, the situation is not static; at their low level the volume of exports increased very rapidly. Secondly, apart from the growth of the export quantum, there were other favourable elements—especially the improved terms of trade and the increased inflow of capital from abroad—which boosted the capacity to import and thus led to a gradual rise in the level of imports, proportionately much greater than that of exports. Finally, although *per capita* imports were low in absolute terms, they were less so if related to the average figure for the *per capita* gross product, and allowance must also be made for the differences in productivity and income distribution patterns which have already been mentioned as observable from one area to another, and which totally excluded a considerable margin of the population from the demand for imported goods. In other words, while a relatively small proportion of the population reaped the benefits of fairly heavy imports, the vast majority remaining consumed only an insignificant quantity of imported goods. Yet another factor that might be mentioned as having facilitated balance-of-payments equilibrium was the favourable evolution of the terms of trade during the period under consideration.

In any event, more satisfactory than the absolute figures as a measure of the importance of the external sector is what is generally called the "import coefficient", i.e., the percentage relationship between the value of imports and the aggregate amount of the gross product. It showed very sharp fluctuations between 1945 and 1955, as the net result of which it rose from 13 to 18 per cent (see figure II and table 12). This increase, which is the result of an expansion of imports proportionally greater than that of the gross product, indicates that a growing contribution was made by imports to total availabilities of goods and services, and, therefore, that the importance of the external sector in the Peruvian economy was intensified.

In itself, the increase in the import coefficient might be interpreted as a factor favourable to Peru's economic development, as it shows Peru's capacity for gradually

Figure II

PERU: IMPORT AND EXPORT TRENDS, 1945-55

(Values in millons of soles at 1955 prices) *Percentages of gross product*

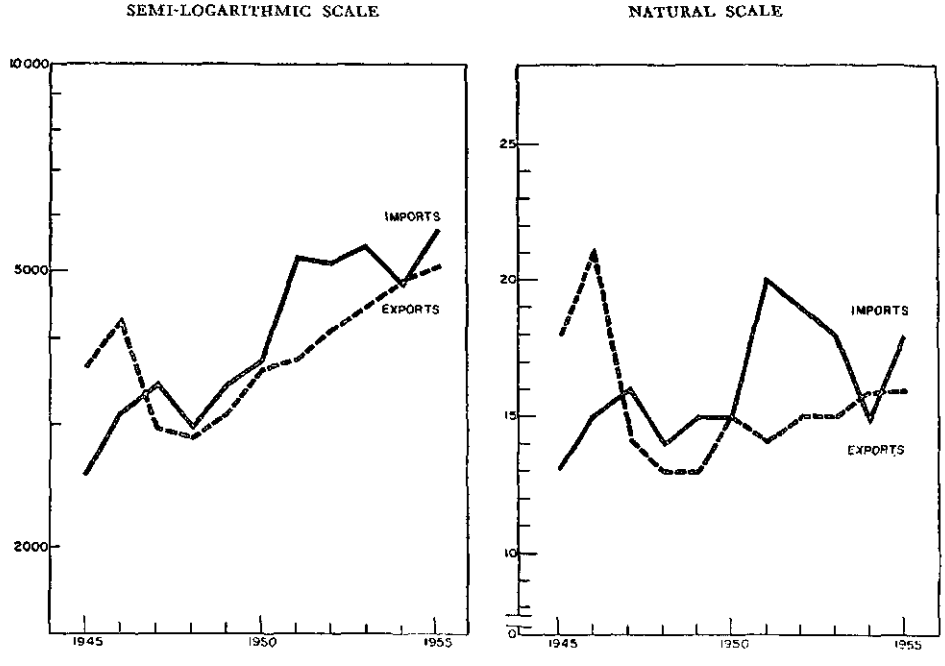


Table 12

PERU: FOREIGN TRADE AND ITS RELATIONSHIP TO THE GROSS PRODUCT, 1945–55

(Values in millions of soles at constant 1955 prices)

Year	Imports	Exports	Trade balance	Percentage relationship to the gross product	
				Imports	Exports
1945	2 538.6	3 625.8	+1 087.2	13	18
1946	3 116.5	4 247.3	+1 130.8	15	21
1947	3 455.0	2 970.8	— 484.1	16	14
1948	2 979.7	2 871.3	— 108.4	14	13
1949	3 446.9	3 127.3	— 319.7	15	13
1950	3 729.4	3 626.9	— 102.4	15	15
1951	5 281.2	3 744.9	—1 536.4	20	14
1952	5 177.3	4 135.9	—1 041.4	19	15
1953	5 474.5	4 480.9	— 993.6	18	15
1954	4 791.1	4 829.7	+ 38.6	15	16
1955	5 748.2	5 105.8	— 642.4	18	16

SOURCE: Estimates based on official statistics.

overcoming the limitations of the foreign currency resources available for imports of capital goods and intermediate products, as well as of specific consumer goods to meet the requirements of the population. Events between 1945 and 1955, however, suggest two points for which allowance should be made. The first of these is the method by which imports were financed, that is, the degree to which their expansion was accompanied by a similar increment in exports; the second is the way in which the additional external resources were utilized, or, in other words, the direction taken by the changes in the composition of imports. The former will be discussed here and now, while the latter will be the subject of brief comment later on.

Imports (valued at constant 1955 prices so that their evolution can be assessed in real terms) increased from 2 538 million soles in 1945 to 5 748 million in 1955; this expansion represented an increment of over 120 per cent in the course of the decade (see again table 12). Exports in turn rose from 3 626 to 5 106 million soles during the same period, that is, by 40 per cent, or barely one-third of the percentage increase in imports. Nevertheless, these comparisons must not be drawn without due regard to the fact that, in 1945, imports were limited by world market supply shortages, whereas exports maintained relatively high levels in consequence of the wartime production effort. Hence, the early years of the period under review, when the world economy, and, to a certain extent, the Peruvian economy as well, had to cope with a process of adjustment to more normal production levels, are not the most suitable for ascertaining steadier foreign trade trends such as afterwards emerged and have remained in evidence up to the present time. But even if the comparison is confined to developments between 1948 and 1955, the two trends continue to differ, although in a more moderate degree; imports expanded by over 90 per cent, whereas in the case of exports an increment of only 78 per cent was registered

The trade balance (exports and imports still being measured at constant 1955 prices) showed a considerable surplus in 1945 and 1946, but, as a result of the trends mentioned above, deficits were registered in all subsequent years, with the single exception of 1954.

The same developments can be expressed in terms of the gross product. In 1945, imports represented 13 and exports 18 per cent of the gross product; in 1955, on the other hand, the import coefficient had risen to 18 per cent, while that of exports had declined to only 16 per cent.

It was pointed out earlier that the main determinants of so marked a disparity between export and import trends were the favourable evolution of the terms of trade and—to a greater extent—a substantial inflow of new foreign capital, far more than enough to cover the servicing of former loans and remittances of profits deriving from earlier direct investment. Neither of these elements seems to hold out equally favourable prospects for the next few years, apart from the difficulty of even maintaining the previous rate of expansion of the export quantum. In any case, before more precise conclusions are drawn, some of the factors mentioned must be discussed in greater detail.

(b) *Composition and trends of exports*

Peru's relatively diversified exports are made up of agricultural and mining commodities in very similar proportions. In 1955, its agricultural exports (among which cotton and sugar are preponderant) accounted for about 48 per cent of total sales abroad, while exports of mining products—mainly copper, lead, silver, zinc and petroleum—constituted 46 per cent; the remaining 6 per cent was provided by manufacturing industry, and consisted chiefly of processed sea-food (see table 13).

The diversity of its exports has to some extent reduced the vulnerability of the Peruvian economy to external fluctuations and has helped to mitigate the effects of the abrupt changes that are apt to occur in world market quotations for primary commodities. Even so, the Peruvian economy is still highly dependent on a few minerals, particularly in view of the fact that these minerals fluctuated considerably between 1945

Table 13

PERU: COMPOSITION OF EXPORTS BY SOURCE, 1945–55

(Percentages of total)

Exports	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Agricultural commodities . .	48	60	50	53	49	51	44	48	53	49	48
Mining products	49	37	48	45	48	45	50	47	43	46	46
Non-metals	19	13	15	17	16	14	13	11	8	8	8
Metals	30	24	33	28	32	31	37	36	35	38	38
Manufactured goods. . . .	3	3	2	2	3	4	6	5	4	5	6

SOURCE: Estimates based on official statistics.
a Valued at constant 1955 prices.

and 1955, although not with the same intensity or with the same impact on the internal economy as in other Latin American countries, dependent in a much higher degree on exports of one or two primary commodities.

The general structure of exports has undergone no significant or lasting change since 1945, except for an expansion of the small relative share of manufactured goods, which increased from 3 per cent in 1945 to 6 per cent in 1955. During given periods (in 1946, for example), agricultural exports came to constitute as much as 60 per cent of the total; at other times (1945, 1951), they were exceeded by exports from the extractive industries (see tables 13 and 14). On the other hand, within these broad groups considerable changes did take place in respect of the relative importance of the different exportable commodities.

During the period under review the expansion of agricultural exports received a powerful stimulus from the improvement of world market prices for the commodities of the greatest importance to the Peruvian economy. From 1948 onwards, cotton and sugar prices registered a steady upward movement which reached its climax in 1951, when quotations for the former were almost 50 per cent higher than in 1950 and sugar prices rose by about 30 per cent in relation to the preceding year. Despite this incentive, the quantum of exports of these two commodities decreased during the boom periods in question, and its expansion throughout the whole course of the period was relatively modest in such favourable circumstances. This apparent lack of response to price incentives may be an indication of the importance of other factors limiting the supply of such exports, as, for example, the gradual exhaustion of the soil and the growing difficulty of developing new land suitable for the cultivation of the commodities concerned. In the case of coffee exports the picture is very different, for they rose from a negligible level to a position of some importance among total agricultural exports, the volume exported increasing almost sevenfold between 1946 and 1955.[12] In contrast, wool exports—another important item among the external sales of the agricultural sector, including not only sheep's wool but also alpaca, llama and vicuña skins—did not show any very clearly-defined upward trend, despite the fact that the price incentive was an important factor in specific years during the period under consideration.

The composition of exports of mining commodities, which declined during the first three years after the war and expanded rapidly from then onwards, underwent even more marked changes. Between 1948 and 1955, exports of metal ores increased by 147 per cent, while those of non-metals fell by 15 per cent. Outstanding among the former were copper, lead, silver, zinc and iron ore, while the latter were almost entirely made up of petroleum derivatives, crude petroleum and coal. Such dissimilar trends were no doubt partly attributable, in the one case, to the adoption of a mining code which provided a number of incentives of different kinds and helped to attract a substantial inflow of foreign capital towards the activities in question, as well as to the favourable trend of world market prices; and, in the other, to the increasing

[12] It should be noted that this expansion of coffee exports meant merely that levels which had already been fairly high before and during the Second World War were regained and improved upon.

Table 14

PERU: EXPORT QUANTUM INDICES, 1945–55

(1948 = 100)

Exports	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Agricultural commodities . .	*115*	*168*	98	*100*	*100*	*122*	*109*	*130*	*157*	*157*	*161*
Mining products	*136*	*121*	*111*	*100*	*118*	*125*	*144*	*150*	*149*	*169*	*185*
Non-metals.	136	112	92	100	104	99	96	94	68	73	85
Metals.	137	128	123	100	127	142	175	186	200	231	247
Manufactured goods. . . .	*197*	*213*	*87*	*100*	*143*	*257*	*373*	*360*	*286*	*413*	*457*
Total	126	147	103	100	108	126	130	144	156	168	178

SOURCE: Estimates based on official statistics. Indices were computed on the basis of valuation of a representative sample of goods at constant prices.

difficulties attending the opening-up of new wells and the growth of domestic demand which gradually encroached upon export availabilities.

Lastly, the products of the fishing industry (tinned fish and fish oils and meal) were still predominant among exports of manufactured goods, of which they constituted over 80 per cent in 1955. Despite the insignificance of the present share of exports of manufactures in foreign trade as a whole, Peruvian industry displayed an interesting potential capacity to compete on foreign markets. On more than one occasion exports of paper products, cotton yarns and textiles, silver and glassware, etc., were registered. Trade in cotton yarns and textiles, exports of which were already fairly substantial in 1951 and 1952, might very easily become much more intensive in the future, in view of Peru's privileged situation as regards availabilities of raw material of unusually high quality. Such possibilities will undoubtedly increase as progress is made towards the establishment of a Latin American regional market.

These, then, are the most significant facts relating to exports, on which the study of Peru's foreign trade prospects will later be based.

(c) *Composition and trends of imports*

The quantum of imports tended to increase more rapidly than that of exports. In this case, too, significant changes in the composition of imports, which are worth bearing in mind, accompanied their expansion.

In 1948, 20.7 per cent of total imports consisted of consumer goods, 49.8 per cent of capital goods and the remainder of intermediate goods (raw materials and semi-manufactured products) and fuels. From then up to 1955 the over-all quantum of the goods comprised in these broad categories increased, but the intensity of the respective increments differed very widely (see tables 15 and 16).

The quantum of imported consumer goods rose rapidly as from 1948, until by 1951 and 1952 it accounted for over 26 per cent of total imports. This expansion was partly due to the measures, adopted in 1949, removing controls and restrictions, which released repressed demand or simply encouraged a preference for specific imported goods that in some cases were also produced at home. Although in subsequent years imports of this kind decreased even in absolute terms, in 1955 they still represented a considerably higher proportion than in 1948, i.e., 24 per cent of total imports. The expansion was particularly marked in the case of imports of durable consumer goods, which more than quadrupled in real terms during the period under review.

Intermediate goods, after a slight contraction at the beginning of the period, tended on the whole to maintain their relative share in aggregate imports. Fuel imports, while small in relation to total imports, fluctuated widely and showed a tendency to increase relatively.

The striking increment in the proportion constituted by consumer goods, as well as the more moderate proportional increase registered for fuels and other intermediate goods, took place at the expense of the relative share of imports of capital goods, which decreased from 49.7 per cent of the total in 1948 to 44.1 per cent in 1955. Machinery and production equipment for mining, industry and other activities were most severely affected, as well as transport and communications equipment; on the other hand, the relative share of agricultural machinery and equipment underwent no appreciable change, and that of imports of building materials increased considerably (see again tables 15 and 16).

Table 15

PERU: COMPOSITION OF IMPORTS, BY DESTINATION, 1948–55

(Percentages of total) [a]

Imports	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Consumer goods	20.7	20.9	25.1	26.6	26.1	20.6	20.5	24.0
Non-durable consumer goods	17.4	18.1	19.7	17.8	19.3	13.9	16.5	17.1
Durable consumer goods	3.2	2.7	5.3	8.7	6.7	6.6	3.9	6.8
Unspecified	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Fuels	1.3	1.9	1.8	2.0	1.6	1.5	2.4	2.1
Raw materials and intermediate goods	28.2	29.9	28.0	22.4	24.5	25.4	30.0	29.7
Metals	3.6	4.4	3.4	3.6	3.5	3.7	4.4	4.4
Non-metals	24.6	25.5	24.6	18.8	21.0	21.7	25.6	25.3
Capital goods	49.8	47.3	45.1	49.0	47.8	52.5	47.1	44.2
Building materials	5.7	4.8	5.2	5.9	6.4	8.5	7.6	7.4
Agricultural machinery and equipment	5.2	8.2	5.4	5.1	6.0	6.2	5.0	5.3
Machinery for industry and other activities	28.2	24.2	19.9	20.8	25.1	26.8	24.0	23.6
Equipment and material for transport and communications	10.7	10.1	14.6	17.2	10.3	11.0	10.5	7.9

SOURCE: Estimates based on official statistics.
[a] Imports valued at constant 1955 prices.

Table 16

PERU: IMPORT QUANTUM INDICES, 1948–55
(1948 = 100)

Imports	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Consumer goods	*116.3*	*148.8*	*227.8*	*218.5*	*182.5*	*158.8*	*222.0*
Non-durable consumer goods	120.4	139.4	181.8	192.8	146.9	152.5	188.5
Consumer goods	97.6	203.3	479.6	379.1	375.9	194.0	403.4
Unspecified	32.1	63.8	153.8	175.7	151.3	136.6	204.3
Fuels	*161.0*	*169.6*	*260.8*	*205.1*	*209.7*	*283.2*	*304.5*
Raw materials and intermediate goods	*122.6*	*121.9*	*139.9*	*150.0*	*165.4*	*170.5*	*201.0*
Metals	139.5	115.7	173.3	165.0	186.2	194.9	228.6
Non-metals	120.0	122.8	134.9	147.7	162.3	166.9	196.8
Capital goods	*110.1*	*110.8*	*174.8*	*166.4*	*194.1*	*151.7*	*169.6*
Building materials	96.9	110.6	182.6	193.7	272.1	121.2	247.9
Agricultural machinery and equipment	185.3	126.7	176.6	204.5	221.1	156.2	195.9
Machinery for industry and other activities	99.4	86.6	130.9	153.4	174.8	136.2	159.4
Equipment and material for transport and communications	109.3	167.3	285.7	168.0	190.1	157.6	141.7
Total	*115.6*	*122.6*	*177.1*	*173.1*	*183.8*	*160.2*	*191.1*

SOURCE: Estimates based on official statistics. Indices were computed on the basis of the valuation of a representative sample of goods at constant prices.

It may be noted in passing that these changes in the composition of imports correspond to the measurement of imports in real terms, valued at constant 1955 prices. A direct analysis of the composition of imports at each year's current prices would lead to different conclusions, owing to the varying intensity of the fluctuations in average prices for the goods included in each of the categories mentioned. While the price index for aggregate imports rose by 173 per cent between 1948 and 1955, for consumer goods the increment was in the neighbourhood of 160 per cent, while for the various categories of capital goods it amounted to 221 per cent (building materials), 265 per cent (agricultural machinery and equipment), 270 per cent (machinery for mining, industry and other activities) and nearly 330 per cent (transport and communication equipment).[13] Although the goods concerned were not affected by the import substitution process, so marked a disparity in the evolution of prices of consumer goods on the one hand and those of capital goods on the other may doubtless have exerted some influence on the unfavourable changes in the composition of imports at constant prices to which allusion has just been made. The implication is, in fact, that in order to maintain the real share of capital goods, the resources annually earmarked for such imports would have had to be increased in much greater proportion.

Whatever the explanation, the fact is that the quantum of imports of consumer goods expanded faster than the capital goods quantum. This observation suggests in turn certain conclusions that should be borne in mind.

In the first place, the low level of development recorded so far by the engineering and metallurgical industries, as well as other branches producing capital goods, establishes a very close relationship between imports of this type of goods and total domestic investment. In other words, the attainable investment coefficient depends essentially on the quantity of capital goods imported. It was precisely because of the relatively large share of capital goods in aggregate imports that it was possible to maintain a sufficiently satisfactory investment coefficient. The decline in the relative scale of these imports in recent years does not affect the investment coefficient to any appreciable extent because of the marked expansion in total imports, but it raises some doubt regarding the possible effect which a subsequent contraction might produce if the capacity to import failed to increase at the same pace. To express this in another way, if appropriate steps are not taken, a possible further drop in the share of capital goods, combined with stagnation or slower growth of the aggregate capacity to import, might have unfavourable consequences as regards continued economic development at a satisfactory pace.

In the second place, during the period under review, demand for imported consumer goods was characterized by a very high degree of elasticity. If the growth of *per capita* consumer goods imports is related to the increase in total *per capita* consumption during the period 1948-55, an average elasticity of nearly 2.0 results; in other words, should conditions remain much the same as in that period, there would be a tendency for every increment in total consumption to be accompanied by an increase almost twice as great in the demand for imported consumer goods. Thus, unless the capacity to

[13] The discrepancy in the trends displayed by the composition of imports depending on whether they are studied in terms of current values or constant 1955 prices was particularly stressed by the economist Romulo Ferrero at the round-table meetings held in Peru to discuss the preliminary version of this study. Generally speaking, the whole analysis here is based on measurements at constant prices, but the reservation made may be very important if it is desired to draw some conclusion from these data regarding the economic policy followed in this connexion, which falls outside the scope of this study.

import continued expanding very rapidly indeed, goods of this type would tend to absorb a steadily growing proportion of available external resources.

It should be noted here that these trends and changes in the composition of imports provide a more objective frame of reference against which to measure how far the rate of growth of industrial production has or has not been satisfactory. The rise in the import coefficient; the increasing share of consumer goods in total imports, often competing with the production capacity already developed by domestic industry; and the fact that, within the slower growth of imports of capital goods, a more marked upward trend is observable for building materials, where again competition with domestic activity is keenest, are all factors which, *inter alia*, lead to the conclusion that the industrialization process has not been sufficiently intensive to take full advantage of the expansion of demand and that Peruvian industry, instead of supplying a steadily increasing proportion of consumer requirements, has been losing ground. This does not mean that no industrial development took place in the period under review. On the contrary, manufacturing production expanded at the quite high rate of 65 per cent between 1948 and 1955; but the progress made by external sources of supply was still more intensive, so that industry failed to profit fully by the incentives and opportunities which the expansion of demand afforded.

An opportunity will arise later to revert to these tentative conclusions as a basis for the study of possible development prospects and problems within the next few years and of the role that would be incumbent, in the circumstances, on subsequent industrial development.

(d) *The direction of trade*

The foregoing rapid sketch of foreign trade must be supplemented by some indications of its direction, although this does not seem to be a very important factor for the specific purposes of the present study. Still, in view of the possible establishment of a common Latin American market and the increase in intra-regional trade which this would bring in its train, attention should be drawn to the importance of Peru's trade with neighbouring countries and the items currently traded.

Like its exports, the direction of Peru's foreign trade is characterized by its diversification, as regards both purchaser and supplier countries. This circumstance also helps to reduce Peru's vulnerability to the behaviour of demand in any of its markets. In 1955, rather more than one-third of its exports were shipped to different European countries, a little over 36 per cent to North America and more than one-fifth to South America; Central America purchased 3 per cent of Peru's exports, and Asia—mainly Japan—4 per cent. Europe's buying position remained the same as in 1950, when it had recovered in relation to 1945, in which year because of the aftermath of the war and supply difficulties European buyers had been able to absorb only 10 per cent of Peru's exports. The South American countries, which had constituted Peru's chief markets during the war, declined in importance as the world economy was gradually restored to normal, and their share fell from 39 per cent in 1945 to 31 per cent in 1950 and 21 per cent in 1955. During the first five-year period this relative loss of importance (which also affected Central America), took place as a result of the increase in Europe's purchases, whereas from 1950 to 1955 the downward trend was due to an improvement in the relative share of North America which rose from 28 to 36 per cent of the total (see table 17). As regards imports, those from North America—almost entirely from the United States—were predominant, accounting for more than half the total in 1955 and 61 and 55 per cent in 1945 and 1950 respectively. The trends observable here were similar to those registered for exports. South America was also the area whose position was weakened in relation to other parts of the world; after accounting for one-fourth of sales to Peru in 1945, its contribution dropped to a little over 7 per cent in 1950 and 1955.

Even so, Peru is perhaps the Latin American country which conducts most trade with its neighbours. Its exports are shipped mainly to Chile, while its imports come largely from Argentina. Other countries, such as Bolivia, Colombia, Ecuador and Uruguay also play an active part in this trade, although to a lesser degree. As a rule, trade with these nearby countries shows a substantial balance in Peru's favour.

Exports to the South American countries comprise the same commodities that constitute the leading items among total exports: cotton and sugar. Chile, Peru's largest market in South America (its purchases account for nearly two-thirds of the total value of this trade), imports, apart from the commodities mentioned, petroleum products and derivatives. In turn, Chile sells iron and steel, fertilizers and processed foodstuffs to Peru, but these transactions cover barely 10 per cent of the value of Peru's exports to Chile, so that the latter is in a marked net debtor position. On the other hand, as Peru does not produce enough wheat to supply its own requirements, it imports substantial quantities from both Argentina and Uruguay, its trade balance with these countries being unfavourable for want of reciprocity in this branch of trade. There was a time when the imbalance was mitigated by Peru's exports of coal to Argentina, but in recent years Argentina has discontinued its purchases, with the inevitable effects on the trade balance. Exports to neighbouring countries also include paper, timber and different kinds of woollen yarn. But these items, like others exported on a smaller scale, can no longer be considered traditional owing to the sharp fluctuations they display from year to year, some of them actually disappearing completely at times. Exports of petroleum and its derivatives, which now constitute an important item, also show a tendency to decrease with the growth

Table 17

PERU: DIRECTION OF TRADE

(Imports and exports as a percentage of the total) [a]

Country	1945		1950		1955	
	Imports	*Exports*	*Imports*	*Exports*	*Imports*	*Exports*
Europe	7.31	10.79	31.81	34.93	34.13	34.55
America	88.93	82.12	63.28	59.61	61.85	60.19
North America	61.16	33.97	55.02	27.92	52.44	36.14
Central America	2.52	9.04	0.60	0.53	1.57	3.07
South America	25.25	39.11	7.66	31.16	7.84	20.98
Argentina	13.75	3.23	3.68	4.88	4.72	1.79
Bolivia	0.23	5.79	0.01	3.23	0.04	2.33
Chile	5.81	19.24	1.21	14.63	1.28	13.40
Colombia	0.05	2.98	—	3.19	0.12	1.15
Ecuador	1.85	1.12	2.51	0.60	0.07	1.44
Uruguay	0.49	3.89	0.01	2.81	1.28	0.35
Asia	2.54	1.04	1.92	4.85	3.81	4.44
Africa	0.06	—	0.17	0.12	0.13	0.13
Oceania	1.07	1.14	2.81	0.09	0.07	0.52
Others	0.09	4.91	0.01	0.04	—	0.17

SOURCE: Basic data from *Anuarios de comercio exterior* (Foreign Trade Yearbooks).
a In terms of current values.

of domestic consumer requirements, so that they could only be maintained if production were to expand to a notable extent. Again, unless the necessary increment is achieved in domestic wheat production, imports of this cereal will tend to increase considerably in the future.

(e) *Foreign capital contributions*

One last aspect which may usefully be mentioned in connexion with the external sector's share in the development of the Peruvian economy during the last decade is that related to movements of foreign capital and funds in general. It covers the amount of capital thus contributed, the amortization payments involved, remittances of profits and interest abroad, etc.

According to figures recently published by the United States Department of Commerce,[14] in 1953 long-term foreign capital in Peru amounted to the sum of 506 million dollars. Of this total, 396 million corresponded to direct private investment and 110 million to portfolio investment; three-quarters of the former consisted of United States capital. If these data are supplemented by other official statistics,[15] it may be concluded that total foreign capital rose from 384 million dollars in 1945 to 587 million in 1955. A reminder that in the year in question the latter figure represented 15 per cent of the total capital at the disposal of the Peruvian economy, will enable a clearer idea to be

14 United States Department of Commerce, *Investment in Peru*, Washington, 1957.

15 For foreign investment statistics published by the Banco Central de Reserva del Perú, see *La Renta Nacional del Perú 1955* (Balance of Payments Section).

Table 18

PERU: MOVEMENT OF LONG-TERM FOREIGN CAPITAL, 1945-56

(Millions of dollars)

Year	*Total capital in Peru* (A)	*Gross investment* (B)	*Amortization* (C)	*Net investment* (D)	*Services* (E)	*Coefficients (Percentages)* (E : A) (F)	(C : A) (G)
1945	384.1	15.7	0.7	15.0	20.0	5.2	0.2
1946	399.1	11.7	1.0	10.7	18.5	4.6	2.5
1947	409.8	15.4	3.4	12.0	12.0	2.9	0.8
1948	421.8	19.5	1.7	17.8	13.6	3.2	0.4
1949	439.6	5.6	6.2	— 0.6	11.3	2.6	1.4
1950	439.0	4.5	13.6	— 9.1	9.7	2.2	3.1
1951	429.9	42.3	16.5	25.8	21.6	5.0	3.8
1952	455.7	69.1	18.8	50.3	20.6	4.5	4.1
1953	506.0	69.5	14.3	55.2	20.5	4.0	2.8
1954	561.2	45.3	19.6	25.7	22.1	3.9	3.5
1955	586.9	71.0	35.7	35.3	23.1	3.9	6.1
1956	622.2	121.2	45.5	75.7	31.8	5.1	7.3

SOURCES: 1945-55: *Banco Central de Reserva del Perú, Renta Nacional 1955 (Balance de Pagos)*; 1956: International Monetary Fund. Estimates of total foreign capital in Peru were derived from the basic figure given for 1953 by the United States Department of Commerce, *Investment in Peru*.

formed of its relative importance. With the help of the same sources of information, gross investment, amortization payments, net investment and the remittances of profits and interest deriving from the foreign investment mentioned can be fairly accurately estimated (see table 18).

The marked increase in the foreign capital invested in Peru was largely attributable to the adoption of official measures designed to provide incentives and favourable conditions for such investment, especially from 1949 onwards. Suffice it to mention that more than one-fourth of the total stock of foreign capital in 1955 was composed of investment effected as from 1951. As will be seen later, the fact that such a large proportion of foreign investment was new has far-reaching implications as regards the incidence of future amortization payments and remittances of profits and interest.

Gross external investment, which fluctuated between 5 and 20 million dollars annually between 1945 and 1950, increased remarkably after 1951, rising to annual figures which ranged from 40 to 70 million dollars. The bulk of this inflow of capital was constituted by direct investment, mainly in mining and petroleum activities, but in recent years portfolio investment too was gradually intensified by virtue of loans from the International Bank and the Export-Import Bank. Such an inflow of funds from abroad considerably helped to raise the total level of internal investment, of which foreign capital came to represent, on an average, almost one-fifth during the period 1951-55.

This inflow was to some extent offset by the fact that the outflow of capital abroad in respect of amortization payments, charges and other disbursements was very moderate up to 1954; in 1955, on the other hand, it substantially increased, apparently because amortization payments were begun in respect of private and official capital invested during recent years. The outflow under these heads totalled 35.7 million dollars in 1955, a figure which, if related to that of 71.0 million dollars registered for gross external investment, gives a net investment of 35.3 million dollars. This latter figure is still not representative of the net balance of the total movement of funds to and from foreign countries, as it is further necessary to take into account remittances, of profits and interest, which remained relatively stable during the last five years of the period considered, at a level a little above 20 million dollars. The annual figure for 1955 was 23.1 million dollars, which deducted from the net investment figure of 35.7 million dollars, leaves a positive balance in the movement of funds to and from foreign countries of 12.2 million dollars.[16]

These are, in brief, the most significant of the relevant statistics. It is important to emphasize, for the purposes of the analysis that follows, not only the unquestionable importance of foreign capital as a factor favourable to economic growth during the period under review, but also the symptoms of a weakening of its dynamic role, which may ultimately bring about a substantial change in the nature of its contribution to future development. In the first place, there can be no doubt that amortization requirements are pursuing a pronounced upward trend, which, as has just been mentioned, was already apparent in 1955. Secondly, remittances of profits and interest were relatively moderate, in the period in question, as a result of the heavy rate of reinvestment characteristic of new investment during a phase of rapid expansion of the economy as a whole; but this again is a positive factor which cannot be relied upon to continue operating indefinitely.

It might well be asked what would happen if, in the course of the next few years, an increase in amortization payments were to coincide with a decrease in the reinvestment rate of the enterprise concerned, since, in that case, only a very marked increment in the inflow of new capital would enable Peru to continue benefiting from a positive balance in the movement of funds to and from foreign countries similar to that registered during the last decade. Finally, it seems that over the long term such positive balances would inevitably be offset by net outflows of capital, to judge from the experience of several Latin American countries today; whether Peru will or will not have to cope with such a situation in the fairly near future is a question that will be discussed later on.

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16 The total net foreign capital contribution actually exceeded this figure slightly (it is estimated as having been equivalent to some 346 million soles), since short-term credits are not taken into account in these observations.

Chapter II

ECONOMIC DEVELOPMENT PROSPECTS

Chapter I presents a picture—although a highly simplified one which brings out only the most salient features—of the development of the Peruvian economy during the period 1945-55. The ultimate aim of this analysis is to assemble the assential background data with which to form some idea of the possible intensity and patterns of future growth, a matter which is dealt with in the present chapter, with a view to defining the demands that the development in question would make on the economic activity with which the present study is chiefly concerned—manufacturing industry.

Before this topic is embarked upon, the main conclusions to be drawn from the preceding review of past events may usefully be summed up.

Since the ultimate aim of economic activity is the progressive improvement of the living conditions of the population, the results obtained in the course of the period 1945-55 might be assessed in terms of the increment in *per capita* consumption of goods and services. As was pointed out in the appropriate context, the average cumulative annual rate of increase registered during the period was 3.0 per cent, an expansion which compares very favourably with that recorded in most of the other Latin American countries over the same lapse of time. If a similar rate of growth were maintained in the future, Peru would be able gradually to improve its position—at present one of the lowest—as regards the relative income levels currently prevailing in the region.

Apart from the considerable domestic effort which this satisfactory rate of growth of consumption entailed, it was also partly due to the combination of several favourable factors by which it was undoubtedly greatly facilitated. These factors included a rate of population growth which was relatively moderate, or at any rate lower than that registered in more recent years; a sizeable inflow of foreign capital; an improvement in the terms of trade; and a rise in the product-capital ratio, at levels which were already relatively high. Thanks to favourable trends in the terms of trade and in the movement of foreign funds, the import coefficient rose considerably, proportionately far more than the export coefficient. The rise in the latter led in turn to an increase in the availabilities of goods and services greater than that of the gross product which, together with the improvement in the product-capital ratio, also promoted a swifter expansion of consumption.

Thus, an indispensable adjunct to any study of future growth prospects is a careful analysis of the possibilities of a recurrence of an equally favourable combination of all these factors. Should the chances of this seem slight, it will be necessary to investigate what additional changes and efforts would be called for if as satisfactory a rate of growth as in the preceding decade were to be maintained.

1. *An automatic projection of historical growth*

The following considerations will be based on the hypothesis that the increase in *per capita* consumption between 1955 and 1965 will be proportionally equal to that registered in 1945-55, and that similar growth patterns will be followed, especially as regards the contribution of the external sector. In other words, the development of the Peruvian economy will be assumed to continue with much the same intensity and characteristics as in 1945-55.

It would be completely unrealistic to ignore certain recent changes which are already affecting specific factors in greater or lesser degree and which necessarily imply a modification of the characteristics of the earlier phase of development. The most striking of these relate to the growth of the population, terms-of-trade trends and the possible variations in the product-capital ratio.

The most important facts bearing on the growth of the population were discussed and the conclusion was reached that the rate of increase has been considerably accelerated in recent years. According to the relevant estimates, the future natural increment is likely to fluctuate between 24.0 per mil (in 1955-60) and 25.6 per mil (in 1960-65), which will mean that the total population will probably increase from 8 941 000 inhabitants in 1955 to 11 464 000 in 1965. So far as the present study is concerned, this would mean that the maintenance of the previous rate of expansion of *per capita* consumption (3.0 per cent annually) would require a more rapid growth of total consumption than before. A total increment of 73 per cent in 1955-65 would be necessary, as against only 65 per cent in 1945-55. Here, then, is an initial pointer to the fact that if the same rate of improvement in *per capita* consumption levels is to be maintained, a proportionally greater effort will have to be made in the future than in the past—in view of the accelerated growth of the total population.

From a superficial study of the outlook for the

terms of trade, another similar indication can be deduced. Although a more serious endeavour to evaluate probable price trends for the main import and export commodities would entail a complex analysis of exogenous factors—world market prospects, the possible supply from other parts of the world, etc.—the necessarily limited scope of the present study confines discussion within the bounds of hypotheses which, although not of proven validity, seem to be confirmed by the latest developments.[1] As a matter of fact, the net profit accruing to Peru as a result of the turn taken by the terms of trade during the period 1945-55 was largely due to the very high levels attained by export prices during the hostilities in Korea; but in subsequent years a downturn was registered. Indeed, in February 1958, the terms of trade were much lower than in 1955, nor were there any very obvious symptoms of a decided recovery. It therefore seems quite a reasonably assumption—hardly to be described as pessimistic—that on an average, during the period 1955-65, the terms of trade are likely to regain and remain at a level similar to that recorded in 1955. Were this to happen (and it must be stressed that such a development would imply a considerable improvement upon the current situation), Peru would not thereby be enabled to achieve an increase in the volume of available goods and services over and above the expansion of strictly domestic activity, as was the case in the preceding decade. This leads again to the previous conclusion: the attainment of the same rate of growth of *per capita* consumption would make greater demands on domestic effort.

As regards the prospects for the product-capital ratio, this factor undoubtedly constitutes a key element in an analysis of future development possibilities. As was mentioned in earlier sections, the absolute level of the product-capital ratio is relatively favourable in Peru by comparison with other Latin American countries, and its evolution during the period 1945-55 was positive. Although the possibility that it may improve in the future within each sector is not to be dismissed, the assumption that its evolution will continue to be equally satisfactory for the economy as a whole is hardly tenable; in fact, future development will probably imply a greater relative participation of the extractive industries—sectors in which the product-capital ratio is lower than in the over-all economy—while at the same time there will be an increasing need for heavier investment in basic social capital, such as transport and energy, where the corresponding ratios are lower still.[2] Such changes in the sectoral composition of capital would probably be more than sufficient to offset the possible improvements within each individual sector; if these latter are not achieved, a decline in the aggregate ratio will of course be inevitable. All in all, it seems reasonable to assume, as a working hypothesis, that in the course of the current decade the product-capital ratio will remain much the same as in 1955, in consequence of the conflicting influences of improvements in sectoral ratios on the one hand, and on the other, an increase in the relative share of total capital falling to sectors which are characterized by less favourable ratios. In such an event, another of the factors which facilitated development in previous periods will cease to operate, and here again its absence will have to be compensated by a proportionally greater effort than in the past.

In these circumstances, will it be possible for the Peruvian economy to keep up an equally intensive rate of development without other more radical changes in its growth patterns? This question will now be discussed with the help of the most representative aggregate figures.

If the population were to increase at the rate mentioned above, and the increments achieved in *per capita* consumption and the *per capita* gross product were proportionally similar to those registered in the period 1945-55 (3.0 and 2.9 per cent *per annum*, respectively), the total gross product would have to rise from 32 048 million soles in 1955 to 54 649 million in 1965, and total consumption from 26 254 to 45 443 million soles. If a product-capital ratio equivalent on the average to 0.40 were maintained, such an expansion of the gross product would mean that the total stock of capital would have to be increased from 80 723 million soles in 1955 to 136 622 million in 1965.[3] This rate of growth of the product, combined with such a scale of capital requirements, would in turn determine an annual gross investment of approximately 12 979 million soles[4] (see table 19). In these circumstances, the investment coefficient (ratio between gross investment and the gross product) would rise to 23.7, which is certainly a high figure, but not beyond the reach of the Peruvian economy as the experience of earlier periods shows.

At this juncture it is useful to consider the extent to which these over-all projections coincide. It should be borne in mind that, according to the concepts being applied, consumer demand and investment require the attainment of a certain level of total availability of goods and services which, in turn, should equal the amount of the gross product plus the product which could be achieved as a favourable effect of fluctuation in the terms of trade and the positive balances that

1 With particular reference to world market price prospects for some of Peru's main exportable commodities, see the ECLA secretariat study on Mexico, a country where the composition of exports is relatively comparable (*External disequilibrium in the economic development of Latin America: the case of Mexico* (E/CN.12/428)).

2 There will also be a considerable increase in the relative importance of manufacturing industry, whose product-capital ratio is at present above the average. But in this sector the situation is much the same as in the economy as a whole. Even though the product-capital ratio may rise in specific branches of industry, those manufacturing industries whose capital input is proportionally larger than the average for existing industry will presumably tend to develop more rapidly.

3 These figures, and those which will be cited in the course of the following sections, are expressed in terms of soles with a constant purchasing power equivalent to that of 1955.

4 Equal to the stock of capital in 1965 multiplied by the sum of the rates of depreciation (0.04) and of increase of the gross product (0.055).

Table 19

PERU: AUTOMATIC PROJECTION OF HISTORICAL GROWTH BETWEEN 1955 AND 1965

	1955	*1965*
A. VALUES AT CONSTANT 1955 PRICES		
Population (thousands of inhabitants)	8 941	11 464
Gross product: Total (millions of soles)	32 048	54 649
Per capita (soles)	3 584	4 767
Consumption: Total (millions of soles)	26 254	45 443
Per capita (soles)	2 936	3 964
Capital (millions of soles)	80 723	136 622
Gross investment (millions of soles)	6 140	12 979
Depreciation (millions of soles)	3 228	5 465
Net investment (millions of soles)	2 912	7 514
Available goods and services (millions of soles)	32 394	58 422
Difference between gross product and available goods and services (millions of soles)	346	3 773
Product-capital ratio	0.4	0.4
Gross investment coefficient	19.2	23.7
Net investment coefficient	9.1	13.7
	1945-55	*1955-65*
B. ANNUAL GROWTH RATES		
Population	2.0	2.5
Gross product: Total	5.0	5.5
Per capita	2.9	2.9
Consumption: Total	5.1	5.6
Per capita	3.0	3.0

SOURCE: 1945-55, official data. See annex I.

might exist in the total movement of foreign funds. In the case under consideration, the simultaneous achievement of a consumption figure equivalent to 45 443 million soles and of gross investment amounting to 12 979 million would call for total availabilities of goods and services to the value of 58 422 million soles. Comparison of this last figure with the hypothetical gross product shows that the deficit ultimately registered would be 3 773 million soles. The considerations set forth in earlier paragraphs suggest that this deficit—equivalent to some 190 million dollars—could not be covered by an improvement in the terms of trade, so that the necessary balance could only be established by a net inflow of capital equivalent to the same sum. Consequently, this is a primary requisite if such projections are to prove feasible and realistic.

Another of the factors which characterized previous development—the expansion of imports—may usefully be incorporated into these hypothetical projections. It will be recalled that between 1945 and 1955 the gross product increased by 63 per cent, while the import quantum rose by 126 per cent. If, for the reasons indicated, the comparison is confined to developments from 1948 onwards, it will be seen that the relevant increments amounted to 47 and 93 per cent respectively; in other words, in 1948-55, the average product-elasticity of imports was fairly high, reaching 1.57, as can be deduced from the detailed computation of the correlation of both series. If this elasticity figure (much more modest than if the whole period were taken into acount) is now related to the 71-per-cent expansion projected for the gross product, the conclusion will be reached that by 1965 an import quantum of some 13 671 million soles would be needed. This would mean that the import coefficient rose from 18 per cent in 1955 to not less than 25 per cent in 1965.

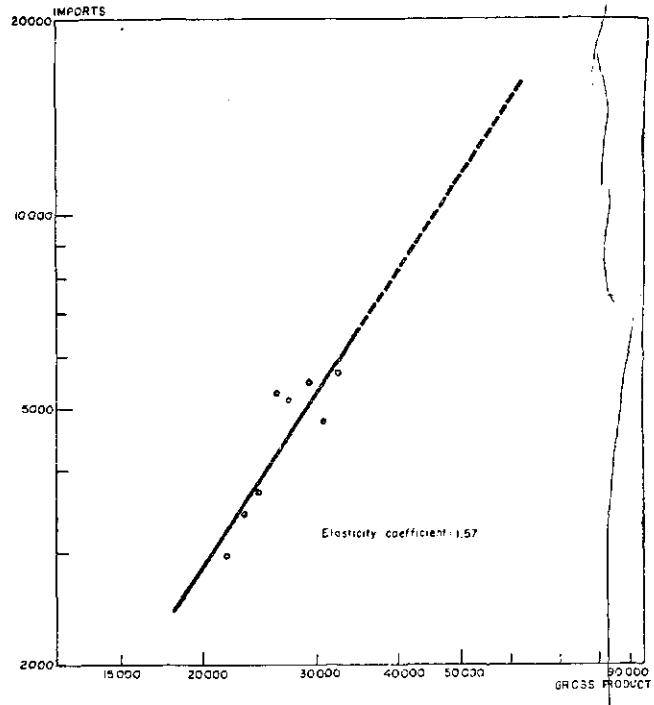
The problem is so important that it deserves somewhat more careful consideration, especially as regards the possible behaviour of specific basic categories of imports. The aggregate import-elasticity coefficient may in fact conceal widely differing elasticities for the various types of goods. This point is illustrated in some detail in figures III and IV, which show the

Figure III

PERU: RELATIONSHIP BETWEEN GROWTH OF IMPORTS AND GROSS PRODUCT

(Millions of soles at 1955 prices)

LOGARITHMIC SCALE



relevant ratios for the following four groups of imported goods: consumer goods, raw materials and intermediate products, fuels and capital goods.

An alternative projection of imports, this time based on the partial ratios between each type of goods and the total for the gross product—as was made for the period 1948-55—would nevertheless give a final result very similar to that recorded above (see table 20).

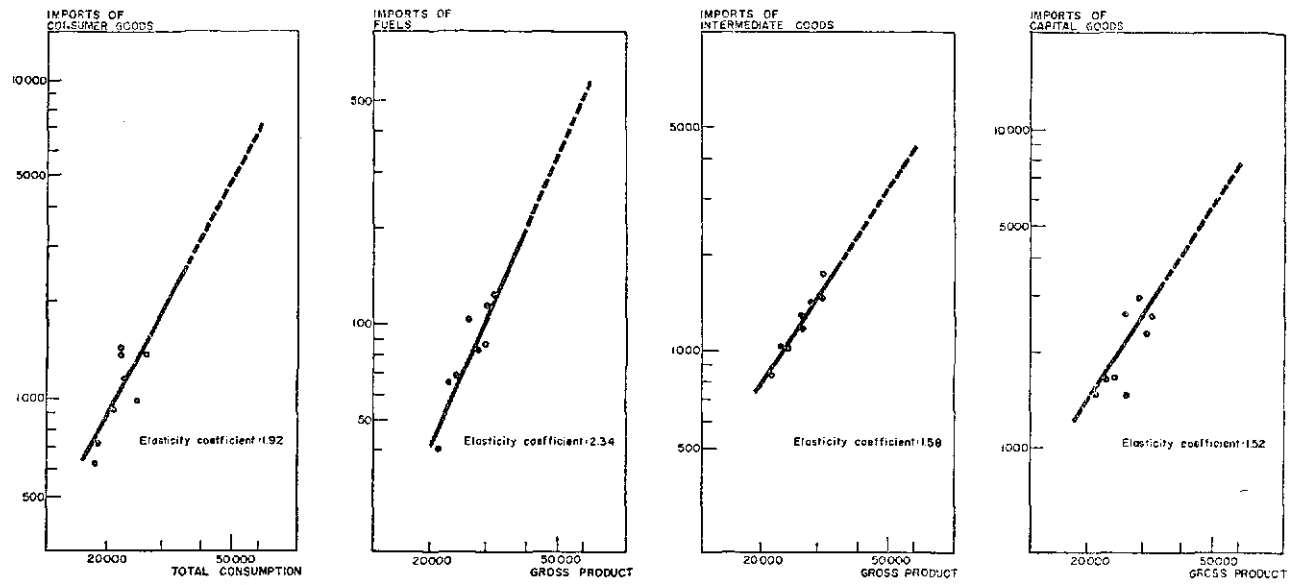
As can be noted, an automatic projection of past trends, such as that just formulated, clearly reveals the consequences of maintaining the present trend of imports of consumer goods. Their relative share in total imports, which had already risen from 20.7 to 24.0 per cent between 1948 and 1955, would reach 26.1 per cent by 1965, while imports of capital goods, which

Figure IV

PERU: IMPORT-ELASTICITY, BY TYPES OF GOODS

(Values in millions of soles at 1955 prices)

LOGARITHMIC SCALE



had already contracted from 49.8 per cent to 44.2 per cent between these two years, would continue to represent a proportion (44.5 per cent) very similar to this latter up to 1965. Nevertheless, in both cases the expansion of imports would exceed that registered for total requirements of both types of goods, so that domestic production would develop less intensively.

Be this as it may, at present the most important thing is to ascertain whether the aggregate import quantum could effectively expand during 1955-65 to the extent indicated, or, in other words, whether the growth of exports, as well as of other components of the capacity to import would cover the financing of so substantial an increase in the quantum of imports.[5]

[5] In earlier paragraphs the possibility that an improvement in the terms of trade might help to finance such an expansion of imports was rejected, since it was assumed—what is more, as a relatively optimistic hypothesis—that the terms of trade would remain unchanged at much the same level as in 1955. In these circumstances, the only possible sources for the necessary financing would be an increase in the quantum of exports and a larger net inflow of foreign capital.

This is another of the basic requisites if these more or less automatic projections of historical growth are to be at all likely to reflect that of the period 1955-65. The time has now come to launch a full discussion of these requisites in somewhat more specific terms.

2. *Prospects for the net inflow of foreign capital*

It will be recalled that foreign capital contributions, in the form of both direct and portfolio investment, played a very important part in Peru's economic development during the period 1945-55, especially in its latter half. Attention has been drawn to the existence of certain symptoms of a weakening in the dynamic role of such investment, deriving from the heavier amortization payments and remittances of profits and interest it entailed in recent years.

In 1955, long-term foreign capital investment in Peru totalled 589.6 million dollars, of which 446.9 million can be estimated to represent direct investment and the remaining 140 million, portfolio investment

Table 20

PERU: AUTOMATIC PROJECTION OF IMPORTS FOR 1965

(Values in millions of soles at constant 1955 prices)

	1948	1955	1965	
			Value	*Percentage composition*
Consumer goods	623	1 383	3 727	26.1
Raw materials and intermediate products	850	1 708	3 761	26.4
Fuels	40	123	429	3.0
Capital goods	1 494	2 535	6 340	44.5
Total	3 007	5 749	14 257	100.0

SOURCE: 1948 and 1955: Calculations based on official statistics (see figure IV).

(mainly the external public debt and commitments contracted with the International Bank and the Export-Import Bank).

Again, according to official data,[6] the total profits of United States enterprises in Peru amounted to 41 million dollars in the same year, on a total of 301 million dollars (i.e., 13.6 per cent). Since United States capital accounted for a major share of direct private investment, a similar percentage can be assumed for the remaining direct investment from other sources. However, not all this margin of profits gave rise to remittances abroad, as a considerable proportion was earmarked for reinvestment to expand the production capacity of the enterprises concerned. In fact, in 1955 remittances abroad under this head amounted in the aggregate to only 20.5 million dollars, or 4.6 per cent of direct foreign investment. To this must be added external payments corresponding to amortization, deductions and disbursements in respect of private capital, which totalled another 20.5 million dollars, that is, once again, 4.6 per cent of the total capital invested.

As regard portfolio investment, remittances abroad were chiefly determined by two factors. These were payments of interest on the external debt (2.7 million dollars, or approximately 1.9 per cent of the principal) and amortization payments. The latter were exceptionally high in 1955, in comparison with immediately preceding years probably because amortization of recently contracted international loans was begun. They totalled 15.3 million dollars, a sum equivalent to 10.9 per cent of total foreign portfolio investment in the year in question.

In short, with gross investment amounting to 71 million dollars and amortization payments on both direct and portfolio capital totalling 35.8 million, net foreign investment in 1955 stood at 35.3 million dollars. When remittances of profits and interest, etc., are deducted from the latter figure, it will be seen that the total net foreign contribution amounted to only 12.2 million dollars.[7]

These are the most important of the objective background data which must be taken into account in an analysis of the possible future contribution of foreign capital.

A preliminary hypothesis on which such an analysis might be based is that total foreign capital invested in Peru, according to estimates prepared by generally well-informed sources, might reach some 1 000 million dollars by 1965. Should this estimate prove accurate, it would imply, in concrete terms, that net investment would steadily increase until by 1965 it reached levels in the neighbourhood of 50 million dollars *per annum*, as compared with the 35 million mentioned as the net investment figure registered in 1955. Consequently, such a hypothesis might be considered reasonable, and even conservative to a point in the light of previous experience.

This criterion might therefore be adopted as a first approximation, which would need to be supplemented by certain additional hypotheses. In the first place trends observable during the most recent years, for which the relevant data are available, would seem to justify the assumption that in the future composition of capital the proportions represented by direct and portfolio investment will remain approximately unchanged. The second of these supplementary hypotheses is of a much more dubious nature, and relates to remittances of profits deriving from direct investment.

As was mentioned earlier, in 1955 remittances under this head represented only 4.6 per cent of the capital concerned, even though total profits were equivalent to 13.6 per cent. But it would appear unwise to assume as a working hypothesis that in the future so high a proportion of profits will continue to be reinvested, especially as the period in question was that of the initial phase of industrial expansion, and consequently profits can hardly be expected to maintain the same level. Hence, for the purposes of the present estimates, it will be assumed, though without the support of any very objective data, that the rate of profit will remain at 13.6 per cent up to 1965, but that remittances will increase to 9.0 per cent of the capital, so that the proportion reinvested will be much more moderate. In brief, this will imply an annual outflow of 67.5 million dollars in respect of total direct investment amounting to 750 million, as compared with the 20.5 million dollars registered in 1955.

By contrast, a substantial increment in depreciation payments is unlikely since a considerable proportion of the capital accumulated up to 1965 will be already amortized by that year. Thus, the relevant calculations will comprise only depreciation of capital incorporated during the last 15 or 20 years, that is, from 1945 or 1950 onwards. If a depreciation period of some 15 years is reckoned for this new capital (in virtue of the favourable conditions offered by Peru), remittances abroad under this head will amount to about 23.3 million dollars by 1965, thus representing a lower proportion of total capital than in 1955.

Portfolio investment, including official loans, will amount to some 250 million dollars in 1965. Interest on official loans granted by the International Bank and the Export-Import Bank, as well as on the foreign debt and other commitments, will probably represent on an average about 4 per cent of this sum, and will consequently imply an outflow of capital in the neighbourhood of 10 million dollars. Furthermore, such loans are not usually extended for terms longer than 15 years, so that an amortization rate of 6.7 per cent

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[6] United States Department of Commerce, *op. cit.*

[7] It should be noted that what is of particular significance for the immediate purposes of the analysis is this net foreign capital contribution, which could be used to finance the amount whereby available goods and services exceeded the gross product. There is no question of under-estimating other direct and indirect contributions made by foreign capital to the Peruvian economy, adequate discussion of which is outside the more limited scope of the present study.

will involve an additional annual outflow of 16.7 million dollars.[8]

Table 21 presents the results of these hypothetical calculations. To sum up, amortization payments (40 million dollars) and net investment (50 million dollars) will give a gross external investment figure of 90 million dollars for 1965. This gross inflow of foreign capital will not be enough to cover the outflow of funds in respect of remittances of profits and interest and amortization payments, and the final deficit resulting will amount to 27.5 million dollars.

Table 21

PERU: PROJECTIONS OF FOREIGN CAPITAL MOVEMENTS FOR 1965
(Millions of dollars at 1955 prices)

	1955	1965	
		Conservative hypothesis	*More favourable hypothesis*
Total foreign capital	587	1 000	1 250
Direct investment	447	750	940
Portfolio investment	140	250	310
Annual net external investment	35.3	50.0	100.0
Direct investment			
Total profits: Value	60.8	102.0	127.8
Percentage	13.6	13.6	13.6
Remittances of profits abroad: Value	20.5	67.5	84.6
Percentage	4.6	9.0	9.0
Amortization payments: Value	20.5	23.3	29.1
Percentage	4.6	3.1	3.1
Portfolio investment			
Interest: Value	2.7	10.0	12.4
Percentage	1.9	4.0	4.0
Amortization payments: Value	15.3	16.7	20.8
Percentage	10.9	6.7	6.7
Total foreign capital outflow	59.0	117.5	146.9
Amortization payments	35.8	40.0	49.9
Remittances of profits and interest	23.2	77.7	97.0
Total receipts (gross external investment)	71.0	90.0	149.9
Net foreign capital inflow	+ 12.0	−27.5	+ 3.0

SOURCE: 1955: Calculations based on official statistics.

The inference to be drawn from these simple calculations is that herein will lie the first obstacle to the fulfilment of the more or less automatic projections of historical development formulated in earlier paragraphs. Far from having at its disposal a net inflow of funds amounting to about 190 million dollars, Peru will have to finance negative balance in the movement of such funds. Consequently, under the conditions of the hypothesis, available goods and services cannot be expected to expand to a proportionally greater extent than the gross product; on the contrary, the latter will have to increase more intensively, with the consequent effects on the investment coefficient, capital goods requirements, etc.

Before this inference is adopted as conclusive, at all events in its quantitative sense, it is in any case worth while to consider how far it would be modified by the postulation of another and a distinctly more favourable hypothesis. Supposing, for example, that net annual foreign capital investment amounted to 100 million dollars up to 1965, and that the total capital accumulated by that year reached the sum of 1 250 million dollars. Given a method of calculation similar to that applied in the preceding case, and identical assumption in respect of specific partial aspects which were mentioned in that context, the following conclusions would be reached. Gross investment would work out at 149.9 million dollars and aggregate remittances abroad at 146.9 million, which would mean that there was no longer a net outflow of capital; but neither would there be any sizeable net inflow. Although optimistic, this second hypothesis would not be beyond the bounds of possibility. Total gross investment requirements would unquestionably be high, but it must be borne in mind that even in 1956, according to provisional data, net investment stood at over 75 million dollars and gross investment had risen above 120 million. Conversely, it should be mentioned that in the same year a special contribution was received from the Export-Import Bank for the Toquepala project, and official loans—which have been fairly substantial in the last few years, after having played a relatively passive role in previous periods—cannot be expected to go on increasing indefinitely.

In any event, while gross foreign capital investment may feasibly approach 150 million dollars by 1965, it is very unlikely to exceed this limit, unless exceptional circumstances arise. Thus there would seem to be nothing to detract from the validity of the conclusion recently stated.

3. *Export prospects*

Consideration must now be given to the second of the basic requisites which would enable the Peruvian economy to maintain a rate of development equal in intensity to that registered in 1945-55 and a growth pattern unchanged in its essential characteristics. Briefly, the problem is to assess how far it may reasonably be expected that during the decade 1955-65 the export quantum will increase sufficiently to finance the expansion of imports which would result from the maintenance of elasticity figures similar to those recorded in previous years.[9]

It was already seen that, in 1955, the share of agri-

[8] A considerable number of official loans are contracted for terms of less than 15 years, but some degree of compensation may be assumed to exist between these and external debt bonds and other securities placed abroad, which are usually on a longer-term basis.

[9] Following the previous discussion, it would really be more appropriate to state that the increment in the quantum of exports would have to finance not only the expansion of demand for imports, but also very probably a net outflow of foreign capital. However, only the more favourable hypotheses will be taken into account below.

cultural commodities in the composition of exports was very high (about 48 per cent), that of the products of the extractive industries was practically the same (46 per cent) and that of manufactured goods very small. Separate consideration must therefore be given to the prospects which, to judge from the background data currently available, each of these three categories of goods would seem to offer. In the first two cases it will also be necessary to describe in very brief outline the over-all characteristics of the sectors concerned, as a first step towards a more systematic examination of their possible contribution to an increase in exports.

(a) *Agricultural export prospects*

It is very likely that Peruvian agriculture will continue to increase its contribution to the country's exports, but the rapidity of the process must largely depend on a number of sometimes conflicting factors, of which a detailed study would be outside the scope of the present report. No forecasts will therefore be hazarded here; a few of the objective background data available at present will be summed up as a basis on which to formulate certain hypothetical projections which are indispensable for the analysis contained in later sections, although their validity is questionable. There are large tracts of land in Peru which could be brought under cultivation, but the cost of reclaiming them, especially in respect of irrigation works, rises steadily in relative terms as the areas offering most natural advantages are gradually utilized. Similarly, production for export may be expanded through better yields, but it must be remembered that significant improvements have already taken place and that in the case of some export crops the yields obtained compare favourably with those recorded in most of the other producer countries of the world. Lastly, due account must be taken of the expansion of domestic consumption which will mean that more and more supplies are needed for the home market and that export crops have to face a certain amount of competition for the available land.

According to estimates, the area at present fit for crop and stock farming totals a little over 32 million hectares, i.e. 25 per cent of the national territory. The remainder is made up of about 60 million hectares of forests and *selva* and over 37 millions hectares classified as non-productive from the standpoint of agriculture. A major part of the 32 to 33 million hectares of land suitable for farming consists at the present time of natural grassland. The area under cultivation covers only about 2.5 million hectares. Of these, 1.7 to 1.8 milion are sown to annual crops and plantations, some 150 000 hectares are under artificial pastures and about 600 000 hectares are lying fallow.

About 16 per cent of the crop farming area is used for production for export, especially along the coastal belt. This latter zone comprises in all about one-third of the area under cultivation, while almost two-thirds correspond to the sierra and a bare 100 000 hectares to the *selva*.

The ultimate implication of the foregoing data is that the expansion of the area under cultivation will long continue to be a problem of financial resources for investment in land reclamation rather than of physical limitations in respect of the amount of land available. How much can reasonably be expected to be achieved during 1955-65, whereabouts, and on what types of soil, is thus primarily a question of the priorities that could be allocated to such undertakings within a broad economic development programme, with due regard to the magnitude of total investment resources. Secondly, it is also a matter of detailed research into the specific conditions prevailing in each zone, of meticulous study of alternative projects, suggestions, etc. Hence, for the purposes of the hypothetical calculations which will be included in the following paragraphs, all that will be attempted is the presentation of estimates based on various opinions expressed by the Peruvian officials and experts concerned. Accordingly, it will be assumed that during the period 1956-65 the area under cultivation might expand by between 400 000 and 500 000 hectares, of which a certain proportion, mainly in the sierra, would not require costly irrigation works.

Expansion on this scale would not necessarily imply

Table 22

PERU: ESTIMATES OF PRODUCTION, CONSUMPTION AND AREA UNDER CULTIVATION OF STAPLE AGRICULTURAL COMMODITIES, 1955

Commodity	*Production*	*Consumption*	*Area under cultivation*
	(Thousands of tons)		*(Thousands of hectares)*
Exports commodities			373.0
Cotton fibre	109.1	24.9	217.5
Sugar	677.5	194.5	56.9
Rice	165.0	165.0	62.1
Cacao	4.2	4.2	14.0
Coffee	12.1	5.5	22.5
Import commodities			380.0
Barley	207.6	224.4	184.8
Wheat	151.9	457.9	159.3
Tea	0.8	1.0	1.9
Fruit	680.0	688.8	34.0
Commodities for domestic consumption			997.0
Maize	297.5	297.5	236.0
Quinoa	36.0	36.0	32.6
Sweet potatoes	83.5	83.5	11.5
Yucca	228.2	228.2	16.7
Potatoes	1 400.6	1 400.6	234.7
Coca	9.4	9.4	13.5
Pulses	70.3	70.3	75.8
Vegetables	792.2	792.2	61.0
Miscellaneous	...	...	315.2
Total			1750.0

Source: Official information and partial estimates.

Table 23

PERU: PROJECTIONS OF CONSUMPTION OF AGRICULTURAL COMMODITIES FOR 1965

Commodities	Consumption in 1955		Demand-elasticity coefficient [c]	Consumption in 1965	
	Total [a] (Thousands of tons)	Per capita [b] (Kilogrammes)		Total [d] (Thousands of tons)	Per capita [e] (Kilogrammes)
Cotton	24.9	2.80	0.5	35.8	3.16
Sugar	194.5	21.80	0.5	278.3	24.28
Wheat	457.9	51.20	1.0	727.8	63.49
Coffee	5.5	0.62	1.0	8.8	0.77
Barley	224.4	25.10	1.0	356.5	31.10
Tea	1.0	0.11	0.5	1.4	0.12
Hulled rice	165.0	18.50	0.6	241.3	21.05
Cacao	4.2	0.47	1.2	6.8	0.60
Fruit	688.8	77.03	0.5	983.3	85.77
Milk	270.0	30.20	1.0	429.3	37.45
Cheese [f]	106.0	11.90	0.5	151.9	13.25
Butter [f]	129.0	14.40	0.5	183.8	16.03
Eggs [g]	115.0	12.90	1.0	183.4	16.00
Lard	12.0	1.30	0.8	17.7	1.54
Beef	80.7	9.00	0.8	125.5	10.95
Mutton	28.0	3.10	0.4	38.7	3.38
Pork	12.0	1.30	1.0	18.5	1.61
Maize	297.5	33.30	0.1	390.1	34.03
Quinoa [a]	36.0	4.00	0	45.9	4.00
Yams	83.5	9.30	0	106.6	9.30
Yucca	228.2	25.50	0.1	298.8	26.06
Potatoes	1 400.6	156.60	0.4	1 956.5	170.67
Coca	9.4	1.10	—0.3	11.4	1.00
Pulses	70.3	7.90	0.4	98.7	8.61
Vegetables	792.2	88.60	0.5	1 131.0	98.66

SOURCE: For 1955: Calculations based on official statistics and partial estimates.
a See table 22.
b Estimates based on a population of 8 941 000 inhabitants.
c Estimates based on incomplete data and comparisons with other countries.
d Figures calculated on the basis of *per capita* consumption and an estimated population of 11 464 000 inhabitants.
e Figures calculated by the use of the expression: $C_{65} = C_{55}\ (1.24)^{E}$, in which "C" is *per capita* consumption and "E" the corresponding elasticity coefficient.
f In terms of fresh milk.
g Millions of units.

an equally intensive increase in exports crops, since the agricultural sector would also have to cope with the growth of domestic demand for foodstuffs and raw materials, besides substituting home production for certain agricultural imports which at present weigh heavily on Peru's foreign exchanges resources. The study of export prospects cannot therefore be dissociated from that of the increment in agricultural production which will have to be earmarked for these other purposes.

For the sake of simplicity, a distinction may usefully be drawn between the following three types of agricultural commodities: those produced for export (or which might be exported in the future), those which at present are entirely or partly imported and those in which Peru is self-sufficient and which are intended primarily for domestic consumption. The principal data on the situation as regards these three categories of products in 1955 are presented in table 22. More careful consideration may now be given to a hypothetical evaluation of the supplies of agricultural commodities that will needed for the domestic market.

This analysis will be based on the assumption that the future annual rate of increase of total *per capita* consumption of goods and services will be 2.2 per cent —more moderate, that is, than the rate registered in 1945-55.[10]

The average elasticity of demand for agricultural commodities can be estimated as between 0.75 and 0.80; this, in combination with the hypothesis just formulated, would imply an annual expansion of *per capita* demand of about 1.8 per cent, to which the effects of the population increment should be added.[11] The detailed results of the pertinent calculations are given in table 23.

This procedure affords an approximate idea, in quantitative terms, of the extent to which agricultural production for domestic consumption will need to expand; the additional area under cultivation which will be required to that end can now be assessed. Table 24 shows the relevant estimates for the group of commodities in respect of which Peru is self-sufficient. As

10 The calculations might equally well have been based on the same rate of increase as in the past, and this would in fact have been more consistent with the hypothesis set forth earlier. The change introduced here was determined solely by practical consideration, as it coincides with the final hypothesis that will later be adopted for the essential purposes of the study. In any case, it should be borne in mind that this more conservative hypothesis would tend to indicate greater possibilities for the development of exports than a more substantial expansion of internal consumption would permit.

11 The average elasticity mentioned above is the outcome of widely varying elasticities for the several individual components of this group. Estimates often suggest that foodstuffs have a lower income-elasticity, because of the pronounced trend towards the allocation of a larger proportion of income increments to expenditure on manufactured goods and services. Nevertheless, it must be remembered that at present the dietary levels of the Peruvian population are low, and that, consequently, for a fairly long time a substantial share of the income increment will probably continue to be used for foodstuffs.

Table 24

PERU: PROJECTIONS OF NECESSARY EXPANSION OF AREA UNDER CROPS FOR DOMESTIC CONSUMPTION FOR 1965

Commodity	*Supply requirements (Thousands of tons)*	*Yield (Kgs. per hectare)*	*Area required (Thousands of hectares)*
Maize	390.1	1 600	243.8
Quinoa	45.9	1 350	34.0
Yams	106.6	8 000	13.3
Yucca	298.8	13 900	21.5
Potatoes	1 956.5	7 000	279.5
Coca	11.4	850	13.4
Pulses	98.7	950	103.9
Vegetables	1 131.0	13 000	87.0
Miscellaneous			362.4 [a]
Total			*1 158.8*

a Estimated on the basis of a growth rate equivalent to the average for the commodities specified.

will be noted, in specific cases possible improvements in yields are here taken into account.

The problem is undoubtedly more complex in so far as it relates to those commodities which are at present imported, at any rate in part. However, some general criteria may be adopted which will at least enable an approximate estimate to be made. Apart from livestock production, which is not explicitly taken into account for the purposes of these calculations, the most important deficit is registered in wheat supplies. Broadly speaking, it is generally agreed that Peru could hardly become self-sufficient in this commodity within a reasonable space of time, both because so large an area would have to be brought under cultivation and also because of qualitative deficiencies which would make it essential to import a given minimum proportion. Hence, it will be tentatively assumed that by 1965 production may increase to about 320 000 tons. In such circumstances, import requirements will still be considerable, but the relative contributions of domestic production will also be substantially greater, without the appropriation of an unduly large share of available resources for this sole purpose. As regards barley and tea, on the other hand, domestic production will be assumed to meet all Peru's requirements, while as far as fruit is concerned, small quantities of specific varieties that are not produced in Peru will still be imported. The implications of these hypotheses can be seen in more detail in table 25.

In brief, the postulated increment in production for domestic consumption would require an area under cultivation 161 800 hectares larger than in 1955, with the addition of a further 194 400 hectares representing the necessary increase in the area sown to crops that at present are imported. If these requirements are examined in the light of the original hypothesis it will be seen that the total expansion of the area that could be brought under cultivation in 1956-65 would not exceed 500 000 hectares, the new land available for growing more export crops would amount only to about 143 800 hectares; that is, by 1965 the total area used for this purpose would be approximately 516 800 hectares. A possible break-down of this area by commodities is given in table 26, which also includes specific hypotheses on prospective yields as a step to a final estimate of total production in each case, from which domestic supply requirements, as calculated in table 23, are deducted.

Probably, in view of the kind of crops for which it would be earmarked in the circumstances described, a major share (some 350 000 hectares) of the total increment in the area under cultivation would be found in the coastal belt, a smaller proportion (about 100 000 hectares) in the sierra, and the relatively small amount of approximately 50 000 hectares in the *selva*.

In any case, what is of the greatest immediate importance here is the expansion that might be registered in exports of agricultural commodities. Table 27 presents a comparison of the quantum of exports in 1955 and 1965 together with the values of the commodities concerned at 1955 prices.[12] To complete the picture,

12 As will be noted, no projection of possible export commodity price trends is attempted here, because one of the assumptions formulated earlier as bases for the analysis was that the terms of trade would not alter. Thus a more or less favourable evolution of agricultural export prices would be offset by different fluctuations in quotations for other exports, or similar variations in import prices. Although the precise purpose of these calculations is to provide hypothetical figures for the quantum, not the value, of exports, admittedly no account is taken of the fact that, if the behaviour pattern

Table 25

PERU: PROJECTIONS OF EXPANSION REQUIREMENTS UP TO 1965 FOR THE AREA UNDER CROPS TRADITIONALLY IMPORTED, 1965

Commodity	*Supply requirements* [a] *(Thousands of tons)*	*Percentage of domestic production*		*Production required (Thousands of tons)*	*Yield (Kgs per hectare)*	*Area required (Thousands of hectares)*
		1955	*1965*			
Barley	356.5	92.5	100.0	356.5	1 250	285.2
Wheat	727.8	33.2	44.0	320.0	1 350	237.0
Tea	1.4	0.8	100.0	1.4	400	3.5
Fruit	983.3	98.7	99.0	973.5	20 000	48.7
Total						*574.4*

SOURCE: 1955, official data.
a See table 24.

Table 26

PERU: PROJECTIONS OF CROP AREA AVAILABLE FOR EXPORT COMMODITIES AND ITS POSSIBLE UTILIZATION IN 1965

Commodity	Crop area (Thousands of hectares)	Yield (Kgs per hectare)	Production	Domestic requirements [a]	Exports
			(Thousands of tons)		
Cotton	280.1	560	156.9	35.7	121.2
Sugar	89.4	11 204	1 001.6	278.3	723.3
Rice	93.3	3 100	289.2	241.3	47.9
Cacao	21.8	330	7.2	6.8	0.4
Coffee	32.2	556	17.9	8.8	9.1
Total	*516.8*				

[a] See tables 24 and 25.

an estimate of possible exports of wool of the llama, vicuña, alpaca and guanaco species is also included.

To sum up, if all the conditions implicit in this series of assumptions and hypotheses were to be fulfilled, the quantum of agricultural exports in the course of the period 1956-65 would increase by 48 per cent. This would mean that the sector's contribution to total exports was relatively smaller than in 1948-55, despite the magnitude of the effort that would be called for in terms of the expansion of the area under crops and the improvement of certain production techniques in order to obtain higher yields.

It should not be forgotten that the same hypotheses take into account the agricultural production increment that would be needed to meet the growth of domestic requirements, as well as the expansion of particular crops to replace imports. The balance between exportable surpluses and necessary imports of agricultural commodities, which is implicit in the projections just formulated, will be discussed later.

It should be repeated that these hypothetical calculations are intended only to indicate in approximate terms some of the magnitudes concerned, as a background for subsequent discussion of more general aspects. They are not based on a sufficiently detailed study of the many problems which would be involved in a more accurate projection, nor is any claim made to forecast future trends. It could be argued justifiably that it seems over-optimistic to assume that during the period under review the area under cultivation might expand by over 25 per cent; were this the case, agriculture's contribution to total exports would be more moderate than is postulated here, with the result that the conclusions reached in this analysis would be corroborated. Similarly, it would be perfectly reasonable to formulate another hypothesis assuming a different distribution of resources and giving higher priority to export commodities at the expense of those for domestic consumption; in this case, exports might increase, but at the same time import requirements would also be greater, so that the final balance for the sector would not be appreciably different. To sum up, the foregoing paragraphs present only one of the many hypotheses that might be formulated; but this is not of vital importance, since the qualitative conclusions that will later be reached would not be affected unless the outlook could be shown to be radically altered.

of prices was more or less favourable, the volume would no doubt be influenced, because of the incentives or encouragement that such price movements would imply for domestic production.

(b) *Export prospects for the products of the extractive industries*

What is usually termed Peru's "mining sector" comprises not only the extraction but also the processing, smelting and refining, transport and sale of mineral

Table 27

PERU: PROJECTIONS OF QUANTUM OF EXPORTS OF AGRICULTURAL COMMODITIES FOR 1965

Commodity	Quantum of exports (Thousands of tons)		Average price in 1955 (Dollars per kg)	Constant values of exports (Millions of dollars at 1955 prices)	
	1955	1965		1955	1965
Cotton	84.2	121.2	0.81	68.2	98.2
Sugar	483.0	723.3	0.08	36.7	54.9
Rice	—	47.9	0.11	—	5.2
Cacao	—	0.4	0.80	—	0.3
Coffee	6.6	9.1	1.18	8.0	10.7
Wool (Llama, vicuña, alpaca, etc.)	3.4	3.6	1.64	5.6	5.9
Total				*118.5*	*175.2*
Quantum index				*100.0*	*147.8*

SOURCE: 1955, official data.

ores, as well as the production and refining of petroleum.[13] With the exception of fuels, almost the entire output of the extractive industries is exported, and any fundamental changes in this respect seem highly unlikely in the next few years.[14]

The atmosphere propitious to the investment of foreign capital created by the 1950 Mining Code, as well as the steady rise in the prices of several mining products which took place as from that year, helped to stimulate a very rapid expansion of mining activities during the latter part of the period under consideration. The exports concerned (excluding non-metals, mainly consisting of petroleum, and valued at constant 1955 prices) increased from about 1 075 million soles in 1945 and 1 121 million in 1950 to nearly 1 950 million soles in 1955. Meanwhile, the growth of domestic demand for fuels progressively reduced the margin of petroleum derivatives available for export.

Within the current value of mining exports proper, gold and silver lost a good deal of their relative importance in the course of the period 1945-55, mainly because of the greater stability of their prices in contrast with the rising trends in quotations for other metals. Vanadium and some other metals produced on a smaller scale, such as tin and antimony, also declined in importance. In contrast, the expansion registered in the production of copper, lead and zinc was spectacular, and exports of iron ore were begun, assuming sizeable proportions from 1953 onwards. The most striking increment undoubtedly was that recorded for copper, which by 1955 accounted for over 28 per cent of total mining exports, while lead rivalled it, and, in specific years—1948 and 1951—took the lead among the ores exported. Prior to 1951, zinc followed a rapid upward trend, but the sharp fall in world market prices later constituted a handicap. Nevertheless, the physical output continued to increase even faster than production of lead, since the mine worked proved richer in the former than in the latter,[15] while at the same time a larger quantity of zinc was refined in Peru, thanks to the expansion of installed capacity at the La Oroya metallurgical plant.

In the case of petroleum derivatives, certain refined products like petrol and residual oil, which had previously been exported on a considerable scale, were channelled towards the domestic market during the later years of the period under review. Exports of crude showed a rising trend up to 1950, both in absolute terms and in relation to the amount of crude petroleum produced; but from that year onwards they declined, until by the end of the period they represented no more than 15 per cent of output.

Sharp fluctuations were registered in exports of anthracite, owing to foreign exchange difficulties in Argentina, its largest market. In 1955, Argentine imports almost ceased, and anthracite, formerly the most important of Peru's mining exports other than metals, was outstripped by others of this type, such as onyx, magnesite and barytes.

As regards more recent developments, it should be noted that for some time mining in Peru has had to face a marked reduction of its dollar earnings, as a result of world market restrictions which have been simultaneously reflected in a smaller volume of exports and lower prices. In the case of lead, the immediate outlook is rather more favourable, since the growth of world consumption more or less balances the production increment envisaged. On the other hand, the reverse is true of zinc, and in recent years the growth of world production capacity has outstripped that of consumption. For some time, the production surplus was absorbed by the United States to increase its strategic reserves, but as from early 1957, on the completion of this programme, the burden of over-production was shifted to the markets, with the result that prices fell. This excess of production over consumption will of course tend to disappear, either because of lower mining output levels or on account of standstills at marginal mines. The latter alternative may apply in the case of some small mines in Peru where the workings are narrow and extraction and transport conditions are difficult.

Despite the unfavourable conditions prevailing since early 1957, there are no signs that exports of mining products are likely to slow down during the decade 1955-65; on the contrary, the investment programmed for existing mines, as well as for the opening-up of new workings, suggests that very substantial increments may be registered in the future. These prospects may be more conveniently discussed in relation to each of the most important commodities.

(i) *Copper.* In 1956, about 31 000 tons of refined copper were produced, this figure being equivalent to some 60 per cent of the total copper output; the remaining 40 per cent was exported in the form of concentrates or ore, and came mainly from the medium-sized and small mining companies. According to their current programmes, the large integrated enterprises might achieve an output of approximately 180 000 tons by 1965, almost the whole of which would be mined in their own workings. The production prospects of the medium-sized and small mines are more uncertain and far more dependent on the trend registered for copper prices. Were these to remain at relatively low levels, it is estimated that by 1965 such

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13 Some of these activities are not strictly covered by the extractive industries; smelting and refining, for example, may more accurately be considered an aspect of industrial activity, and will be treated as such later. For purposes of the study of exports, it seems better to preserve the broad definition of the mining sector to which reference has just been made.

14 In 1955, domestic consumption accounted for barely 0.5 per cent of total production of lead, 0.1 per cent of that of zinc and 3.5 per cent of that of silver; copper consumption had registered a sharp increase owing to the installation of a new plant for the manufacture of electric conductors, but even so it represented less than 1 per cent of the corresponding exports.

15 In most of the Peruvian mines zinc is regarded as a by-product, especially of lead. The relationship between the ores mined fluctuates from 75 per cent zinc and 25 per cent lead to approximately equal amounts of each, but there are also large proven reserves—not yet exploited—where the proportions of zinc are even greater.

enterprises might be able to produce about 23 000 and 7 000 tons respectively. In these circumstances total production would amount to some 210 000 tons. A more favourable price trend would probably make no difference to the production programmes of the large enterprises, but it would encourage production on a larger scale by the medium-sized and small mining companies, so that output might rise to rather more than 230 000 tons by 1965.[16]

(ii). *Lead.* In 1956 the output of lead consisted of a little over 59 000 tons smelted by a big enterprise which possesses the necessary installed capacity and a rather larger quantity consisting of the ores and concentrates produced by the medium-sized and small mining companies. Existing programmes provide for an expansion of smelting capacity which would amount to approximately 91 000 tons by 1962; the volume of production of the medium-sized and small mining companies will probably depend upon the course followed by lead prices.[17]

If a price rather lower than the 1955 quotation were postulated—for example, 12 dollars cents per pound—probably by 1965 only the expansions mentioned, which correspond to programmes already more or less prepared, would take place; in these circumstances, total exports might be in the neighbourhood of 151 000 tons. Of these, 91 000 would consist of smelted lead and 60 000 of ores and concentrates produced by the medium-sized and small mining companies, so that figures similar to those registered in 1955, when higher prices prevailed, would thus be maintained. Better price levels would justify the assumption that by 1962 the expansion achieved might exceed that envisaged, and the output of the small enterprises might be larger, with the result that total production might reach approximately 235 000 tons of metal content.

(iii) *Zinc.* Zinc exports in 1956 amounted to about 144 000 tons of metal content, of which only some 7 000 tons were exported in refined form (bars or ingots). But there are programmes for a noteworthy expansion of current refining capacity, which by 1962 would raise production to approximately 80 000 tons, besides other projects, e.g. for the installation of a national refinery with an annual capacity of 50 000 tons.[18] Furthermore, there are the programmes of the large and medium-scale mining companies for exports of concentrates, which by the same year might reach some 190 000 tons. If it were assumed that the additional capacity provided for in these programmes would be in full operation by 1965 and that up to that date the small mines would maintain their output at about the same level as in 1956, total zinc production in 1965 would amount to about 286 000 tons of fine content. These figures might even be exceeded if prices were more favourable, since the result might be that a still greater increase in refining capacity would be registered from 1962 onwards, that programmes for the installation of the national refinery would be expedited and that the medium-sized and small mining companies would be given a more powerful incentive to expand their exports of concentrates. In these circumstances, total exports in 1965 might even amount to more than 450 000 tons of fine content.

As in the preceding cases, domestic consumption prospects are very limited in comparison with possible aggregate production figures. It is estimated, for example, that a galvanized zinc installation in connexion with the Chimbote steel mill would utilize about 170 tons annually, so that by 1965 domestic consumption would probably represent about 500 tons, and would have virtually no effect on exports.

(iv) *Silver.* In 1956, Peru's largest producer enterprise mined 300.5 tons of silver; its expansion programmes would raise production to 1 445 tons by 1965. As regards other producers, if the output of silver were to be maintained at much the same level, in accordance with the hypotheses cited for lead, the medium-sized and small mining companies would produce about 345 tons, which would give a total of some 1 790 tons for 1965.

Domestic consumption has not accelerated its rate of increase during the last five years, and seems unlikely to acquire any great importance in the near future. In 1955 it stood at 22 tons and in 1956 at 26.4 tons, so that its volume by 1965 may be estimated as approaching 50 tons.

(v) *Aluminium.* The world's largest aluminium-producing enterprise is studying the possibility of building an aluminium refinery near the Bay of Paracas, which would operate on the basis of imported bauxite and would utilize the low-cost hydroelectric energy that would be produced by the Mantaro project, 180 miles away. An output of 750 000 kW could serve installed capacity for the production of 300 000 tons of aluminium ingots annually. Thus, Peru would profit by the margin of value added to the imported bauxite, which would probably represent about 13 per cent of the value of the product. In any event, no definite action has yet been taken in connexion with these programmes, so that there is no certainty that they will ever be carried out, at any rate within the lapse of time to which these projections relate.

16 The programmes referred to were prepared at a time when world market prices exceeded 35 dollar cents per pound; even estimates based on relatively low quotations assume that price levels will fluctuate around 28 dollar cents per pound.

17 These estimates do not take into account the possibility that a lead foundry in Lima, a project for the installation of which has been under discussion for some time, might enter into operation before 1965. However, it is held that only a very large plant would be capable of separating by-products like silver, bismuth and other metals, and it seems rather unlikely that Lima will be in a position to construct such a plant, unless lead prices reach extremely favourable levels. What seems more probable is the installation of a refinery with an annual capacity of 5 000 or 7 500 tons of lead, which would serve a group of medium-sized and small mining companies, and in which only silver would be extracted as a by-product, a special type of ore being utilized which is found on a limited scale in the central zone. But the execution of the latter project would have no appreciable effect on the value of exports.

18 There is a project for the creation of a parastatal metal corporation with assets amounting to about 300 million soles. Were this project to be approved by Congress, the refinery might enter into operation before 1965.

(vi) *Iron ore.* In 1956, only one enterprise was operating in Peru, although others were engaged in prospecting. The present producer firm might achieve an output of about 2 million tons of ore for direct export and 2 million tons of sintered ore by 1960. Another enterprise will be exporting a minimum of 1 million tons by 1959 and possibly more in later years, probably attaining 3 million tons by 1963. This would mean that total exports might amount to about 7 million tons, by 1965, leaving aside the fact that foreign enterprises, especially Japanese firms have also shown interest in investing in this field. Given its current capacity, Chimbote's steel-making requirements would represent only some 125 000 tons of 60-per-cent ore.

(vii) *Other ferrous metals.* This group includes tungsten, molybdenum, manganese and vanadium. Among these, tungsten is of the greatest economic importance for Peru. Most of it is produced by a large domestic enterprise, which some time ago obtained a loan from the Export-Import Bank in Washington in order to expands its activities.

Until very recently, Peru was one of the leading producers of vanadium. All the ore came from the Minasragra deposits, which at one time were ranked among the world's chief sources of vanadium, but have been closed down, owing, apparently, to the depletion of reserves.

Manganese and molybdenum were also produced sporadically during the war and early post-war years.

During recent years there has been a spectacular rise in the prices of all these metals except vanadium; the maintenance of equally high levels would undoubtedly provide Peru with a powerful incentive to produce them on a larger scale. However, there are no sound bases for an assessment of their possible expansion. Merely for the sake of illustration, therefore, it will be assumed that their contribution to total exports may be doubled by 1965.

(viii) *Gold and other metals.* In 1955, exports of gold, antimony, bismuth, cadmium and tin accounted for 3 per cent of total mining exports; of these, gold alone contributed 62.5 per cent of the total for the group, three-fifths of it being sold as ingots. There are so many unworked deposits that it is difficult to hazard estimates as to the future of gold in Peru. If production were to follow a growth trend parallel to that of lead and copper (excluding the Toquepala deposits), and if no rise in the price of gold took place, exports might increase by 50 per cent between 1955 and 1965.

It is even harder to estimate output in the case of the other metals mentioned. For illustrative purposes, the increment will be estimated as similar to that of gold exports, with due regard to the fact that the amount produced largely depends on the expansion registered by lead and zinc.

(ix) *Other mining products.* Before 1955, the most important commodity in this group was anthracite from the Santa coalfield in the Department of Ancash. In that year, however, exports of this fuel decreased, owing to payments difficulties experienced by buyer countries. It is doubful whether Latin American demand for Peruvian anthracite will recover. Argentina, which used to be the principal buyer, is hoping to become self-sufficient as from 1960, thanks to the expansion and modernization of the Río Turbio mines, whose annual production capacity exceeds 1 million tons; Chile, which years ago also purchased anthracite, is implementing an energetic development policy in respect of coal production with the financial assistance of the International Bank. In view of this general outlook, Peru's coal industry, to which the domestic market cannot as yet give sufficient support, has endeavoured to seek new markets in other parts of the world.[19]

The other non-metal mining exports include barytes and selenium ores.[20] Although these are not at present produced on a large scale in Peru, they might acquire some significance within the total value of exports, if prices were very favourable.[21] For illustrative purposes, therefore, it will be assumed that exports of this group of commodities will be doubled between 1955 and 1965.

(x) *Petroleum and its derivatives.* In 1956, exports of petroleum and its derivatives amounted to 7 185 120 barrels, worth 21.3 million dollars; these figures represent 31 per cent of the total volume and 44 per cent of the value of production. While Peru is still a net exporter of petroleum, the exportable balance has been gradually diminishing year by year, owing to the failure of production to keep pace with the rate of increase of domestic consumption.

When prospecting first began in the Sechura Desert (Department of Piura) and in Pisco (Department of Ica), the industry entertained high hopes of finding new oilfields which might enter into production in a relatively short space of time and the volume of whose output would solve future demand problems. But the prospecting was unsuccessful, and the petroleum companies operating in Peru were compelled to wage an extensive campaign to increase or at least maintain their output, in order to meet the requirements of domestic demand.

Peru's largest oilfield is that of Talara-Lobitos, which has been worked so intensively for so many years that production by primary methods has been reduced as a result. Nor is there much optimism as regards the possibility of discovering new petroleum reserves in that area. In January 1953, proven reserves amounted to about 250 million barrels, sufficient only for some

19 In the last quarter of 1957 a contract was signed by the Peruvian producers and A.T.I.C. (France) for the sale of 180 000 tons of anthracite fines within 18 months from the signing of the agreement.

20 World consumption of barytes has doubled in the last ten years, as the result of the intensive demand of the petroleum companies, and it will probably be used still more in the future both in this field and in other branches of the chemicals industry.

21 The price of selenium rose by 154 per cent between 1945 and 1955, and that of barytes by 25 per cent during the same period.

12 or 13 years at the current rate of production. To stimulate production, the petroleum companies had to invest substantial amounts in order to apply secondary methods of recovery, whereby the extraction of crude was increased. At the same time, prospecting for new sources was intensified, and so was drilling in the existing production areas.[22] Production in these oilfields is expected to gain in intensity during the next few years as a result of the contract signed during the first half of 1957 between the two most important petroleum companies in Peru, under the terms of which one is to transfer to the other—whose resources are larger—50 per cent of its capital (i.e., its investment in the north of Peru). Moreover, the two companies have undertaken to invest larger amounts with a view to intensive prospecting and working of the concessions. The increment in the future output of the deposits in the northern coastal belt may therefore be said to depend upon the more efficient recovery of the existing petroleum wells, as well as on intensive drilling to discover new wells either in the present oilfields or in any others that may be found in the same part of Peru.

For the moment the highest hopes are placed in the eastern provinces. In 1956, declared prospecting was under way in a total area of 13 505 918 hectares in the *selvas* and was in the hands of 16 companies. One enterprise was actually working 86 974 hectares. The prospecting was crowned with an initial success in the Contamina district, where reserves totalling 20 million barrels were discovered. Furthermore, in the old Aguas Calientes oilfield (near Pucallpa), new reserves were found and proven reserves thus rose to some 30 million barrels. The other enterprises operating in the area are now completing the reconnaissance work in order to decide whereabouts drilling for prospecting purposes, as programmed for 1958 and 1959, will be undertaken. For these discoveries to prove of economic significance, output would have to be large enough to justify an oil pipeline across the Andes to a specific port. All in all, the assumption that within the next 10 years Peru will be able to export a considerable quantity of crude petroleum and derivatives from the eastern *selva* seems a very optimistic hypothesis; the work of prospecting alone may take a minimum of approximately 5-6 years, and the layout and construction of the oil pipeline is unlikely to take less than another 4 years.

This seems to indicate that the production increment which might be achieved by 1965 on the basis of existing sources would be moderate, unless petroleum were to be discovered in the continental shelf. If this possibility is discounted, it is estimated that by 1965 output might amount to about 30 million barrels, or 44 per cent more than in 1955. Were this the case, Peru would probably be able to export only about 200 000 barrels of derivatives, while it would have to meet import requirements equivalent to some 4 million barrels.

(xi) *Total exports of the extractive industries.* The implications of the foregoing hypotheses from the point of view of a possible expansion of the extractive industries' export quantum may now be more concisely reviewed.[23] Table 28 compares the figures referred to in preceding paragraphs with those registered in 1955, valued in both cases at the latter year's unit prices. As can be seen, if the levels cited were attained in each case, the quantum of exports of the extractive industries would expand between 1955 and 1965 by almost 150 per cent, increasing from a total value (at constant 1955 prices) of 2 380 million soles in the first of these years to nearly 5 900 million soles by the end of the period.

As in the case of the projections for agricultural exports, it must be emphasized that these estimates are

22 In 1956, 202 wells were drilled in the coastal belt.

23 As in the case of agricultural commodities, possible price variations will not be taken into account, since it is assumed that the terms of trade for the economy as a whole will remain at a level similar to that registered in 1955. Even so, it cannot be overlooked that a more or less favourable price hypothesis would largely determine the adoption of more moderate or more optimistic criteria in respect of the evolution of the quantum of exports, because of the incentives which prices would provide for the expansion of production.

Table 28

PERU: PROJECTION OF EXPORTS OF PRODUCTS OF THE EXTRACTIVE INDUSTRIES FOR 1965

Commodity	*Quantum (Tons)*		*Average price in 1955 (Soles)*	*Values at 1955 prices (Millions of soles)*	
	1955	*1965*		*1955*	*1965*
Copper	41 292	210 000	13 492	557	2 833
Lead	107 148	151 000	4 664	497	704
Zinc	146 557	286 000	1 794	263	513
Iron ore	1 542 206	6 875 000	99	152	681
Silver	632	1 740	487 342	308	848
Other ferrous metals				54	108
Gold and other metals				119	180
Non-metallic minerals				6	12
Petroleum and derivatives	7 576 [a]	200 [a]	55 174	418	11
Total				2 374	5 890
Quantum index				100.0	248.1

SOURCE: 1955: official data.
a Thousands of barrels.

hypotheses, not forecasts, especially as many elements of doubt are involved, for example, as regards aluminium and petroleum.

The expansion indicated might be considered too great for a relatively short period; it certainly does exceed that registered between 1945 and 1955, but is more moderate than the growth recorded from 1948 onwards, although it is true that in the latter case there was idle capacity to draw upon, as is suggested by the fact that production had declined during the three preceding years. In the course of the discussion of individual commodities, mention was made of possibilities transcending those finally taken into account for the formulation of the hypothesis embodied in table 28. Had this set of alternatives been adopted, the increment ultimately assumed would have been far bigger still.

It should also be pointed out that the foregoing estimates are largely based on the current expansion programmes of the major enterprises. Broadly speaking, their new installations are expected to enter into production by 1962. In other words, instead of a gradual climb to the levels noted, what is actually likely to take place is that fresh lines of production, which will not be initiated until a few years have gone by, will then be rapidly incorporated. It may be very important to bear this in mind in the discussion of Peru's shorter-term balance-of-payments prospects, since although by 1965 the mining sector's contribution may be substantial, a much more critical situation may prevail during the intervening period.

As will have been noted, these projections make no explicit allowance for the factors relating to external demand. Although this might constitute an important aspect of a more thorough study of the subject, various considerations have led to its omission here. In the first place, the findings of another recent study suggest that the expansion of external demand for Peru's staple export commodities will be relatively intense;[24] secondly, even if this were not so, Peru's competitive position would probably be strong, thanks to its low production costs. Lastly, none of the principal exportable commodities produced by Peru's mining sector is of sufficient importance in the world market to make any substantial difference to supply conditions.

(c) *Total export quantum*

Exports prospects for agricultural commodities and products of the extractive industries having been considered, it now remains to review the outlook for manufactured goods, in order to form a complete picture assembling all the hypotheses on possible variations in the export quantum up to 1965.

Exports of manufactured goods constituted a very small fraction of total exports in 1955. For this very reason, spectacular relative increments may well be registered during the period 1956-65, even if their value in absolute terms is still very moderate. What is more, if some of the ideas at present under discussion in connexion with the possibilities for a Latin American common market were to take concrete shape over the short term, Peru's opportunities of participating would no doubt be considerable; this is another element which makes it very difficult to assess more or less objectively the possible future evolution of exports of manufactured goods. All that will be ventured upon here, therefore, is the arbitrary adoption of a very simple hypothesis, which almost certainly underestimates their contribution to some extent. This assumption postulates that such exports will continue to grow at much the same rate as in previous years.

Table 29 shows the outcome of all these criteria and hypothetical calculations. Briefly, the inference is that in such circumstances the quantum of exports would be practically doubled between 1955 and 1965, as compared with the increment of only 78 per cent registered between 1948 and 1955 (which becomes smaller still if the whole of the period 1945-55 is taken into account). In other words, these projections visualize not only a continuance of the already rapid expansion of exports observable in previous years, but even an acceleration of the rate of development.

Table 29

PERU: PROJECTIONS OF QUANTUM OF TOTAL EXPORTS FOR 1965

(Values in millions of soles at constant 1955 prices)

Commodity	*1948*	*1955*	*1965*
Agricultural commodities . . .	1 523	2 448	3 618
Products of extractive industries	1 286	2 374	5 890
Manufactured goods	62	283	656
Total	*2 871*	*5 106*	*10 164*
Quantum indices			
1948–55	100.0	177.8	
1955–65		*100.0*	*199.0*

SOURCE: 1948 and 1955: official data.

Nevertheless, the increase in exports would still be far from enough to ensure the compatibility of those automatic projections of historical growth to which reference was made earlier. As will be recalled, the conclusion reached was that imports would amount to over 14 000 million soles by 1965, if their behaviour in relation to the gross product continued to follow much the same pattern as in the preceding period. They might possibly be financed in part by a favourable evolution of the terms of trade, and/or by a net inflow of foreign capital. But the discounting of these possible contributions meant that the decisive factor would be the expansion of the export quantum for which the prospects look poor.

Hence the future maintenance of rates and patterns of development similar to those registered in earlier years would very probably give rise to a market dis-

[24] See *The external disequilibrium in the economic development of Latin America: The case of Mexico*, op. cit., Vol. II, pp. 59-89.

equilibrium between the potential demand for imports and the value of exports. According to the hypotheses propounded above, by 1965 the difference would amount to over 4 000 million soles (more than 200 million dollars) and would thus represent more than 40 per cent of total exports.

In view of this situation, it will be well to retrace the main assumption on the basis of which so pronounced a potential balance-of-payments disequilibrium is estimated. As will be remembered, one of the points of departure for the formulation of these hypothetical projections was the postulate that during 1956-65 the rate of growth of *per capita* consumption would be the same as in 1945-55, but this time in much less favourable conditions, for the reasons already enumerated. Obviously, if the gross product were to increase at a rate more moderate than the really very high cumulative annual rate of 5.5 per cent which has been assumed, the potential balance-of-payments deficit would be very much smaller. Nevertheless, were this the sole change, the necessary compatibility could most probably be secured only by means of a very drastic deceleration of the growth rate, which is of course undesirable.

This underlines the importance of the other assumption on which these projections are based, i.e., that the elasticity of imports in relation to the gross product would remain the same as in previous years. The stabilization of the balance of payments would entail a very severe reduction of the elasticity of imports, and, consequently, the application of a thoughtfully planned and fairly ambitious import substitution policy, with a view to diverting part of the increment in demand for currently imported goods towards domestic production.[25]

To sum up, under the conditions assumed in all the hypotheses mentioned, it seems highly unlikely that Peru's economic development can continue during the next few years along the same lines as between 1945 and 1955. The foregoing remarks suggest that either the rate of growth will in the end be drastically reduced, or the trends registered for the relative shares of domestic production and imports in the satisfaction of domestic demand will have to be radically altered.[26]

25 Even this would not ensure the complete compatibility of the projections formulated. In fact, the problem is not merely one of balance between exports and imports; the rate of increase of available goods and services would also have to exceed that of the gross product, by virtue of foreign capital contributions, as was discussed in connexion with table 19.

26 As will be seen later, the point is not even that effective import substitution would necessarily have to take place, but that the import coefficient could not again increase in more or less the same proportion as in the preceding decade. The expansion of the capacity to import would still exceed the increment in the gross product, but the trends followed could not be so markedly dissimilar as before. In other words, there would still be room for a moderate increase in the import coefficient, but this would doubtless fall far below the requirements of the automatic projections just formulated. In this sense, the problem would be much more acute for Peru than for other Latin American countries which are faced with the need to reduce their import coefficient and consequently to achieve effective import substitution.

4. *A more probable hypothesis of future growth*

By virtue of the foregoing analysis it has been possible to sketch out a number of conclusions which must similarly be taken into account in the formulation of a more reasonable set of projections, not this time automatic like the former series, but incorporating the changes that will probably be entailed by the altered circumstances that will attend future development. For the time being, the same assumptions will be maintained as to the intensification of population growth and the stability of the terms of trade and the product-capital ratio; the additional element that will now be incorporated is the conclusion reached with regard to foreign capital movements, to the effect that, even allowing for relatively heavy external gross investment, Peru will not be able to rely on a positive balance in the over-all movement of funds to and from foreign countries.

Even within the general framework of these limitations, there would undoubtedly be room for many alternative hypotheses as to the possible rate of development. A detailed discussion of these would be useful as a means of observing the effects of the adoption of slightly different hypotheses as to any of the numerous variables to be considered. Only one will be selected, however, for the sake of simplicity.[27]

The basic point of reference adopted will be the consistency of a hypothesis assuming the maintenance of the former rate of development measured in terms of the annual rate of increase in the *per capita* gross product. The grounds for this preference are obvious, since the least that could be expected—unless too great an effort were entailed—would be for Peru to contrive to maintain a rate of growth already registered in previous periods. Thus, it is not so much the intensity as the patterns of development—especially in so far as the participation of the external sector is concerned—that will in the last analysis distinguish these projections from earlier ones.

In such circumstances, the increase in the gross product, as well as many of the other aggregate magnitudes, will be the same in this case as in the foregoing projections. As before, then, it will be assumed that the *per capita* gross product will increase at an average cumulative annual rate of 2.9 per cent, and that consequently the total gross product will do so at an annual rate of 5.5 per cent. Since the product-capital ratio is assumed to remain stationary at a level of 0.40, the increment in capital requirements will also be the same, and, just as before, the gross investment coefficient will have to rise from 19.2 per cent in 1955 to 23.7 per cent in 1965 (see table 30 for the relevant data). It has already been noted that the latter figures seem relatively high, but not beyond Peru's reach, to judge

27 Furthermore, the fact that the same methodology would be applicable in the formulation of any other projection facilitates the introduction of appropriate corrections by those who have other background data at their disposal or who differ from any of the criteria —sometimes subjective—that have been adopted here.

from what was achieved in specific years during the period 1945-55.

The first important difference between these and the previous projections derives from the fact that no allowance will now be made for a net inflow of foreign capital, but, on the basis of previous analyses, equilibrium will be assumed to exist between gross external investment and remittances abroad under the head of amortization payments, interest and profits. Given such a hypothesis, available goods and services cannot this time exceed, but will have to be identical with the gross product; thus, they will amount to some 54 600 million soles, as compared with over 58 400 million in the earlier projections (see again table 19). As gross investment requirements are the same in both cases, this smaller increment in available goods and services will inevitably mean that the growth of consumption will also be more moderate.

Herein, then, lies the most significant difference, from this point of view, between the previous automatic projections and those now formulated more in accord with the probabilities. In the former, which reflected only a prolongation of development between 1945 and 1955, the annual increase in the *per capita* gross product was assumed to be 2.9 per cent, alongside a 3.0-per-cent annual increment in *per capita* consumption. According to the new projections, the expansion of *per capita* consumption would have to be restricted to only 2.2 per cent annually, if the same rate of growth of the *per capita* gross product were to be maintained in the future. It is this that evidences the greater sacrifice which the maintenance of the growth rate would impose, inasmuch as it would entail a much more moderate expansion of consumption in comparison with the increase in the gross product, whereas in previous periods the reverse was the case, thanks to the net inflow of foreign capital and other favourable factors.

The rise in the gross investment coefficient also indicates the same need for the gross product to increase faster than consumption.

For the aggregate magnitudes projected to be arithmetically consistent is not, of course, enough. The less intensive growth of consumption, for instance, might be interpreted as a trend towards a more regressive income distribution and a reduction of the already relatively small share falling to the wage-earning sectors. In that case, the limited volume of effective demand for many domestically-produced goods might discourage the development of specific branches of manufacturing industry and other activities, and eventually become an obstacle to the achievement of the aggregate economic expansion postulated by the present hypothesis. However, this is not bound to happen, in view of the apparently very extensive possibilities of restricting increases in the consumption of less essential goods, usually with a much higher import content. At all events, such considerations should be borne in mind in evaluating the practical potentialities of a hypothesis of this kind.

The other requisite, within the framework of the hypothesis now under consideration, is a change in the relationship hitherto registered between the growth of imports and the increment in the gross product. Given the export prospects already studied, if future balance-of-payments deficits are to be avoided, the elasticity of imports (in relation to the gross product) will have to be reduced from 1.57—the figure recorded in the past, during 1948-55—to an average of only 1.20 in the decade 1955-65. Otherwise a deficit would be inevitable, and this too would militate against the attainment of a rate of economic growth of the intensity envisaged.[28]

Fortunately, such a reduction does not seem to constitute an insuperable obstacle—provided that an appropriate economic policy is adopted—in view of the many import substitution possibilities apparently existing in a number of branches of economic activity in Peru. This aspect will be dealt with at greater length in the next chapter, in connexion with the role that manufacturing industry will be called upon to play in the future development of the Peruvian economy. The hypothetical projections just formulated in respect of the most important aggregate magnitudes will provide a general frame of reference within which this and other industrial development problems can be viewed in better perspective.

Table 30

PERU: MORE PROBABLE HYPOTHESIS OF FUTURE GROWTH BETWEEN 1955 AND 1965

	1955	*1965*
A. VALUES AT CONSTANT 1955 PRICES		
Population (thousands of persons)	8 941	11 464
Gross product: Total (millions of soles)	32 048	54 649
Per capita (soles)	3 584	4 767
Consumption: Total (millions of soles)	26 254	41 670 [a]
Per capita (soles)	2 936	3 635 [a]
Capital (millions of soles)	80 723	136 622
Gross investment (millions of soles)	6 140	12 979
Depreciation (millions of soles)	3 228	5 465
Net investment (millions of soles)	2 912	7 514
Available goods and services (millions of soles)	32 394	54 649 [a]
Difference between gross product and available goods and services (millions of soles)	346	0 [a]
Product-capital ratio	0.4	0.4
Gross investment coefficient	19.2	23.7
Net investment coefficient	9.1	13.7
	1945-55	*1955-65*
B. ANNUAL GROWTH RATES		
Population	2.0	2.5
Gross product: Total	5.0	5.5
Per capita	2.9	2.9
Consumption: Total	5.1	4.7 [a]
Per capita	3.0	2.2 [a]

SOURCE: 1945-55, official data. See annex I.
a These magnitudes differ from those considered in the automatic projection of historical growth included in table 19.

[28] The deficit would be rather less than that indicated in the automatic projections presented in earlier sections, but still large enough to be regarded as gravely inconsistent with this new set of projections.

Chapter III

MANUFACTURING INDUSTRY: EXPANSION REQUIREMENTS

The preceding chapters were intended to provide a general frame of reference within which to study the needs of industrial development, on the assumption that its expansion would be consistent with the overall requirements which the maintenance of a reasonable rate of increase for *per capita* income would necessitate, as well as the balanced development of the various sectors of economic activity. This chapter will analyse the extent to which industry would have to expand during the period 1955-65 in order to make these hypotheses consistent, using the aggregate projections previously formulated. In other words, a tentative approximate evaluation will be made of the rate of growth that industry would need to attain in order to make an effective contribution to development instead of hampering it.

To begin with, the foregoing analysis raises at least two problems which seem to be of key importance for the future development of the Peruvian economy and in the solution of which industry is destined to play a leading role. The first is the marked increase that will be registered in the labour force, which will have to be given opportunities of productive employment in the various sectors of economic activity, in ways that will further the basic aim of raising the income and consumption levels of the population. The second is the limitation of the capacity to import; foreign exchange resources will probably be inadequate to meet the sharp increase in demand for imported goods, and this may make it a relatively urgent matter to create domestic production capacity for the manufacture of a number of goods that are at present imported. The response to each of these factors which will be required of industry must therefore be examined, even if somewhat cursorily.

1. *The labour force: growth and absorption prospects*

As will be recalled, the brief review of the main demographic trends presented earlier led to the conclusion that between 1955 and 1965 the active population of Peru might increase by about one million persons. This would imply employment levels exceeding those registered at present by as much as about 27 per cent, or even more in some of the most important sectors of economic activity, since the maintenance of the same sectoral distribution as at present would not be compatible with the hypothesis of a relatively rapid rate of economic development. The question is, therefore, what proportion of this increased available active population could be absorbed by each of the main sectors of the Peruvian economy.

A brief digression is permissible here in order to mention an additional factor which may make it still more difficult to solve the problem satisfactorily. A tendency to economize in manpower by increasing capital intensity has been observable in the development process over the last few years, and is also implicit in many of the current expansion programmes. It often happens that such programmes provide at one and the same time for very substantial increases in the volume of production and the maintenance of current employment levels, so that their implementation will not involve the absorption of additional manpower. The problem is undeniably complicated, as the need to raise productivity to the maximum, especially in an economy like that of Peru, might well be adduced in defence of this trend. The export sector is obviously anxious to improve its competitive position on the world market, while manufacturing industry develops within an institutional framework conducive to keen competition with imports, and consequently aims at reaching higher levels of efficiency as rapidly as possible. Conversely, a point worth noting is that a policy of this kind may give rise to no less serious problems, by leading to the over-investment in some activities at the expense of others which might help to absorb the persistent increment in available manpower. In these circumstances, the counterpart of such an improvement in productivity in specific sectors might well be overt or disguised unemployment, and the stagnation or even the deterioration of productivity in those activities which have to bear the brunt of increasing demographic pressure, with the consequent derived effects on aggregate real demand. It is therefore at least open to discussion whether the trend in question represents an optimum distribution of Peru's relative labour and capital resources, or whether, on the contrary, it results from the influence of factors which are not strictly economic.[1]

[1] These include social factors, and the imperfections of the machinery for the conduct of relations between workers and employers. In certain cases, the want of a properly organized capital market may also encourage the tendency towards over-investment in particular enterprises, because it complicates the transfer of available investment resources to new activities. (See Part Two for fuller discussion of this last point.)

In any event, the consideration of immediate importance is that the intensive growth of particular sectors of economic activity—especially that of the extractive industries—will not be accompanied, during the period 1955-65, by an equally large contribution to the absorption of the manpower increment which will need opportunities of productive employment.

A few hypotheses may be put forward in more specific terms with respect to the possible distribution of the active population increment in 1955-65, which, it will be remembered, should amount to some 996 000 persons (from 3 696 000 active persons in 1955 to 4 692 000 in 1965).

Some thought ought to be given to the possible increase in agricultural exports as well as the larger volume of production that will be required, on the one hand to cover the increment in consumption of non-processed foodstuffs, and, on the other, to supply industry, and, up to a point, agriculture itself, with the appropriate raw materials. The inference would seem to be that the gross value of crop and livestock production will have to rise from 12 732 million soles in 1955 to 19 261 million soles in 1965 (at constant 1955 prices), that is, by 51.3 per cent.[2]

It may further be considered, as a fairly realistic assumption, that the gross product generated by crop and stock farming will expand in much the same proportions as the gross value of production. Thus the gross product should rise from 10 113 million soles in 1955 to about 15 298 million in 1965 (also at 1955 prices). Obviously, the increment in the active population employed in agriculture will have to be proportionally smaller than this increase in the gross product; otherwise, productivity would remain at its present extremely low levels, and the implication would be that throughout the whole of the decade agriculture would remain completely impervious to any form of technical progress, while at the same time it would continue to bear the brunt of manpower surpluses now existing in specific areas.

As a reasonable hypothesis—not, of course, precluding the formulation of others—it can be assumed that by 1965 productivity per employed person in the agricultural sector may improve by about 23 per cent; in other words, that the gross product per active person in that sector will rise from the sum of slightly over 4 648 soles registered in 1955 to about 5 734 soles in 1965. From a comparison of the latter figure with that just mentioned for the total gross product of agriculture, it can be inferred that in such circumstances the total employment opportunities offered by crop and stock farming will suffice for about 2 668 000 active persons. In other words, out of a manpower increment of 996 000 persons, agriculture will be able to absorb, on these assumptions, only about 492 000 (about 23 per cent of the present number of persons employed) and more than half a million will have to seek employment in non-agricultural activities.

The latter figure would be much higher if a greater improvement were assumed to take place in the productivity of the active population employed in agriculture, and this would only bear out the conclusions that will later be deduced from these hypothetical calculations. An opposite line of reasoning may also be pursued, on the assumption of a smaller increment in the productivity of the agricultural labour force. It should be borne in mind, however, that even the hypothesis of a 20-per-cent improvement adopted here implies a future widening of the already considerable gap at present existing between agriculture and the other economic activities in respect of productivity, since in the course of the same period the gross product per active person in the economy as a whole will have risen by 34 per cent.

Meanwhile, development in other activities must be considered. In the first place, the non-agricultural active population is assumed to increase from 1 520 000 persons in 1955 to about 2 024 000 in 1965 (see table 31). If, as is highly likely, the ratio between the non-agricultural active population and the total urban population remains approximately constant, the latter will rise to some 4 808 000 persons by 1965, or about 41.9 per cent of the population as a whole. This relatively slow rate of urbanization (in 1955 urban population represented 40.4 per cent of the total), much lower in fact than during the preceding decade, is another indication that the relative shift of manpower from agriculture to other activities will on the whole be on a moderate scale.

As regards possible development in respect of employment in the various non-agricultural sectors, little information is available for a fairly objective analysis. The prospects of expansion for the extractive industries are excellent, as was inferred from the study of export possibilities; but there has also been a trend—very marked in this sector—to increase capital intensity and to avoid raising employment levels so far as pos-

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2 The composition of the gross value of production in the two years mentioned would be as follows (expressed in millions of soles at 1955 prices):

	1955	*1965*
Non-processed consumer foodstuffs	5 196	6 494
Raw materials for agriculture and industry	5 088	9 149
Exports	2 448	3 618
	12 732	19 261

The projection relating to foodstuffs for direct consumption was formulated on the basis of a detailed table of consumption of staple commodities in 1955, and a series of income-elasticity coefficients of demand for these goods was used in association with the growth of total consumption postulated in the over-all development hypothesis for 1965. Export prospects were analysed in chapter II. Raw materials include agriculture's own inputs—seed, animal feed, ginned cotton—and those utilized in manufacturing industry for the processing of foodstuffs and other goods. In this latter case, the method adopted was similar to that applied in dealing with foodstuffs for direct consumption. A detailed table of supplies in 1955 and the hypothetical increase in total consumption were taken as points of departure, and related this time to elasticity coefficients of demand for the end goods in which the raw materials concerned were ultimately to be incorporated. Lastly, the necessary adjustments were made to take into account possible changes in the sources of supply (domestic production and imports). This aspect was studied in chapter I.

Table 31

PERU: PROJECTION OF INCREASE AND POSSIBLE DISTRIBUTION OF ACTIVE POPULATION BETWEEN 1955 AND 1965

(Thousands of persons)

	1955	1965
Total active population	3 696.0	4 692.0
Agricultural activities	2 176.0	2 668.0
Non-agricultural activities	1 520.0	2 024.0
Extractive industries	62.8	100.0
Manufacturing industry	616.0	850.0
Registered	(120.6)	(216.0)
Unregistered and artisan industry	(495.4)	(634.0)
Services and other sectors [a] . . .	841.2	1 074.0

SOURCE: 1955, official data.

a Construction, transport, commerce, financial services, public administration, etc.

sible. Even so, the opening-up of new mines and the further development at least of medium and small-scale mining, will undoubtedly necessitate additional manpower. In these circumstances, it may be estimated that the active population employed in this sector will increase from the 1955 figure—almost 63 000 persons—to about 100 000 in 1965. This will still mean a considerable improvement in productivity, if it is taken into account that production will be about two and a half times greater in the latter than in the former year.

It is impossible to formulate equally detailed hypotheses for each of the other sectors, until the manpower absorption requirements, a major share of which would have to be met by manufacturing industry, can be residually determined, since, in the last analysis, this is what matters for the purposes of the present study. Certain indirect criteria will therefore have to be adopted once again.

In 1955, the figure for employment in industry totalled about 616 000 persons and included approximately 121 000 persons employed in "registered industry"—broadly speaking, industry proper, operating on a fairly large scale—and slightly over 495 000 persons employed in "unregistered" and artisan industry. In the aggregate, about 40.5 per cent of the total non-agricultural active population was absorbed in these activities. Clearly, if industry is expected to play a dynamic role in future development, it will also have to make a positive contribution as regards employment, and some increase in the proportion under discussion must therefore be postulated. To adopt a moderate hypothesis once more, let it be assumed that by 1965 manufacturing activities will have come to absorb some 42 per cent of the non-agricultural active population; this would imply that the number of persons employed in the sector in question totalled about 850 000, or over 230 000 more than in 1955.

To sum up, between 1955 and 1965 the total active population would grow by almost 27 per cent; employment in agricultural and in non-agricultural activities would increase by under 23 per cent and over 33 per cent respectively. Within the latter, increments would be in the neighbourhood of 59 per cent in the extractive industries, about 38 per cent in manufacturing as a whole and nearly 28 per cent in the case of the other non-agricultural sectors.

In these calculations yet another essential aspect is omitted, namely, within manufacturing activities, the relative growth of industry proper, on the one hand, and of unregistered and artisan industry on the other. The expansion of employment in industry largely derives from the absorption of manpower formerly employed in artisan activities, which gradually shifts towards large-scale and more efficient forms of production. In other words, there seems to be no doubt that employment will have to increase more intensively in industry proper than in artisan activities. If, for the sake of simplicity, it were assumed that employment in artisan activities would expand up to 1965 at a rate similar to the rate of growth of the total population (about 28 per cent between 1955 and 1965), the total number of active persons belonging to this sector would rise from a little over 495 000 to some 634 000 persons. Consequently, by 1965 employment in industry proper would absorb 216 000 persons, which would represent an increase of almost 80 per cent over the 1955 levels, and would be the largest increment registered in any of the main sectors of economic activity. Even so, registered industry would account for barely over 25 per cent of the total active population employed in aggregate manufacturing activities in 1965, while unregistered and artisan industry would retain almost three-quarters of the labour force in question. In the light of this consideration, therefore, the growth hypothesis adopted in respect of employment in industry proper seems quite the reverse of excessive.

Despite the numerous assumptions on which they are grounded, these hypothetical calculations at least provide an approximate indication of the magnitude of the problem to be tackled. With an employment figure that in 1955 barely exceeded 120 000 persons, industry proper will have to absorb nearly 100 000 additional persons in the following ten years if its contribution to employment opportunities for the active population increment is to prove really positive. As has already been shown, even this effort, substantial as it seems in absolute terms, will imply only a moderate increase in the proportion of the active population employed in manufacturing in relation to total employment in non-agricultural activities as a whole, and only a slight improvement in the ratio between employment in industry proper and employment in artisan activities.

If the growth of employment is taken in conjunction with the effect of the higher levels of productivity which the industrial sector will undoubtedly succeed in attaining, the conclusion will be reached that the increase in the quantum of industrial production, and, consequently, in this sector's contribution to the gross

product, will be very intensive. This, however, is an aspect which will be discussed in greater detail later.

2. *The role of industry in relation to the limitations of the capacity to import*

Consideration may now be given to the second of the aspects which have been described as of key importance for the future development of the Peruvian economy, namely, the possible evolution of the capacity to import in comparison with trends in demand for imported goods.

In the first place, the analyses and data presented in chapter II give some idea of the order of magnitude of the problem. As will be recalled, a hypothesis was formulated to the effect that by 1965 total exports would amount to some 10 164 million soles (at 1955 prices). Similarly, it was estimated that the terms of trade could hardly be expected to make a positive contribution, as at best—to judge from the objective background data available—levels similar to those registered in 1955 might be regained. Lastly, it was assumed on the basis of various considerations that by 1965 the inflow of foreign capital would be closely balanced by the resulting remittances abroad, so that net external capital receipts would be virtually non-existent. The hypotheses relating to the last two points therefore imply that in the future the capacity to import will tend to coincide with the export quantum and, consequently, will attain the same figure (10 164 million soles at 1955 prices) by 1965.

Again, if the behaviour of demand for imports in relation to the relevant magnitudes—gross product or consumption as the case may be—is assumed to be much the same as in the preceding decade and is then related to future projections for these, it will be concluded that by 1965 the demand in question may amount to some 14 257 million soles. This total can be broken down into demand for consumer goods (3 725 million), for raw materials and intermediate goods (3 761 million), for fuels (429 million) and for capital goods (6 340 million). In short, a demand for imported goods equivalent to over 14 000 million soles will be registered, as against a capacity to import of barely more than 10 000 million soles. Here, then, is a first approximation in this attempt to assess the substitution effort which the Peruvian economy would have to make in order to avoid a balance-of-payments disequilibrium so pronounced that it would in all likelihood considerably reduce the rate of growth envisaged in the over-all hypotheses from which these calculations are deduced.[3]

There is no reason why the avoidance of this potential balance-of-payments disequilibrium should be based entirely on a policy of import substitution in respect of manufactures, as considerable substitution possibilities also exist in other economic activities, especially farming. More careful consideration must therefore be given to the proportion that might correspond strictly to manufacturing industry.

It may be assumed that Peru will manage to become entirely self-sufficient in crop commodities, with only a few exceptions, for instance, the imports needed to cover the possible wheat deficit, which, according to the hypotheses formulated, might amount to a little over 400 000 tons by 1965, and a small volume of imports of such fruit as cannot be produced in Peruvian territory. In all, such imports will represent about 545 million soles. Similarly, imports of fuels may be assumed to represent about 220 million soles, a sum equivalent to approximately 4 million barrels, according to criteria also presented earlier. This will mean that the capacity to import available for bringing manufactures into Peru—whether consumer, intermediate or capital goods—will be limited to about 9 387 million soles. Demand for imported manufactures will represent 12 750 million soles,[4] if elasticities similar to those registered in the preceding decade are maintained. In other words, of total substitution requirements—amounting to a value of just over 4 000 million soles—more than three-quarters would have to be achieved within the sphere of manufacturing production.

It is by no means superfluous to stress the rough nature of these calculations, not only from the standpoint of how far they may be corroborated or invalidated by the trends actually registered in future development, but also from a strictly methodological aspect. For example, import requirements in respect of intermediate or capital goods cannot be assessed very accurately until the expansion needs of industry and other activities have been evaluated; in turn, it is just these requirements, in relation to the available capacity to import, which must serve here as one of the criteria on which to base an appraisal of the necessary rate of expansion of industrial activity. The mutual interaction of these two objectives, in the last analysis, would greatly complicate an exact appraisal. Thus the present estimates aim at no more than an approximate approach to the problem, although the precision of the figures quoted might suggest that their findings are much more accurate than is really the case.

With the appropriate reservations, attention may be turned to the possible industrial implications of the need for import substitution to a value of about 3 400 million soles. In the first place, the expansion of the value of industrial production would have to exceed the latter figure considerably, since any production in-

[3] The meaning of the expression "import substitution", as it is used here, should be clarified. As was seen earlier, the hypotheses on which the projections are based imply that the expansion in total imports will outstrip the gross product. Hence what is involved here is not a reduction in the import coefficient but merely a tendency between what the demand for imports would be if the elasticity shown by imports in previous periods were maintained and what Peru's available capacity to import would be.

[4] This total would be made up of 3 660 million soles for manufactured consumer goods, 2 750 million for manufactured intermediate goods and 6 340 million for capital goods, as mentioned in the preceding paragraph.

crement calls in turn for raw materials and intermediate goods needed for the production process. Inputs supplied by manufacturing industry itself, without taking into account those which other activities would have to provide, would alone represent, in view of the Peruvian economy's present structural characteristics, not less than 27 per cent of every increase in final output. An additional output to a value of 3 400 million soles designed to replace a similar quantity of imports would thus imply—with all the corresponding derived effects—the need for a total expansion of manufacturing production equivalent to not less than 4 400 million soles.[5]

To sum up, if industrial development during the decade 1955-65 is to be efficacious in helping to prevent a balance-of-payments disequilibrium which might slow up the rate of growth of the whole economy, for this sole purpose industrial production would have to exceed its 1955 levels by over 30 per cent. To this must be added expansion requirements to meet the increment in demand for those commodities which are already provided by domestic industry at the present time. Hence it will once again be concluded that the over-all development hypotheses under discussion could only be fulfilled on the basis of a highly intensive industrial development.

3. *The necessary rate of industrial development and its compatibility with the growth of other activities*

It will now be possible to evaluate somewhat more accurately the extent to which industry will have to expand if the targets set in the foregoing set of hypotheses are to be attained, within the limitations imposed by the capacity to import. Given this latter, manufacturing production will have to serve a variety of ends. It must satisfy some part of demand for manufactured consumer goods, help to meet capital goods requirements, contribute a share of the intermediate goods needed as inputs in other economic activities and supply a specific proportion of those to be absorbed by industry itself. So wide a range of manufacturing output tends to complicate the process of determining what production requirements will be consistent with the possible development of other activities and the probable behaviour of the "final demand sectors",[6] without upsetting the balance of payments. An attempt will be made to discuss the problem, however, with the help of a highly simplified inter-industrial relationships model.

Table 32 shows in outline the whole of the flow of goods and services registered in the Peruvian economy during 1955. For simplicity's sake, the various economic activities are grouped under only four sectors, i.e., agriculture, the extractive industries, manufacturing industry and services, this last including the added value of construction, trade and transport, apart from other typical services.[7] In accordance with the traditional interpretation of such tables, the distribution of each activity's output is shown horizontally, whether it takes the form of intermediate sales (input of other sectors of production) or of sales to the so-called "final demand" sectors (exports, consumption and investment); whereas in the vertical columns appear the purchases (or inputs) required by each activity for its production process, together with a break-down of final demand by sectors of origin. The presentation of a similar break-down for imports facilitates comparison of the respective shares of these and domestic production in the satisfaction of each type of need.

The aggregate magnitudes are naturally the same as those already mentioned. This is true, for example, of the sum of the gross values of production in all sectors (45 238 million soles). The difference between this and total inputs (13 190 million soles) is identical with the gross product (32 048 million, a sum also equivalent to the total gross product of the four sectors, that of agriculture being 10 113 million, that of extractive industries 2 367 million, that of manufacturing industry 5 643 million and that of services 13 925 million). As regards goods and services, the difference between imports (6 465 million soles) and exports (6 119 million) determines the balance-of-payments position on current account. The addition of this balance to the gross product gives the funds available for financing investment and consumption. Other such equivalences, could likewise be adduced.

The interest of a table of this kind is twofold. By its means, the consistency of the several magnitudes can be checked. But it also provides an account, at once complete and concise, of what has taken place in the economy during a specific period. Thus it may constitute a valuable instrument of analysis for such a problem as that of assessing what degree of industrial

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[5] At the round-table meetings where the preliminary version of this study was discussed, attention was drawn to the availability of making it clear that it would be misleading to interpret the fact that total production requirements would be on a larger scale than the import substitution which they would necessitate as meaning that the processing in Peru of the goods concerned would necessarily be more expensive than the corresponding imports. As soon as the concept of "value of production" is used, the concept of certain inputs is redundant when it includes end goods in terms of gross value and not of the value added. Hence this has nothing whatever to do with comparative production and import costs, since the same phenomenon could occur in the industry of the present country of origin of the imports.

[6] Including consumption, investment and exports.

[7] A similar model, in which, however, economic activities will be classified in much more detail, will be used later. The two tables will not strictly correspond to each other because of the slightly different ways in which the sectors are defined. For example, in table 32, production and exports of sugar, on the one hand, and of refined metals and petroleum derivatives, on the other, are considered as coming directly from the agricultural sector and the extractive industries respectively, instead of manufacturing industry being regarded as the sector of origin, as it will be in the more detailed tables. This procedure has been followed for the sake of uniformity with the classification of exports utilized in previous chapters. For a similar reason, the composition of the gross product by sectors will not always be the same, although the total will. For a more detailed explanation of the characteristics and methods of application of the type of outline adopted here, see ECLA, "The Input-Output Model", *Economic Bulletin for Latin America*, Vol. 1, No. 2, (Santiago, Chile, September 1956).

Table 32

PERU: SIMPLIFIED OUTLINE OF THE ECONOMY IN 1955

(Values in millions of soles)

Break-down of production \ Composition of inputs	Agricultural activities	Extractive industries	Manufacturing industry	Services	Total intermediate transactions	Total final demand	Exports	Consumption	Investment	Total production and imports
Agricultural activities:										
Demand	1 955	61	3 564	—	5 580	7 675	2 448	5 227	—	13 255
Production	1 954	39	3 095	—	5 088	7 644	2 448	5 196	—	12 732
Imports	1	22	469	—	492	31	—	31	—	523
Extractive industries:										
Demand	212	1 564	85	—	1 861	2 707	2 374	333	—	4 568
Production	212	1 564	74	—	1 850	2 707	2 374	333	—	4 557
Imports	—	—	11	—	11	—	—	—	—	11
Manufacturing industry:										
Demand	356	388	3 835	—	4 579	14 660	283	10 954	3 423	19 239
Production	212	227	2 812	—	3 251	10 773	283	9 602	888	14 024
Imports	144	161	1 023	—	1 328	3 887	—	1 352	235	5 215
Services:										
Demand	96	177	897	—	1 170	13 471	1 014	9 740	2 717	14 642
Production	96	177	897	—	1 170	12 755	1 014	9 024	2 717	13 925
Imports	—	—	—	—	—	716	—	716	—	716
Total inputs:										
Demand	2 619	2 190	8 381	—	13 190					
Production	2 474	2 007	6 878	—	11 359					
Imports	145	183	1 503	—	1 831					
Gross value of production	12 732	4 557	14 024	13 925						45 238
Exports and imports							6 119			6 465
Gross product, consumption and investment:										
Demand	10 113	2 367	5 643	13 925			(−346)	26 254	6 140	32 048
Production								24 155	3 605	
Imports								2 099	2 535	

SOURCE: Estimates based on official statistics.

expansion would be duly consistent with the development of other activities and of the over-all economy, which is the question at present under consideration. A similar model will therefore be constructed for 1965; and from the hypothetical projections formulated earlier can be deduced the industrial expansion requirements they imply. The relevant operations will next be described in some detail, so as to illustrate more clearly the methods applied for this purpose, although this will entail a rather wearisome enumeration of statistical data.

The most important aggregate magnitudes have been determined beforehand. The total gross product should thus amount to 54 649 million soles (at constant 1955 prices), gross investment requirements—on the assumption that the product-capital ratio will remain at much the same level as in 1955—will reach 12 979 million soles, and consumption will represent 41 670 million. Exports of goods will total 10 164 million soles, and the import figure will have to be the same, since the aim is to keep the balance of payments stabilized. It is assumed that there will be no change in the terms of trade and that equilibrium will be maintained between the inflow of foreign capital and the services involved. An additional hypothesis is that exports will be equal to imports of services (the amount being arbitrarily fixed at 1 500 million soles).

The probable distribution of the main aggregate magnitudes by sectors will now be examined. Certain basic assumptions which will facilitate this process were explained earlier. Firstly, a projection of the composition of exports of goods is already available; the aggregate sum of 10 164 million soles mentioned above will be made up of 3 618 million in respect of agricultural commodities, 5 890 million represented by products of the extractive industries and 656 million contributed by manufactured goods. In accordance with developments in 1955, gross investment will this time be composed of 7 229 soles in the form of machinery, equipment and other capital goods—almost all manufactured—and 5 750 million soles covering installation costs and other relevant charges and services.

The study of the possible composition of consumption is rather more complex. According a hypothetical projection formulated in a previous chapter, consumption of non-processed foodstuffs, direct from the agricultural sector, will absorb domestically-produced and imported commodities (the latter mainly fruit) to values of 6 494 million and 15 million soles respectively

in 1965. The extent to which agriculture would have to expand in order to supply the raw materials required by industry, chiefly for the production of processed foodstuffs, was evaluated at the same time. Consumption of manufactured goods may be conveniently classified by dividing them into foodstuffs and non-foodstuffs. The former, according to the hypothesis referred to, will increase from 4 833 million soles in 1955 to 7 598 million in 1965, the implication being that the income-elasticity of demand will be relatively low, as a comparison of this increment with the growth of total consumption over the same period would seem to suggest. In the case of non-foodstuffs, special research was undertaken to establish the relationship between their expansion and that of total consumption during the period 1948-55. The findings revealed a very high elasticity (1.68). But it seemed wiser to utilize a rather lower coefficient (1.5) on the basis of which consumption of this type of goods will rise from 6 121 million soles in 1955 to 12 239 million in 1965.[8] All in all, total consumption of manufactured goods will amount to 19 835 million soles by 1965. From total consumption as projected may now be deducted the figures for non-processed foodstuffs and manufactured goods as a whole, as well as about 1 230 million soles for products of the extractive industries (mainly petroleum derivatives) and the 1 500 million soles estimated for consumption of imported services. The resulting conclusion is that expenditure on consumption of services of domestic origin will reach 13 144 million soles. With the aid of these calculations, the sectoral break-down of total final demand will be completed (see table 33), although the possible contributions of domestic production and supplies in each case will not as yet have been fully discussed.

The picture is now virtually complete so far as the distribution of agricultural production is concerned. The necessary intermediate purchases for this activity can next be determined. To deduce these, coefficients of input per unit of production identical with those recorded in 1955 may be adopted (see again table 33, second column). A similar assumption can be made in respect of the extractive industries, whose expansion is mainly attributable to the increase in exports (see again table 33, third column and second line). Thus the problem reduces itself in essence to what may take place in manufacturing industry, and the solution here

[8] The reduction of the elasticity coefficient from 1.68 to 1.5 was not as arbitrary as it may appear, since it was borne in mind that the aggregate hypotheses on which these calculations were based assumed a rather lower rate of urbanization than had been registered in the preceding decade, and this factor alone generally exerts considerable influence on the growth of demand for manufactured goods.

Table 33

PERU: PROJECTION OF A SIMPLIFIED OUTLINE OF THE NATIONAL ECONOMY IN 1965

(Values in millions of soles at constant 1955 prices)

Composition of inputs / *Break-down of production*	*Agricultural activities*	*Extractive industries*	*Manufacturing industry*	*Services*	*Total intermediate transactions*	*Total final demand*	*Exports*	*Consumption*	*Investment*	*Total production and imports*
Agricultural activities:										
Demand	2 958	142	7 027	—	10 127	10 127	3 618	6 509	—	20 254
Production	2 956	91	6 102	—	9 149	10 112	3 618	6 494	—	19 261
Imports	2	51	925	—	978	15	—	15	—	993
Extractive industries:										
Demand	321	3 635	167	—	4 123	6 570	5 890	680	—	10 693
Production	321	3 635	146	—	4 102	6 490	5 890	600	—	10 592
Imports	—	—	21	—	21	80	—	80	—	101
Manufacturing industry										
Demand	539	901	7 561	—	9 001	27 722	656	19 837	7 229	36 723
Production	321	527	6 012	—	6 860	20 793	656	18 037	2 100	27 653
Imports	218	374	1 549	—	2 141	6 929	—	1 800	5 129	9 070
Services:										
Demand	145	411	1 768	—	2 324	21 894	1 500	14 644	5 750	24 218
Production	145	411	1 768	—	2 324	20 394	1 500	13 144	5 750	22 718
Imports	—	—	—	—	—	1 500	—	1 500	—	1 500
Total inputs:										
Demand	3 963	5 089	16 523	—	25 575					
Production	3 743	4 664	14 028	—	22 435					
Imports	220	425	2 495	—	3 140					
Gross value of production	19 261	10 592	27 653	22 718						80 224
Exports and imports							11 664			11 664
Gross product, consumption and investment:										
Demand	15 298	5 503	11 130	22 718				41 670	12 979	54 649
Production								38 275	7 850	
Imports								3 395	5 129	

is more difficult to discover because one of the targets set up in these projections is stabilization of the balance of payments. Stabilization would of course be far out of reach if it were merely assumed that domestic industry's relative share in the supply of consumer, intermediate and capital goods would remain much the same as in 1955, since in that event imports would greatly exceed exports. The time has now come, therefore, to incorporate here the import substitution requirements mentioned in the preceding section.

There is no need at this point for a tedious account of the mechanical process whereby the necessary adjustment can be arrived at. Since any expansion of industry—even if, as in the present case, the governing motive is the substitution of domestic production for imports—leads to derived requirements of inputs which are partly imported, a rather complex method involving a series of approximations is called for. Briefly, an estimate was prepared of a possible distribution of the capacity to import manufactured goods among the three categories—consumer, capital and intermediate goods—and the extent to which the corresponding branches of domestic industry would have to expand was evaluated. In all three cases, the resulting projections imply some degree of import substitution, although it varies in intensity for each of the categories of goods concerned [9] (see again table 33).

Taken as a whole, therefore, table 33 represents—although in extremely simplified form—a hypothetical projection of the Peruvian economy for 1965 which is consistent from several points of view. It embodies the hypotheses on the growth of the aggregate gross product and consumption which were adopted as a point of departure; it depicts a composition of consumption which largely reflects past experience as regards the behaviour of demand for the various types of goods; it takes into account the aim of securing equilibrium in the balance of payments; it ensures—and this is unquestionably a basic requisite—the necessary compatibility between the development of the several sectors of economic activity, inasmuch as it maintains the inter-industrial relationships imposed by technological conditions, etc.

From a comparison of the two over-all models contained in tables 32 and 33, an idea can be formed of some of the most noteworthy changes that would be registered in the economy between 1955 and 1965, if the general tenor of future development were similar to that postulated by the hypotheses. Apart from considerations relating to the increment in the gross product and the improvement in the living conditions of the population which this would entail—points to which sufficient attention has already been devoted—stress should be laid on the changes that would take place in the following two important respects: the sectoral composition of the gross product, and the composition of imports by types of goods (see table 34). In the former case, the most striking changes would consist in a considerable increase in the relative importance of the gross product generated by the extractive industries and manufacturing, at the expense of that originating in the agricultural sector and—on a smaller scale—in services.[10] In the composition of imports, the outstanding difference would be the greater relative importance of capital goods, accompanied by an equally significant contraction in that of consumer goods, while the proportion of imports of raw materials and intermediate products would remain much the same as in 1955; in all three categories of imported goods, however, increments in absolute terms would be recorded, although their degrees of intensity would vary widely.

Table 34

PERU: PROJECTION OF CHANGES IN COMPOSITION OF GROSS PRODUCT AND IMPORTS BETWEEN 1955 AND 1965

(Percentages)

	1955 [a]	1965
A. GROSS PRODUCT		
Agricultural activities	31.6	28.0
Extractive industries	7.4	10.1
Manufacturing industry	17.6	20.4
Services	43.4	51.5
B. IMPORTS [b]		
Consumer goods	24.1	18.6
Raw materials and intermediate products	31.8	30.9
Capital goods	44.1	50.5

SOURCE: 1955, official data.

a The differences between these figures and the preceding ones (e.g. in table 7) are due to the difference in the scope given to the sectors for the specific purposes of this section. It should be borne in mind particularly that here sugar production is included under "agricultural activities" and metal refining under "extractive industries" instead of under manufacturing industry in both cases.

b Goods only, excluding services.

Nevertheless, the aspects to be emphasized as of immediate importance here are those that have a direct bering upon manufacturing industry. The comparison of the two models under discussion shows that between 1955 and 1965 the gross product generated in this sector should increase by 97.2 per cent—at a rather higher rate, that is, than during the preceding decade.[11] Here, then, is an evaluation of the rate of development that industry would have to attain if it was to play a positive role within the over-all framework of economic

[9] These substitution hypotheses seem reasonable in the light of the present characteristics of the Peruvian economy (especially of industry), but they represent only one of many possibilities, since the same aggregate results could be obtained by means of more intensive substitution in one of the fields concerned, at the expense of the others. It is precisely the chapters which follow that will provide better criteria for judging whether the exact combination presented here would be the best for Peru.

[10] Although this last conclusion may not be considered very plausible, it should be taken into account that specific services greatly expanded during the period 1945-55 as a source of employment for part of the increment in the urban active population, whereas here the assumption is that in the future other more productive forms of employment will be made available.

[11] For the reasons explained earlier, this preliminary estimate of industrial growth requirements is rather different from the more detailed final analysis to be found in chapter IX. Nevertheless, the magnitude of the difference is very small and will in no way alter the qualitative deductions made on the basis of the estimate.

development postulated by the aggregate hypotheses on which the present calculations are based. With an increase in manufacturing output of the intensity described, industry would not lag behind the growing demand for manufactured goods, as was formerly the case. On the contrary, the relative share of imports in supplies of the three categories of manufactured goods would be reduced; and in the course of the period 1955-65, the relationships between the consumption of imported manufactures and total consumption of manufactures, between the value of imports of capital goods and gross investment, and between imports and total utilization of intermediate manufactured goods would fall from 12.3 to 9.1 per cent, from 41.3 to 39.5 per cent, and from 29.0 to 23.8 per cent, respectively.

A further inference that can be drawn from the foregoing figures must also be touched upon; this relates to the investment effort that would be required for such an expansion of industrial production. Should it be assumed, as in other contexts, that more efficient utilization of installed capacity might offset the increase in capital intensity that the opening-up of new lines of industrial production would undoubtedly involve—by which means the product-capital ratio in this sector might be kept very close to its 1955 level—the total fixed capital (depreciated and at replacement cost) which industry would need by 1965 would amount to some 27 000 million soles. This would mean more than doubling the stock of capital available in 1955, and during the whole of the decade 1956-65 would call for an annual average net investment of about 1 500 million soles. The corresponding annual gross investment would probably be in the neighbourhood of 2 400 million soles, a figure equivalent in turn to about one-fourth of Peru's total gross investment. Although in absolute terms these levels may seem high, they would not be unattainable, provided that future development were attended by conditions similar to those visualized in the hypotheses adopted.

Lastly, it remains to be seen whether these projections of industrial growth would be compatible with the requisite absorption of manpower by the manufacturing industries, as discussed earlier in this chapter.[12] It will be remembered that the conclusion was reached that during the period 1955-65 industrial activities as a whole would have to raise their employment levels by about 234 000 persons. From a comparison of this increase in the manpower employed with the increment in the gross product which would take place in this sector, it can be deduced that in order to secure this latter, productivity—defined in terms of gross product per employed person—would have to improve by about 41 per cent. In other words, the annual gross product per active person would be 13 836 soles in 1965 as compared with a little over 9 843 soles in 1955.

[12] In order to make the figures for income and employment comparable, sugar production will be again considered as an integral part of the manufacturing industry in the calculations which follow.

So sharp an upswing in productivity may seem overestimated. It would substantially exceed the increment of approximately 20 per cent which would be registered in agricultural activities, but would be less than the 47-per-cent improvement visualized for the extractive industries, where it is assumed that capital intensity would significantly increase. It should be borne in mind, however, that as regards the possibilities of absorbing manpower allowance was made not only for a rise in aggregate employment in the sector, but also for a relative transfer of active population from unregistered and artisan industry to industry proper.[13] This factor alone is capable of decisively influencing an upward movement in average productivity in the manufacturing sector as a whole, even if within each type of production the level of productivity rises comparatively little. In fact, if the increment in productivity in unregistered and artisan industry is assumed to reach barely 10 per cent, a 24.7-per-cent increase in the productivity of industry proper would suffice to raise the average productivity of the whole manufacturing sector by the 41 per cent required in accordance with the hypotheses under discussion.[14] It should be noted that even including this improvement productivity in manufacturing industry proper would still be not less than 30 per cent below the average level that would be reached by the extractive industries. In similar circumstances, the proportion of the gross product of the entire manufacturing sector generated by industry proper would rise from 64.5 per cent in 1955 to 74.2 per cent in 1965, with the consequent loss of relative importance for unregistered and artisan industry.

Such, then, are the findings of the analysis as regards the growth rate that would have to be achieved by industry during the period 1955-65, and some of the special features that its expansion would have to display, if the economic development of Peru were to be on the scale indicated by the over-all hypotheses. Industry's possible ability to attain such a rate of growth, the obstacles that might foreseeably have to be overcome, the greater or lesser degree of intensity that would have to characterize the expansion of each of the main branches of manufacturing industry, etc., are topics of discussion that will be reserved for subsequent chapters.

[13] Employment figures in these two types of activity would by 1965 stand at 634 000 and 216 000 persons, respectively, instead of the 495 000 and 120 000 persons employed in 1955.

[14] The following are the relevant calculations:

	Number of personnel employed	*Gross product per active person (Soles)*	*Total gross product (Millions of soles)*
Industry proper	216 000	40 412	8 729
Unregistered and artisan industry	634 000	4 783	3 032
Total.	*850 000*		*11 761*

PART TWO

CURRENT CHARACTERISTICS AND PROBLEMS OF INDUSTRY

INTRODUCTION

Part One of this study was designed to provide a general background for a discussion of the question directly bearing on industry with due regard to the relationships between this and other sectors and to the over-all problems of the Peruvian economy. The hypotheses formulated led to the conclusion that the maintenance of a reasonable rate of economic growth —assessed in terms of 2.9 and 2.2 per cent annual increases *per capita* in the gross product and consumption respectively—would mean that industry had to expandy by not less than 10 per cent per annum during the course of the period 1955-65. Thanks to the same analysis, it was possible to define the role that manufacturing activities would have to play in two other basic aspects of future development, namely, the absorption of manpower and import substitution.

The quantitative assessment of these over-all targets is unquestionably important, but from the practical point of view it is far from enough. It will not suffice to know that industry as a whole should achieve this or that degree of expansion. Background data are also needed from which it can be ascertained what branches of manufacturing activities will have to develop most intensively; what obstacles may impede their growth; what incentives can be offered; how much of the development in question will entail new investment and how much can be achieved through the more efficient utilization of existing installed capacity; to which specific projects priority may be assigned; and other similar considerations. Parts Two and Three of this study will be devoted to the study of such problems.

In the first place, an analysis of this kind must obviously be based on knowledge of existing industry, its general characteristics, its composition, its output capacity and the size and skill of the available labour force. This mainly descriptive approach is dealt with in chapters IV and V. Chapter VI evaluates the institutional framework within which industry is developing, so that consideration may be given to such aspects as the methods adopted for the financing of enterprises, including credit policy in relation to industry, and the competitive position of domestic industry *vis-à-vis* imports. With this background information it will be possible to undertake a more satisfactory study of industrial development, the expansion requirements and possibilities of specific branches of manufacturing activity and the conditions and incentives which may be necessary for their growth.

Chapter IV

MAIN STATISTICAL DATA ON INDUSTRY AS A WHOLE

It is no easy matter to condense into a few pages a description of existing industry at once sufficiently concise to disregard questions of secondary importance and sufficiently comprehensive to provide the background data necessary for a proper grasp of the industrial sector's degree of development and future prospects. Attention will therefore first be devoted to the statistical aspects relating to industry as a whole and these will be supplemented in the following chapter with a more detailed review of the special features of the main branches of manufacturing activity.

1. *Value of industrial production and the general characteristics of manufacturing establishments*

The industrial statistics available in Peru comprise data on about 3 000 establishments, employing rather more than 120 000 persons and with an output valued in 1955 at a little over 10 000 million soles. It is to this group of enterprises that the term "registered industry" is applied, a description which in itself implies the existence of an "unregistered industry", whose employment and productive activity are not covered by the aforesaid statistics. An attempt to evaluate the latter with the help of indirect background data leads to the conclusion that its significance is very far from negligible; the value of its production would seem to have reached some 6 000 million soles in 1955, while it provided work for more than 400 000 persons, the majority of whom were employed in mainly artisan activities. These two sectors of manufacturing industry display such widely differing features that it will be advisable to preserve a clear-cut distinction between them in the analysis. In the meanwhile, it is worth noting that, if "registered industry" and "unregistered and artisan industry" are taken as a whole, the total value of manufacturing output apparently just exceeded 16 000 million soles in 1955.

This last figure may seem very high in comparison with others relating to important aspects of the Peruvian economy, such as national income or imports. Its scope and significance must therefore be accurately defined. In the first place, it relates to the gross value of production, assessed at factory prices; hence it does not represent merely the value added by manufacturing, but also comprises the value of all the raw materials utilized, as well as payments of various kinds to other sectors of production. Secondly, the activities included under the head of manufacturing industry were selected on such broad bases that the value referred to includes that of several lines of production which are frequently classified under other sectors of economic activity. Specific exportable goods provide the most outstanding cases in point. Thus, for example, sugar, petroleum derivatives and ores that have undergone smelting or refining are taken as processed goods and therefore as products of manufacturing industry.[1]

The composition of the value of production by branches of industry, and the contribution made in each case by registered industry, on the one hand, and by unregistered and artisan industry, on the other, can be studied in greater detail in table 35. According to the estimates in that table, small-scale unregistered industry and artisan activities are preponderant in specific branches of manufacturing; this is true, for example, of the manufacture of footwear, of other wearing apparel and made-up textile goods, and of furniture, where the value of such production is three or four times as great as that of the output of registered industry. Even in the case of the various activities included under food manufacturing, the value of artisan production is higher than that of registered industry, and its relative importance is still considerable in such activities as the manufacture of leather goods, specific branches of the chemicals industry and the metal transforming industry.

Undeniably, the objective bases for the estimates relating to unregistered and artisan industry are not very sound.[2] Yet it seems to be quite evident that the relative importance of these forms of production is still very marked in Peru. The explanation may partly lie in the fact that, except for specific traditional branches such as certain foodstuffs and textiles industries, most manufacturing activities have only very recently developed production on a substantial scale. In this sense,

1 The classification criteria referred to are the same as those adopted by the United Nations Statistical Office in the *International Standard Industrial Classification of all Economic Activities*, Statistical Papers, series M, No. 4, Lake Success, N. Y., 31 October 1949.

2 The method adopted for these estimates was very similar to that described in annex II in connexion with the indices of the quantum of industrial production. In most instances, registered industry's input of specific raw materials was compared with Peru's total consumption of the materials concerned, on the assumption that the difference between the two constituted an approximate indication of the relative importance of unregistered and artisan industry. In particular cases this yardstick was supplemented or replaced by the indications obtained from data on the distribution of the active population and employment figures in registered industry.

Table 35

PERU: ESTIMATED TOTAL VALUE OF MANUFACTURING OUTPUT, 1955

(Values in thousands of soles)

Branch of industry	*Registered industry*	*Unregistered and artisan industry*	*Total*
Food	2 948 406	3 164 971	6 113 377
Beverages	494 954	88 380	583 334
Tobacco	152 952	—	152 952
Textiles	1 254 300	594 274	1 848 574
Footwear, other wearing apparel and made-up textile goods	299 407	901 824	1 201 231
Wood manufactures	140 884	60 580	201 464
Furniture and fixtures	51 016	204 064	255 080
Paper and paper products	159 938	—	159 938
Printing, publishing and allied industries	150 526	103 862	254 388
Leather and leather products	165 142	99 085	264 227
Rubber products	102 796	32 896	135 692
Chemicals and chemical products	444 870	186 070	630 940
Petroleum and coal products	949 257	—	949 257
Non-metallic mineral products	307 628	126 492	434 120
Basic metals	1 213 796	—	1 213 796
Metal transforming	399 324	383 120	782 444
Miscellaneous	856 412	—	856 412
Total	*10 091 608*	*5 945 618*	*16 037 226*

SOURCES: For registered industry: Ministry of Development and Public Works, Department of Industry and Electricity, specific adjustments of the official statistics being mainly due to differences in classification criteria. For unregistered and artisan industries: estimates.

small-scale and artisan industry used to serve a purpose which other more efficient forms of production could not fulfil, but their relative importance will doubtless tend to decrease as industry continues to grow at a rate similar to that recorded in 1945-55.

What may be described as industry proper—that is, registered industry—operates as a rule on a comparatively large scale, as is shown by the average number of persons employed per establishment, which in 1955 was 42, while the corresponding figure was much higher in specific branches (see table 36). The aggregate employment average presented in table 37 conceal very wide variations from one activity to another. For example, out of the 700 establishments registered under head of food manufacturing, 432 were bakeries, in which total employment fell below 4 300 persons, whereas no more than 21 sugar factories and refineries employed over 19 500 persons. Much the same was true of the textile industries, where 91 yarn and textile factories provided employment for almost 18 000 persons in all, while knitwear was produced in 114 establishments employing in the aggregate fewer than 3 800 persons.

Although the figures given in table 36 and the foregoing observations relate only to registered industry, they give some preliminary idea of the present structure of Peruvian industry and the degree of development of its main branches. In brief, of total employment in this sector more than half is accounted for by the three longest established lines of production,

Table 36

PERU: NUMBER AND SIZE OF ESTABLISHMENTS IN REGISTERED INDUSTRY, 1955

Branch of industry	*Number of establishments*	*Number of persons employed*	*Number of persons per establishment*
Food	700	39 772	57
Beverages	224	7 187	32
Tobacco	2	844	422
Textiles	224	23 233	104
Footwear, other wearing apparel and made-up textile goods	341	8 089	24
Wood manufactures	112	3 106	28
Furniture and fixtures	129	1 807	14
Paper and paper products	32	2 119	66
Printing, publishing and allied industries	163	3 602	22
Leather and leather products	63	2 423	38
Rubber products	12	794	66
Chemicals and chemical products	169	5 388	32
Petroleum and coal products	4	188	47
Non-metallic mineral products	121	7 574	63
Basic metals	27	2 721	101
Metal transforming	434	8 768	20
Miscellaneous	163	3 895	24
Total	*2 920*	*121 510*	*42*

that is, the foodstuffs, beverages and textiles industries.

The extent to which industrial activity is concentrated in those branches is corroborated if the value of production is considered instead of employment. In the three sectors mentioned, including this time small-scale and artisan industry, the gross value of production amounted to about 9 000 million soles in 1955, as against a total value of manufacturing output of 16 000 million; in contrast, the sum of the production of the chemicals and engineering industries totalled barely 1 400 million soles, or less than 10 per cent of the whole.

In any case, the concept in which the composition of industry is most satisfactorily reflected is that of the value added in each branch of activity, or, in other words, the gross value of production minus the value of inputs of raw materials. The relevant figures are shown in table 37 and make no substantial difference to the foregoing conclusion. They do, on the other hand, enable a stricter appraisal to be made of the relative importance of specific branches of industry in which the transforming process is very elementary and in which it is therefore the cost of raw material that determines the relatively high value of production (at sales prices). The most typical case in point is that of the metallurgical industries, which, in terms of the gross value of production, represent about 7.5 per cent of the total value of manufacturing output, whereas the value added amounts to barely more than 1 per cent of the total.

Relative importance of the foodstuffs industries also diminishes a little if this criterion is adopted, mainly because a low proportion of value added is contributed by some of the activities concerned, as, for instance, the manufacture of grain mill products. But this is offset by the consequent increase in the relative importance of the textiles and beverage industries, where the proportion of value added is higher than in manufacturing activity as a whole. All in all, the total relative importance of the three branches proves even greater than if it is assessed in terms of the gross value of production.

In terms of value added, a higher relative importance within the composition of manufacturing output is also acquired by other branches of industry such as the manufacture of machinery and equipment, non-metallic mineral products (cement; glass and glass products; pottery, china and earthenware), furniture, rubber products, etc.

In any case, what it is important to stress is the high degree to which Peruvian industry is at present concentrated in two or three branches, and the very limited contribution of other branches whose rate of growth will no doubt be much more intensive in the future.

In fact, between 1945 and 1956 fairly significant changes in this direction were already registered. While the quantum of aggregate manufacturing production doubled between the first and last years of this period, the main branches of industry developed with widely differing degrees of intensity. It was precisely in food manufacturing that one of the lowest rates of expansion was registered, despite the striking growth of the canning industry, which in real terms increased its production almost fourfold, whereas the increment recorded for the foodstuffs industries as a whole amounted to less than 80 per cent.

The textile industry expanded slightly less than the manufacturing sector as a whole, and a rate of growth fairly similar to that of industry in the aggregate was registered by the manufacture of footwear, other wearing apparel and made-up-textile goods, printing and

Table 37

PERU: COMPOSITION OF MANUFACTURING OUTPUT, BY BRANCHES OF INDUSTRY, 1955

(Values in thousands of soles)

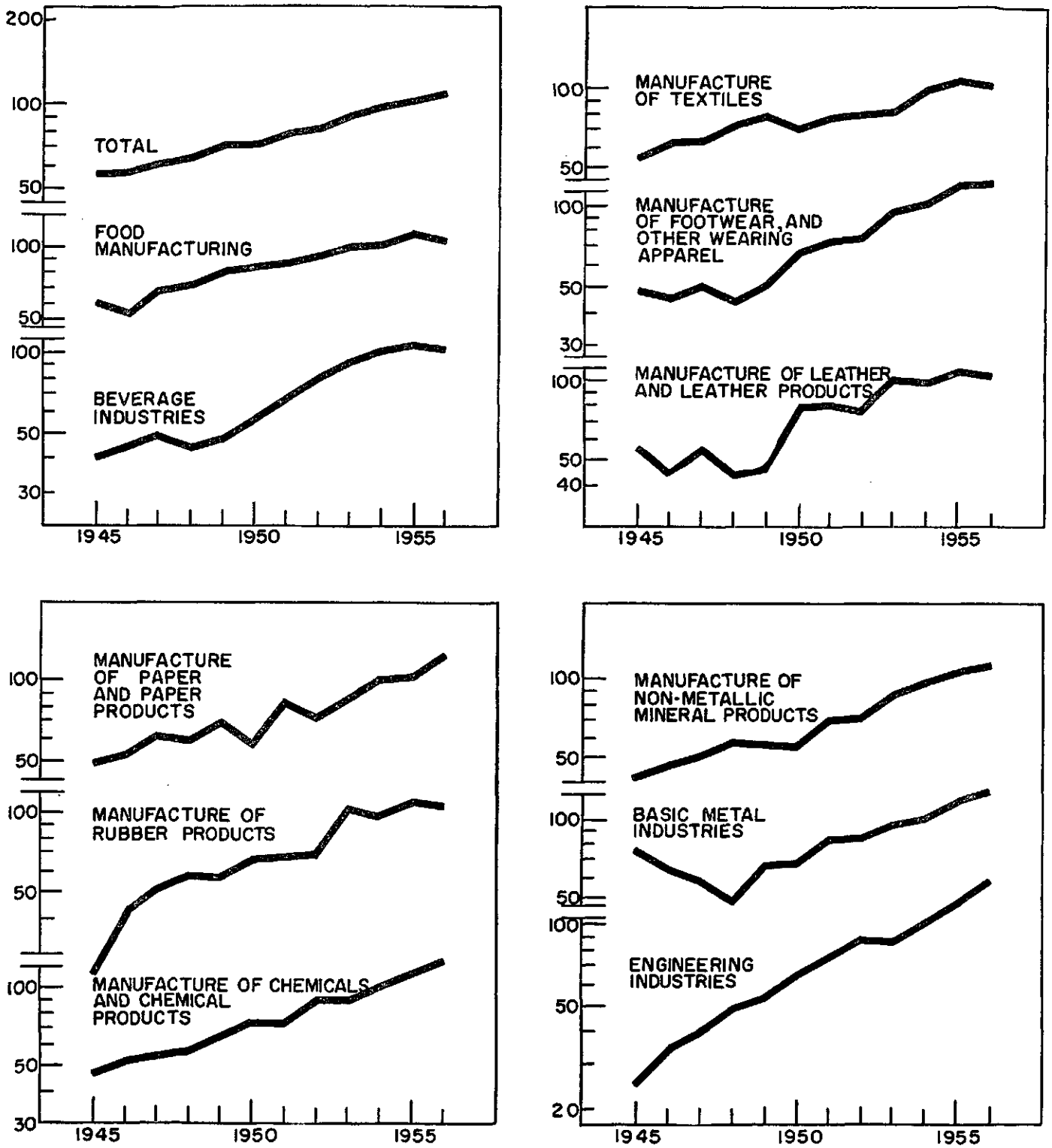
Branch of industry	*Gross value of production*	*Input of raw materials*	*Value added*	*Percentage composition*
Food	6 113 377	4 236 384	1 876 993	33.8
Beverages	583 334	247 121	336 213	6.1
Tobacco	152 952	24 353	128 599	2.3
Textiles	1 848 574	964 899	883,675	15.9
Footwear, other wearing apparel and made-up textile goods	1 201 231	721 565	479 666	8.6
Wood manufactures	201 464	137 815	63 649	1.1
Furniture and fixtures	255 080	107 585	147 495	2.7
Paper and paper products	159 938	103 653	56 285	1.0
Printing, publishing and allied industries	254 388	131 011	123 377	2.2
Leather and leather products	264 227	181 833	82 394	1.5
Rubber products	135 692	76 266	59 426	1.1
Chemicals and chemical products	630 940	338 794	292 146	5.3
Petroleum and coal products	949 257	784 368	164 889	3.0
Non-metallic mineral products	434 120	186 808	247 312	4.5
Basic metals	1 213 796	1 147 136	66 660	1.2
Metal transforming	782 444	342 260	440 184	7.9
Miscellaneous	856 412	753 791	102 621	1.8
Total	*16 037 226*	*10 485 642*	*5 551 584*	*100.0*

SOURCES: Basic statistics from the Ministry of Development and Public Works, Department of Industry and Electricity. For non-registered industry, the ratio between gross value of production and input of raw materials was assumed to be similar to that shown in the tabulations for registered industry.

Figure V

PERU: TRENDS IN THE QUANTUM OF INDUSTRIAL PRODUCTION, 1945–56
(Indices: 1954 = 100)

SEMI-LOGARITHMIC SCALE



publishing, leather manufactures and even the paper industry (see figure V, and annex II, table 32).

The development of the chemicals industry, although more rapid than that of the entire manufacturing sectors, was not relatively very intensive, especially if it is taken into account that during the period under review new lines of production were introduced; the manufacturing of synthetic fibres, for instance, began in 1947. The explanation is largely to be found in the slow growth of the oils and fats and soap and candles industries, which was partly offset by the much more rapid development of the manufacture of pharmaceutical preparations and paint. Much the same was true of the manufacture of non-metallic mineral products, where the marked expansion in the production of glass and glass products and of pottery, china and earthenware was to some extent counterbalanced by a more moderate increase in cement production.

In contrast, the metal transforming and rubber industries expanded very intensively between 1945 and 1956. The quantum of production of the former was six times greater in 1956 than in 1945, thanks to the fact that Peru began to produce numerous goods of which supplies had previously been obtained entirely from abroad.

Thus the present striking preponderance of the foodstuffs, beverage and textiles industries in manufacturing activity as a whole was even more marked in earlier years, so that in this sense there are already signs of a favourable trend towards diversification, which will undoubtedly be strengthened as a result of future industrial development requirements.

Another important question in relation to the composition of manufacturing output is that of its distribution by types of goods. The relevant figures are shown in table 38, where a distinction is drawn between consumer goods, intermediate products and capital goods. As will be noted, in 1955 the first of these made up almost two-thirds of the total value of industrial production, while the output of the last-named was negligible, accounting for under 5 per cent of the total value.

These data are clearly indicative of the pronounced tendency of Peruvian industry to concentrate its efforts on the production of consumer goods. There is nothing surprising about this, as the same process has characterized the early stages of industrialization in other Latin American countries. Various factors may be adduced as accounting for this preference. Usually, the capital intensity required is not as high in consumer goods industries as in those manufacturing capital goods and even some intermediate products; in many cases, too, the minimum scale for economic operation is smaller, and this is a point of vital importance when the market to be supplied is relatively narrow. Lastly, the demands of the production process in respect of technology and skilled personnel are also less exacting as a rule.

The consolidation of consumer goods industries is thus facilitated, while at the same time the difficulty of developing production of intermediate and capital goods increases. Once a certain stage of industrialization has been reached, however, a change is bound to set in, mainly owing to factors connected with demand. The income-elasticity of demand for many manufactures of this kind is relatively low, and this limits the possibilities of expansion, especially when the substitution of domestic production for imports of such goods has been carried far enough.

This does not seem to have been true of Peruvian industry during the last ten or twelve years, in the course of which the fairly rapid expansion registered

Table 38

PERU: COMPOSITION OF MANUFACTURING OUTPUT, BY TYPES OF GOODS, 1955

(Gross production values in thousands of soles)

Branch of industry	*Total*	*Consumer goods*	*Intermediate goods*	*Capital goods*
Food	6 113 377	678 424	5 434 953	—
Beverages	583 334	48 193	535 141	—
Tobacco	152 952	—	152 952	—
Textiles	1 848 574	548 890	1 299 684	—
Footwear, other wearing apparel and made-up textile goods	1 201 231	83 539	1 117 692	—
Wood manufactures	201 464	145 102	40 382	15 980
Furniture and fixtures	255 080	37 938	177 828	39 314
Paper and paper products	159 938	144 806	15 132	—
Printing, publishing and allied industries	254 388	89 896	162 555	1 937
Leather and leather products	264 227	248 592	15 476	159
Rubber products	135 692	33 133	1 853	100 706
Chemicals and chemical products	630 940	382 624	247 235	1 081
Petroleum and coal products	1 709 257	792 238	917 019	—
Non-metallic mineral products	434 120	108 963	63 478	261 679
Basic metals	1 213 796	1 210 054	—	3 742
Metal transforming	782 444	126 900	193 496	462 048
Miscellaneous	856 412	60 978	793 721	1 713
Total [a]	*16 797 226*	*4 740 270*	*11 168 597*	*888 359*

SOURCE: Estimates, partly based on the registered industry tabulations prepared by the Ministry of Development and Public Works, Department of Industry and Electricity.

a Including electric energy.

has not been accompanied by perceptible changes in the composition of industrial production by types of goods. For example, it can be deduced from the detailed figures shown in table 39 that in 1948 consumer goods represented almost 68 per cent of the total value of manufacturing output, and that in 1955 this proportion had only decreased to 66.5 per cent. Yet this does not mean that the stage at which such changes in composition will necessarily become more intensive is not close at hand or already reached. Although fairly considerable imports of manufactured consumer goods are still registered, there are manifest signs that the rate of expansion of the branches of industry concerned is slackening; what is more, between 1955 and 1956, while the quantum of industrial production as a whole increased by about 6 per cent, the indices for the foodstuffs, beverage, tobacco and textiles industries all showed a fairly significant downturn.[3] Thus, if the stagnation or slower growth of these industries is not offset by a much more rapid development of manufactured intermediate and capital goods, Peru's whole industrialization process will go into a decline.

Table 39

PERU: CHANGES IN COMPOSITION OF MANUFACTURING OUTPUT BY TYPES OF GOODS, 1948–55 [a]

(Gross production values in millions of soles at constant 1955 prices)

Year	Total Production	Intermediate goods	Consumer goods	Capital goods
1948	10 190	2 835	6 936	419
1949	11 163	3 236	7 484	443
1950	11 819	3 355	7 960	504
1951	12 563	3 641	8 357	565
1952	13 204	3 824	8 746	634
1953	14 546	4 130	9 712	704
1954	15 510	4 439	10 300	771
1955	16 797	4 740	11 169	888

SOURCE: Estimates based on official statistics.
a Including electric energy.

A superficial glance at the aggregate data gives the impression that manufactured intermediate goods are now being produced on quite a substantial scale; but it is worth while to study the relevant figures in greater detail (see again table 38). In this category, as may be noted, is included virtually the whole value of the production of the basic metal industries, whose activities have already been shown to consist almost entirely in the smelting and refining of metals for export. The category also includes a considerable proportion of the value of the output of petroleum and coal products, which, as in the preceding case, do not constitute typical intermediate manufactures. The exclusion of these two lines of production alone would reduce the total value of production of intermediate goods by one-half, and most of the remainder would consist of specific intermediate food manufactures —mainly grain mill products. In contrast, very little relative importance would attach to activities that are normally characterized by their wide intermediate sales, as are the manufacture of chemicals and chemical products and the basic metal industries themselves.

Lastly, the production of capital goods is confined to cement; a large variety of unimportant items produced by the engineering industries (a group which covers even repairs to motor-vehicles); the manufacture of inner tubes and tyres for lorries and public conveyances; and other lines of production of negligible significance.

In these circumstances, therefore, the trend registered since 1948 is unlikely to be maintained; on the contrary, it does not seem possible for industrial development to continue at a rapid rate without bringing about marked changes in the composition of manufacturing output, accompanied by a much more intensive expansion of the production of capital goods and intermediate manufactures. This in turn may call not only for greater effort in terms of the necessary investment, trained personnel and technology, but also for a change of direction in Government policy with respect to industry, so that the new lines of production may be afforded the incentives and protection they need. This last point will be more thoroughly discussed later.

Such, then, are the general features characterizing the manufacturing sector, with regard to the relative shares of industry proper and small-scale and artisan industry, and to its composition by branches of industry and types of goods, in so far as they can be deduced from the statistical data or estimates available.

2. *The role of domestic industry in supplying internal requirements of manufactured goods*

One way of forming a clearer idea of the present dimensions of industry and its future development prospects is to compare domestic production with the imports required to help meet the needs of Peru's home market. The relevant figures for 1955 are given in table 40.

As can be seen 13.8 per cent of the total value of manufacturing output—about 16 000 million soles—was earmarked for export, so that availabilities for the domestic market amounted to some 13 818 million soles. The c.i.f. value of imports of manufactured goods, excluding customs duties and all charges deriving from transport, distribution and internal marketing, was 5 215 million soles, equivalent, that is, to more than one-fourth of total domestic market requirements.

This over-all relationship between production and imports of manufactured goods might be regarded as of little significance, since in the last analysis it is dependent on the greater or lesser importance of the external sector in the economy as a whole, that is, on the aggregate import coefficient, but it clearly illustrates the role that industry must play in face of any con-

[3] See annex II, table 32.

traction or insufficient growth of the capacity to import; witness the fact that the proportion of total supplies of goods and services represented by imports, which in the case of manufactured goods exceeds 25 per cent, is not as much as 5 per cent in respect of non-manufactured goods taken in conjunction with services. To state this in more concrete terms, in 1955 total imports of goods amounted to a little over 5 700 million soles, so that imports of various kinds of manufactured goods represented more than 90 per cent of the total. It is here, therefore, that the most intensive import substitution processes must necessarily take place, although without neglecting the much more limited opportunities for substitution which are still open in other fields.

In chapter V a rather detailed study will be made of the specific lines of production in which the significance of imports is greatest, as well as the more or less immediate substitution possibilities that may exist in each case, in view of the current development of industry and the pertinent economic considerations. In the meantime, it is worth while to note in general terms the high proportion of domestic requirements supplied by imports in respect of two staple categories of goods. These are chemicals and chemical products, and the output of the basic metal and metal transforming industries. Such imports jointly totalled about 3 500 million soles in 1955, or 69 per cent of total imports of manufactured goods.

The first of these two categories comprises a wide range of products, including both intermediate goods used by industry itself and final consumer goods. Statistical data show that, in 1955, the contributions of domestic production and imports to total supplies of goods of this kind were decidedly similar, amounting to 611 million and 592 million soles respectively. In practice, however, dependency on imports is much greater than these figures indicate; a substantial proportion of the supplies attributed to domestic sources is in fact constituted by the value of production in activities such as the pharmaceutical industry, where inputs of imported raw materials are heavy. While this is a general problem inherent in any such comparison, in the specific case under consideration it becomes particularly important, because in some of the activities included in this sector, very elementary transforming processes applied to imported raw materials are predominant. In other words, the value of domestic production involves a high import content, and if this were deducted for purposes of comparison, the proportion of supplies attributable to domestic sources would be drastically reduced.

As regard the metal industries, a distinction should be drawn between the basic metal and the metal transforming industries. As was previously mentioned, the activities of the former group consist mainly in the refining and smelting of ores for export, so that although the value of their production is high, the surplus available for the domestic market constitutes barely a fraction of aggregate supplies; the volume of imports, on the other hand, is considerable, as they include virtually all metal products for construction, as well as wire, tubing, tinplate and other primary iron and steel products. The transforming industries, on the other hand, produce solely for the domestic market, but their relative importance in comparison with import requirements is very slight, not only quantitatively—they account for little more than one-fourth of total supplies—but also qualitatively, since they comprise the

Table 40

PERU: ESTIMATE OF TOTAL AVAILABILITIES OF MANUFACTURED GOODS, 1955

(Values in millions of soles)

Branch of industry	*Production* [a]	*Imports* [b]	*Exports* [c]	*Availabilities*
Food	6 113	458	816	5 755
Beverages	583	54	—	637
Tobacco	153	15	—	168
Textiles	1 848	294	3	2 139
Footwear, other wearing apparel and made-up textile goods	1 201	128	3	1 326
Wood manufactures	201	84	18	267
Furniture and fixtures	255	9	—	264
Paper and paper products	160	160	2	318
Printing, publishing and allied industries	254	8	—	262
Leather and leather products	264	15	6	273
Rubber products	136	48	—	184
Chemicals and chemical products	631	592	20	1 203
Petroleum and coal products	949	143	318	774
Non-metallic mineral products	434	124	2	556
Basic metals	1 214	302	1 014	502
Metal transforming	782	2 606	—	3 388
Miscellaneous	856	175	14	1 017
Total	*16 034*	*5 215*	*2 216*	*19 033*

SOURCE: Estimates based on the industrial tabulations prepared by the Ministry of Development, Department of Industry and Electricity and those given in the *Anuarios de comercio exterior*.

a Gross factory values of production.

b C.i.f. values.

c Estimated factory value of goods (f.o.b. value minus internal transport and marketing costs).

simplest manufactures and even mere repairs to machinery and motor-vehicles.

In another field, imports also represent a high proportion of domestic supplies in the case of paper and paper products (about 50 per cent), wood manufactures (30 per cent) and rubber products (a little over 25 per cent), as well as non-metallic mineral manufactures (slightly more than 22 per cent). On the other hand, their contribution is relatively very small in respect of processed foodstuffs, beverages, textiles and footwear, other wearing apparel and made-up textile goods. But even here it is quite substantial in absolute terms; in 1955 imports of goods in these last four groups amounted in the aggregate to about 934 million soles, i.e. they absorbed no less than 15 per cent of Peru's total capacity to import.

A very superficial glance at the relative figures suffices to show that in virtually all branches of industry there are still possibilities for import substitution which vary in their scope, but are particularly significant in the case of the chemicals, basic metal and metal transforming industries.

The intensity of industrial growth in recent years would seem to suggest that national production must have been gaining ground over imports in the domestic market, until the situation just described as existing in 1955 was reached. It is therefore somewhat surprising that the reverse was the case. The increase of almost 74 per cent registered between 1948 and 1955 in availabilities of manufactured goods including imports, was due to increments of almost 96 per cent in imports and only 67 per cent in domestic production (see table 41). This shows that during the period in question far from there being effective substitution of domestic production, the relative share of imports in supplies of manufactured goods for the internal market increased.

Table 41

PERU: AVAILABILITIES OF MANUFACTURED GOODS, 1948-55 [a]

(Values in millions of soles at constant 1955 prices)

Year	*Production*	*Imports*	*Exports*	*Availabilities*
1948	9 578	2 667	835	11 410
1949	10 530	2 968	1 062	12 436
1950	11 194	3 374	1 236	13 332
1951	11 871	5 060	1 462	15 469
1952	12 501	4 103	1 479	15 125
1953	13 831	4 414	1 446	16 799
1954	14 763	4 317	1 889	17 191
1955	16 034	5 215	2 216	19 033

a Gross factory values of production.

This conclusion is valid not only for total domestic production and imports of manufactured goods but also for each individual branch of industry, defined in accordance with the classification adopted (see tables 42 and 43). In each separate case, the increment in total availabilities was distributed in varying proportions between domestic production and imports, but in no instance was the absolute amount of the latter less in 1955 than it had been in 1948.

This comparison provides an objective criterion for judging how far the rate of industrial growth during the period under review may be considered satisfactory. Actually the rate of expansion of manufacturing output is not very important in itself, if it is unrelated to the over-all conditions prevailing in the economy concerned. Thus, however high it may appear to have been in Peru's case in comparison, for example, with that registered during the same interval in other Latin American countries, industry clearly did not succeed in taking full advantage of the possibilities offered by the expansion of the domestic market and internal conditions would unquestionably have justified a more

Table 42

PERU: EVOLUTION OF DOMESTIC SUPPLIES (PRODUCTION MINUS EXPORTS) OF MANUFACTURED GOODS, 1948-55 [a]

(Values in millions of soles at constant 1955 prices)

Branch of industry	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Food	3 852	4 139	4 378	4 345	4 487	5 173	4 887	5 297
Beverages	300	317	346	409	474	536	567	583
Tobacco	101	118	126	123	122	134	142	153
Textiles	1 388	1 482	1 287	1 347	1 395	1 469	1 786	1 845
Footwear, other wearing apparel and made-up textile goods	477	516	647	708	764	956	1 049	1 198
Wood manufactures	129	130	141	142	162	154	163	183
Furniture and fixtures	179	181	196	199	225	214	227	255
Paper and paper products	97	112	90	121	112	130	149	158
Printing, publishing and allied industries	107	167	146	184	167	182	217	254
Leather and leather products	103	110	179	186	182	238	238	258
Rubber products	71	73	83	86	88	129	127	136
Chemicals and chemical products	315	356	414	412	486	488	564	611
Products of petroleum and coal	488	527	605	652	722	782	755	631
Non-metallic mineral products	230	228	221	267	274	353	395	432
Basic metals	73	98	102	120	121	137	149	200
Metal transforming	316	349	414	476	573	576	652	782
Miscellaneous	517	565	583	632	668	734	807	842
Total	8 743	9 468	9 958	10 409	11 022	12 385	12 874	13 818

a Gross factory values of production.

Table 43

PERU: EVOLUTION OF IMPORTS OF MANUFACTURED GOODS, 1948-55

(C.i.f. values in millions of soles at constant 1955 prices)

Branch of industry	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*
Food	260	273	383	394	420	245	266	458
Beverages	16	20	29	37	39	46	51	54
Tobacco	13	3	6	5	6	9	13	15
Textiles	135	197	222	338	356	277	297	294
Footwear, other wearing apparel and made-up textile goods	93	55	44	70	104	124	66	128
Wood manufactures	67	80	60	79	86	75	58	84
Furniture and fixtures	9	9	9	9	27	18	9	9
Paper and paper products	51	86	107	117	108	78	126	160
Printing, publishing and allied industries	3	3	4	6	7	7	9	8
Leather and leather products	1	3	6	7	7	14	14	15
Rubber products	28	34	34	58	71	58	63	48
Chemicals and chemical products	330	302	380	483	482	501	548	592
Products of petroleum and coal	48	83	85	121	103	89	138	143
Non-metallic mineral products	50	58	51	103	116	119	105	124
Basic metals	194	250	241	373	382	321	334	302
Metal transforming	1 321	1 469	1 624	2 717	1 652	2 288	2 065	2 606
Miscellaneous	48	43	89	143	137	145	155	175
Total	2 667	2 968	3 374	5 060	4 103	4 414	4 317	5 215

intensive rate of growth. While it might be argued that events took this turn owing to the striking increase in the capacity to import, it must also be remembered that imports expanded faster than exports, and that even in very favourable conditions the composition of imports was not substantially altered in directions calculated to ensure the future maintenance of a high rate of over-all economic development.

3. *Area distribution of industrial production*

The marked tendency of Peruvian industry towards concentration in what is known as the "Lima-Callao zone" to the detriment of industrial development in other parts of the country is common knowledge.

Undoubtedly there are at present many factors justifiying this preference. It is in the Lima-Callao zone that a major share of the purchasing power of the population is concentrated, as well as the benefits of all those external economies which characterize a centre where industrial development has already taken place on a fairly considerable scale. Greater facilities are also available there as regards supplies of imported raw materials and intermediate products, and at the same time it is an excellent locality for industries which aspire to some share in foreign markets. Lastly, access to the official and credit institutions connected with industry is easier and contact with them can be more conveniently maintained.

The aggregate statistics on registered industry do not, however, show as marked a concentration as might have been expected. In fact, according to the data presented in table 44, industries outside the Lima-Callo zone would seem to have accounted for about one-fourth of the total number of establishments in 1955, more than one-third of employment and over 40 per cent of the total value of manufacturing output. Some other considerations may help to clarify the real significance of these figures.

In the first place, a more detailed study by branches of industry reveals that most of the value of manufacturing production outside Lima-Callao is represented by the foodstuffs, petroleum derivatives and basic metal industries, namely, sugar refineries, petroleum refineries and foundries and ore refineries whose site is primarily determined by the nearness of the raw materials. Thus they are not typical transforming industries, but rather represent an extension of the production processes of agriculture in one case and of the extractive industries in the rest. By contrast, if these activities were excluded, the value of production in such areas would represent less than 20 per cent of the corresponding figure for establishments situated in the Lima-Callao zone, with the same exceptions, and would attain some degree of significance only in the case of the beverage, textiles, wood and leather industries. In contrast, it is very likely that a much larger proportion of small-scale and artisan industry —not covered by the statistics under consideration— is carried on outside Lima-Callao. It should also be noted that certain projects formulated and executed in recent years imply a more widespread geographical distribution of industrial production capacity; this applies especially to the cement industry.

The whole problem of the site of manufacturing activities is difficult to discuss in general terms. On the one hand, the concentration of industry is often conducive to economies of scale and increased productivity; on the other, the need for fuller economic integration, opening up possibilities of more balanced development in the various parts of the country, cannot be overlooked. The very intensity with which industrialization will have to progress in the future—in conformity with the hypotheses and projections presented in Part One of this study—may call for maxi-

Table 44

PERU: AREA DISTRIBUTION OF REGISTERED INDUSTRY, 1955

Branch of industry	Number of establishments			Number of persons employed			Value of production (Millions of soles)		
	Total	Lima-Callao	Other areas	Total	Lima-Callao	Other areas	Total	Lima-Callao	Other areas
Food	700	494	206	39 772	16 241	23 531	2 948	1 687	1 261
Beverages	224	101	123	7 187	3 441	3 746	495	367	128
Tobacco	2	1	1	844	804	40	153	147	6
Textiles	224	186	40	23 223	17 561	6 058	1 254	1 025	229
Footwear, other wearing apparel and made-up textile goods	341	295	46	8 089	7 640	449	299	288	11
Wood manufactures	112	76	36	3 106	1 721	1 385	141	99	42
Furniture and fixtures	129	113	16	1 807	1 620	187	51	45	6
Paper and paper products	32	30	2	2 119	1 858	261	160	152	8
Printing, publishing and allied industries	163	135	28	3 602	3 300	302	151	145	6
Leather and leather products	63	42	21	2 423	1 146	1 277	165	112	53
Rubber products	12	11	1	794	791	3	103	103	—
Chemicals and chemical products	169	137	30	5 388	4 619	383	445	418	27
Products of petroleum and coal	4	1	3	188	4	184	949	25	924
Non-metallic mineral products	121	96	25	7 574	7 283	291	308	304	4
Basic metals	27	17	10	2 721	706	2 015	1 214	62	1 152
Metal transforming	434	394	40	8 768	8 016	752	399	379	20
Miscellaneous	163	132	31	3 895	3 001	894	856	334	522
Total	*2 920*	*2 261*	*659*	*121 510*	*79 752*	*41 758*	*10 091*	*5 692*	*4 399*

SOURCE: Basic statistics from the Department of Industry and Electricity, Ministry of Development and Public Works, with some adjustments mainly owing to differences in the classification of industries.

mum investigation and utilization of the best opportunities for the development of manufacturing in each area, with due regard to availabilities of appropriate raw materials and manpower resources, as well as to the size and the expansion prospects of local markets and the undertakings that might be encouraged with a view to increasing supplies for domestic consumption or for export. More specific mention will later be made of particular projects or activities which might serve this end.

4. *Number of persons employed in industry*

In Part One of the present study [4] aggregate statistics were given on employment in the manufacturing sector as a whole. Briefly, the relevant estimates suggest that in 1955 registered industry provided employment for a little over 120 000 persons, while the active population employed in unregistered and artisan industry amounted to over 495 000 persons. The marked difference in productivity between these two sectors of manufacturing is evidenced by the fact that in the former the annual gross product per active person was approximately 28 000 soles, whereas in the latter it barely exceeded 4 000 soles. The high relative importance of small-scale and artisan industry from the standpoint of employment was in turn one of the reasons why average productivity in total manufacturing industry was barely higher than the average for the economy as a whole.

Consideration has already been given to the role that would be incumbent upon industry in the future, as one of the sectors that would have to do most to provide employment opportunities for the large increment in the labour force that will be registered during the coming decade. The time has now come to deal more fully with the salient aspects of employment in industry. The discussion will have to be confined, however, to the personnel employed in registered industry, in view of the lack of sufficiently detailed statistical data on the unregistered and artisan sector.

Table 45 gives, in the first place, a break-down of employment in registered industry by various types of activity. Here again it is patent that industry is concentrated to a high degree in the manufacture of processed foodstuffs, beverages and textiles, branches which in the aggregate account for more than half the total number of persons employed in this sector. A comparison of these employment data with the figures for value added shows that differences in productivity are to be found not only as between unregistered and artisan industry on the one hand and registered industry on the other, but also—although the proportion is less—from one branch of registered industry to another.

If the very special case of the petroleum refining industries is disregarded, the highest figures for the value added per active person are registered in the beverage and rubber industries, followed by the manufacture of chemicals; in contrast, those recorded for the manufacture of footwear, other wearing apparel and made-up textile goods, wood products and furniture, are relatively very low. These disparities, as well as others included in table 45, are primarily related to the average size of the establishments and the varying degrees of mechanization and capital intensity characterizing the activities in question. Up to a point, therefore,

[4] Chapter I, section 2, (a).

Table 45

PERU: PRODUCTIVITY AND REMUNERATION OF PERSONNEL EMPLOYED IN REGISTERED INDUSTRY, 1955 [a]

Branch of industry	*Number of persons employed*	*Value added*	*Total remuneration*	Per capita *value added*	*Average* per capita *remuneration*
		(Thousands of soles)		*(Soles)*	
Food	39 772	1 038 841	255 974	26 120	6 436
Beverages	7 187	292 439	72 455	40 690	10 081
Textiles [b]	23 619	617 119	267 685	26 128	11 333
Footwear, other wearing apparel and made-up textile goods	8 089	120 155	62 477	14 854	7 724
Wood manufactures	3 106	44 510	25 008	14 330	8 052
Furniture and fixtures	1 807	29 499	14 956	16 325	8 277
Paper and paper products	2 119	56 285	17 816	26 562	8 408
Printing, publishing and allied industries	3 602	73 004	47 239	20 268	13 115
Leather and leather products	2 423	51 496	20 598	21 253	8 501
Rubber products	794	45 018	12 070	56 698	15 202
Chemicals and chemical products [b]	5 002	169 244	53 984	33 835	10 792
Products of petroleum and coal	188	164 889	2 523	877 069	13 420
Non-metallic mineral products	7 574	173 764	78 029	22 942	10 302
Basic metals [b]	2 721	73 142	37 368	26 881	13 733
Metal transforming [b]	8 768	216 851	86 057	24 732	9 815
Miscellaneous	3 895	102 620	34 660	26 347	8 899
Total	120 666	3 268 876	1 088 899	(27 090)	(9 024)

SOURCE: Basic statistics from the tabulations prepared by the Ministry of Development and Public Works, Department of Industry and Electricity.

a Excluding tobacco manufacturers.

b Since, in this and the following table, it was not possible to reclassify the rayon industry (because this would mean entering the field of chemicals) nor the welded tube industry (because this would mean entering the metal transforming field), the composition of these branches of industry differs slightly from that in other tables.

they are normal enough at the stage of industrial development through which Peru is at present passing, although they may probably tend to become less marked in the future, as an over-all improvement on current levels of productivity is gradually achieved.

Greater uniformity exists among the several branches of industry as regards average remunerations per employed person, although the differences between, for example, the foodstuffs industries on the one hand and the rubber or basic metal industries on the other are by no means insignificant. Moreover, it is important to stress the fact that in industry as a whole remunerations represent a relatively small fraction of the value added—less than one-third in 1955. This proportion varies considerably from one branch of industry to another, but is exceeded only in those where the lowest levels of productivity are registered.

Another point of undoubted importance in relation to employment in industry is the training and qualifications of the personnel employed. Indeed, this problem is not unconnected with that of the level of productivity just mentioned. Furthermore, it acquires special importance in view of the needs of future development, in the course of which not only will an attempt be made to absorb an increasing volume of manpower, but a considerable proportion of this latter will also have to be constituted by trained personnel and technicians at the various levels.

Despite the importance of the problem, the background data available are too fragmentary for any fairly accurate conclusions to be reached. One aspect only is touched upon in table 46 which presents a break-down of the personnel employed in registered industry in 1955, by professionals and technicians on the one hand, employees and manual workers on the other.[5] Professionals and technicians will be seen to account for barely 2 per cent of total employment; in absolute terms, the number of persons concerned —2 736—was even smaller than the number of establishments, so that an average of less than one professional or technician per establishment was recorded.

The distribution of this employment category among the various sectors of industry was also very uneven. It is worth mentioning in this connexion that the three branches constituted by the chemicals, basic metal and metal transforming industries accounted for 14 per cent of total employment and over 35 per cent of the total number of professionals and technicians. The existence of this larger proportion of technical personnel in the same three activities which will tend to expand more intensively, as was pointed out in earlier chapters, means that it is more important to give due consideration to vocational training questions if the lack of properly trained manpower is not to become one of the most serious obstacles to future industrial development.

Yet this is only one part of the problem, as the statistical data referred to provide no information on the degree of skill and training of manual workers employed in registered industry. In this connexion, Peru has been endeavouring to improve the position, at least since 1945, and mainly through the industrial schools. To judge from a recent study,[6] however, the

[5] In chapter V, in which the principal characteristics of each of the main branches of industry will be discussed, more detailed background data on specific industries or groups of industries will be given.

[6] Fernando Romero, *La industria registrada del Perú y sus obreros calificados, 1955–65. (Análisis e interpretación de sus necesidades y forma de satisfacerlas)* [*Registered industry and skilled labour in Peru.*

Table 46

PERU: BREAK-DOWN BY QUALIFICATIONS OF PERSONNEL EMPLOYED IN REGISTERED INDUSTRY, 1955
(Number of persons)

Branch of industry	*Total*	*Professionals and technicians*	*Employees*	*Manual workers*
Food	39 772	519	3 573	35 680
Beverages	7 187	178	1 243	5 766
Tobacco	844	3	156	685
Textiles [a]	23 619	575	2 286	20 758
Footwear, other wearing apparel and made-up textile goods	8 089	143	1 316	6 630
Wood manufactures	3 106	60	558	2 488
Furniture and fixtures	1 807	42	219	1 546
Paper and paper products	2 119	82	287	1 750
Printing, publishing and allied industries	3 602	49	1 136	2 417
Leather and leather products	2 423	62	392	1 969
Rubber products	794	21	143	630
Chemicals and chemical products [a]	5 002	228	1 415	3 359
Products of petroleum and coal	188	11	8	169
Non-metallic minerals products	7 574	137	684	6 753
Basic metals [a]	2 721	163	122	2 436
Metal transforming [a]	8 768	381	1 358	7 029
Miscellaneous	3 895	82	562	3 251
Total	*121 510*	*2 736*	*15 458*	*103 316*

SOURCE: Ministry of Development and Public Works, Department of Industry and Electricity.
a Since, in this and the preceding table, it was not possible to reclassify the rayon industry (because this would mean entering the field of chemicals) nor the welded tube industry (because this would mean entering the metal transforming field), the composition of these branches of industry differs slightly from that in other tables.

effort made is still far from intensive enough to meet the requirements of industrial development in present conditions. In fact, the number of pupils leaving State technical schools totalled only 547 by 1956 and 4 394 throughout the period 1945-54. The same study explains that, if the present rate of training is not accelerated, the total number of graduates of industrial schools which would be absorbed by manufacturing activities during the period 1955-65 would reach 5 474 persons and that this would imply a skilled labour deficit.

Besides calling attention to the smallness of the financial resources at present allocated for this purpose and the necessity of increasing them, the study also stresses the lack of contact between educationists and industry, as a result of which the special skills taught are completely divorced from industry's real requirements (it is shown, for example, that in some important fields there are hardly any students at all, whereas in others the number of pupils exceeds the total number of workers currently in service in the particular line concerned). In brief, the need to launch a comprehensive training programme, in which industry itself would participate as fully as possible and advantage would be taken of the experience acquired in this field by other Latin American countries, especially Argentina, Brazil, and Colombia, is urgent.

5. *Capital resources available to industry*

The study of the capital at the disposal of industry —whether in the form of machinery and production equipment or in that of sites, buildings and circulating capital—is of particular importance for an examination of the salient features of the manufacturing sector. In the first place, a comparison of the capital resources accumulated with the production obtained therefrom —quantified, for example, by means of the product-capital ratio [7]—will provide a first clue to the intensity with which existing production capacity is utilized, and, consequently, to the benefit that is being derived from previous investment effort. The fluctuations in this ratio in their turn provide a useful instrument for measuring how far the expansion of production has been accompanied by a parallel increase in output capacity; in other words, whether it has been based on the more intensive utilization of resources already available, or whether, on the contrary, new reserves of capacity susceptible of more efficient utilization in the future have been created. The same indicators constitute a valuable means of assessing how far the investment effort on which subsequent development must be based will need to be relatively more or less intensive than in the past. Lastly, by means of estimates of the stock of capital, depreciation requirements can be evaluated, and as a result, consideration can be given to what extent current investment is capable of covering such requirements and at the same time of increasing output capacity in real terms.

The statistical measurement of this concept is a difficult matter. One of the scanty sources of information

1955–65. (Analysis and interpretation of its requirements and how to meet them)], unpublished study, April 1958.

[7] This concept can be defined in at least four ways, according to whether the gross value of production or the value added is taken into account, and whether only fixed capital or the whole of the capital at industry's disposal is allowed for. It is important to bear these alternatives in mind when such ratios are compared with those registered in other countries.

Table 47

PERU: BOOK VALUE OF CAPITAL AND PURCHASE OF MACHINERY IN REGISTERED INDUSTRY, 1955

(Values in thousands of soles)

Branch of industry	*Invested capital as at 31 December 1955*	*Purchases of machinery during 1955*
Food	1 436 096	64 364
Beverages	411 691	10 238
Textiles	809 877	51 944
Footwear, other wearing apparel and made-up textile goods	96 556	2 920
Wood manufactures	62 459	3 834
Furniture and fixtures	12 728	1 137
Paper and paper products	80 632	9 915
Printing, publishing and allied industries	52 809	8 203
Leather and leather products	70 641	3 777
Rubber products	24 742	1 559
Chemicals and chemical products	209 540	5 269
Petroleum and coal products [a]	6 520	...
Non-metallic mineral products	424 169	9 068
Basic metals	26 701	12 540
Metal transforming	239 679	18 512
Miscellaneous	262 991	2 305
Total [b]	*4 227 831*	*205 585*

SOURCE: Ministry of Development and Public Works, Department of Industry and Electricity.

a Presumably excluding petroleum refineries and including only the various relatively small establishments engaged in the manufacture of coal products.

b Excluding tobacco manufactures.

available on Peruvian industry is provided by the book values of the capital at the disposal of registered industry. The inadequacy of such data for the precise purposes of the study of this problem goes without saying; suffice it to mention that, broadly speaking, these figures stand for capital values at purchase cost in various periods, without the appropriate revaluation to bring them into line with current price levels, and that they are depreciated on the basis of financial criteria which often fail to represent a real depreciation concept. In short, they greatly under-estimate the effective amount of the existing stock of capital. Even so, it is worth while to glance briefly at some of the conclusions to be drawn from the figures in question (see table 47).

With the exceptions noted in the table, the capital invested in registered industry as at 31 December 1955 would seem to have amounted to a little over 4 200 million soles. If this aggregate amount is related to the gross value of industrial production (about 7 000 million soles, with the same exceptions) or the value added (about 3 000 million soles), extremely favourable ratios will result. Their significance is slight in view of the unquestionable under-estimating of capital just mentioned; on the other hand, even if this reservation is ignored, a comparison of such accumulated investment with the value of the machinery purchased during 1955 does shed a great deal of light on the question. As can be seen, the latter represented barely 5 per cent of the total capital invested, which—if the heavier investment in sites, buildings and other installations, and in circulating capital is disregarded—indicates a relatively low investment coefficient. Unless this were exceeded, it would probably be impossible to ensure an expansion of production capacity on the scale envisaged in the hypothetical projections presented in Part One of this study.

Another important point emerging from the data referred to—subject, of course, to the reservation that they relate only to one specific year—is that there are no signs of a trend towards the diversification of output capacity with a view to strengthening underdeveloped lines of production. In fact, out of the total capital invested as at 31 December 1955, nearly 63 per cent corresponded to the foodstuffs, textiles and beverage industries, which also accounted for an almost equal proportion (a little over 60 per cent) of total purchases of machinery in that year. Although an improvement was observable, for example, in the metal transforming industries, where 5.7 per cent of the accumulated capital and 9 per cent of 1955 investment was to be found, this was offset by regressions in other branches at a similar stage of development, such as the chemicals industries, in which, although they accounted for 5 per cent of the capital, purchases represented only 2.5 per cent. This apparent stagnation in the composition of investment by branches of industry may constitute one of the obstacles to future industrial development, which would require a greater diversification of resources in order to enable output capacity to adapt itself gradually to the changing composition of demand for manufactured goods and other needs deriving from over-all economic growth (including, for example, import substitution requirements).

An attempt at more direct evaluation of the existing stock of capital (defined in terms of depreciated capital and at replacement cost), less likely to err in the direction of under-estimation than the book values, remains to be considered. The calculation concerned was based on imports of machinery and equipment for industry, valued at constant 1955 prices, and accumulated over a long period (from 1925 to 1955). An estimated aggregate real depreciation rate was applied. Lastly, to the c.i.f. value of imported machinery calculated in this way, a 50-per-cent surcharge was added; it was estimated that this percentage would cover tariff duties, customs clearing dues, internal transport and installation costs.

The conclusion reached by this method was that industry's total stock of capital in terms of machinery and equipment amounted to about 10 800 million soles in 1955. This figure is not directly comparable with those previously cited, not only because the latter were underestimated but also because the new calculation takes into account capital in industry and artisan activities as a whole instead of in registered industry alone, as was the case with the earlier data.

If investment in sites and buildings is added to the above-mentioned estimate, which comprises solely ma-

chinery and production equipment, total fixed capital may be estimated at about 13 000 million soles [8] (see table 48). It was precisely this figure which was mentioned in Part One of this study in connexion with investment and output capacity in the economy as a whole.[9] As will be recalled, according to this estimate the product-capital ratio for industry in the aggregate would seem to have been 0.41 in 1955—a very favourable level, in view of the fact that it exceeds the figure registered in that year for the Peruvian economy as a whole (0.40). In the same context, mention was made of the possibility that this relatively high product-capital ratio might suggest that industry had achieved an intensive utilization of its installed capacity; but data on the degree of utilization of installed capacity in the main branches of manufacturing did not bear out this supposition, as will be discussed in greater detail in the following chapter. The conclusion reached was that the factors possibly accounting for so favourable a ratio were the high proportion of the sector represented by small-scale and artisan industry (where the stock of capital stood at minimum levels) and the present composition of industry, in which the branches calling for lower capital intensity were predominant.

There is no need to stress the great importance of utilizing available capital resources as efficiently as possible. One of the problems which is most frequently held to limit the possibilities of a faster rate of growth is precisely that relating to the shortage of investment resources, in terms both of internal saving and of imports of machinery and production equipment. It is therefore surprising that notwithstanding these difficulties a high proportion of idle capacity is registered; and in this respect Peruvian industry is by no means an exception in Latin America. The laying-off of work shifts, and even the failure to make full use of equipment while the shifts are on duty, are common characteristics of industry, which are not always justified by the lack of markets, as is evidenced by the fact that, in many industries registering idle capacity, additional investment for expansion purposes continues to be effected. The want of a properly developed capital market, and the consequent difficulty of diverting reinvested profits into activities other than the line of production from which they originated, the lack of technical personnel and skilled workers to cover additional shifts, the difficulties currently attendant on night work, etc., are factors which undoubtedly hamper the more intensive utilization of the capital resources that industry has already accumulated.

It must be recognized that a considerable improvement has taken place in this respect over the last ten years, during which the expansion of production has been much more intensive than that of production capacity (see the comparison of the relevant series in figure VI). Thus, the product-capital ratio in industry gradually rose from a level of only 0.33 in 1945 to the above-mentioned figure of 0.41 in 1955. In other words, a major proportion of the increment in industrial production registered during that period derived from the more efficient utilization of the capital already at industry's disposal, apart from the share directly atributable to investment in the expansion of industrial capacity.

Unfortunately, it proved impossible to prepare estimates of the distribution of capital by branches of industry, which would have enabled more careful study to be given to specific aspects of the problem. In any event, it may safely be stated that the industries whose future growth will probably be most intensive—for example, the chemicals and metal transforming industries—are also, as a rule, those that call for a re-

[8] The evaluation of investment in sites and buildings was based on the study of data for a relatively comprehensive sample of interprises. An average relationship was thence deduced, according to which sites and buildings represented about 20 per cent of the value of machinery and equipment. In the same sample, the value of circulating capital was equivalent to one-third of fixed capital.

[9] Chapter I, 3.

Table 48

PERU: ESTIMATES OF CAPITAL AT THE DISPOSAL OF THE MANUFACTURING INDUSTRY, 1945-55

(Thousands of soles at constant 1955 prices)

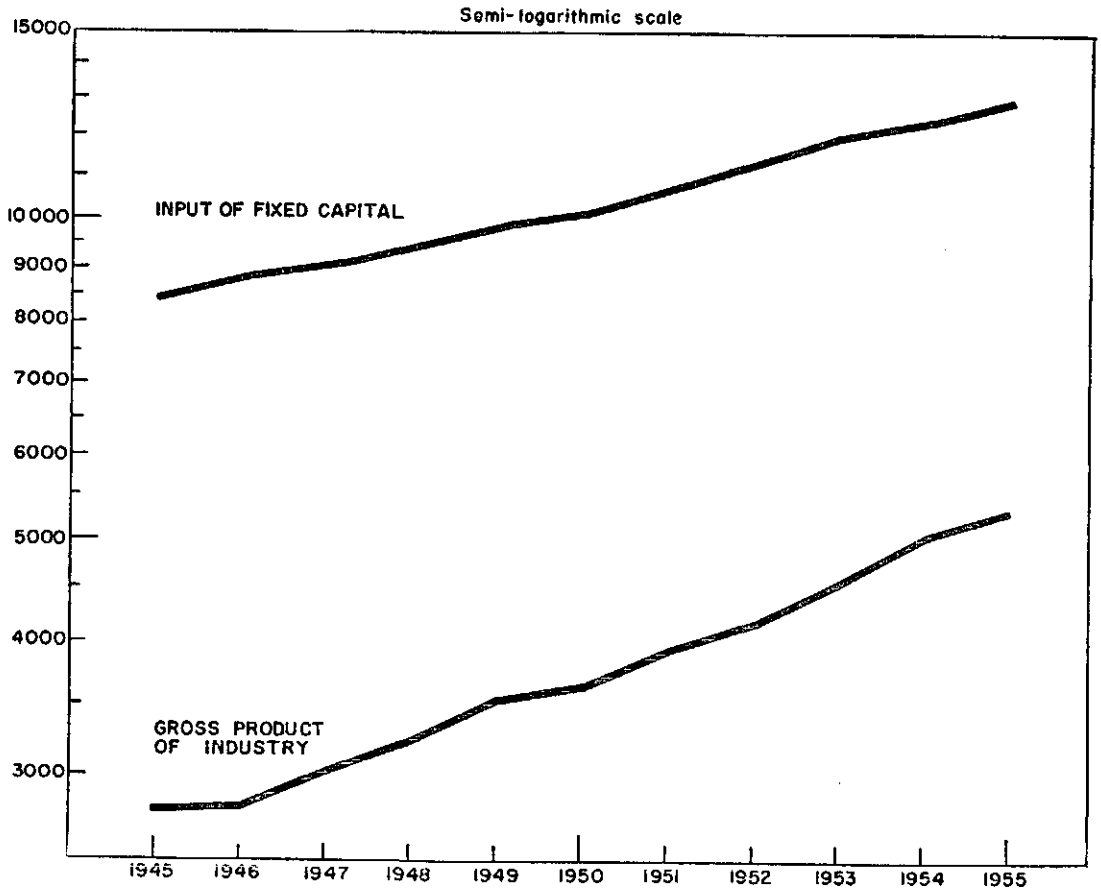
Year	Annual imports [a]	Depreciation [b]	Net investment [c]	Cumulative c.i.f. values of imports [d]	Total fixed capital [e]
1945	246 965	137 361	109 604	4 688 299	8 439 000
1946	335 673	140 649	195 024	4 883 323	8 790 000
1947	271 279	146 499	124 780	5 008 103	9 015 000
1948	398 951	150 243	248 708	5 256 811	9 462 000
1949	389 285	157 704	231 581	5 488 392	9 879 000
1950	325 749	164 652	161 097	5 649 489	10 169 000
1951	441 663	169 485	272 178	5 921 667	10 659 000
1952	480 872	177 650	303 222	6 224 889	11 205 000
1953	581 067	186 747	394 320	6 619 209	11 915 000
1954	468 102	198 576	269 526	6 888 735	12 400 000
1955	508 046	206 662	301 388	7 190 123	12 942 000

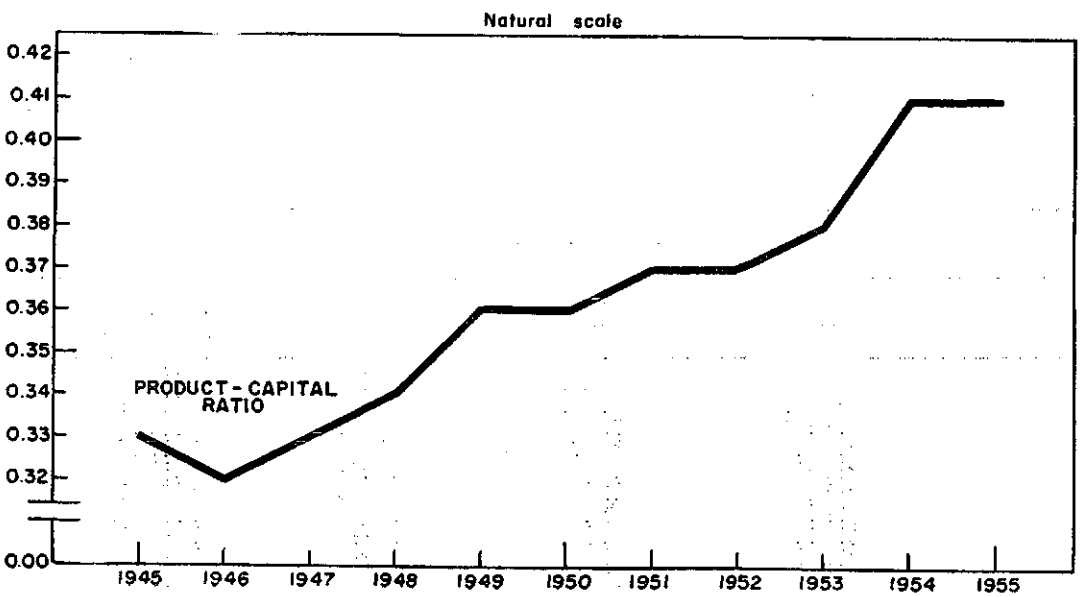
a Sum of all annual imports of machinery, equipment and spare parts for industry, valued at 1955 unit prices.
b Estimated at 3 per cent of the cumulative value of imports of industrial machinery.
c Difference between annual imports and depreciation.
d To construct the series, the 1955 value was first estimated on the basis of accumulation and depreciation of imports as from 1925; thence the figures for 1945-54 were deduced, net investment in each period being taken into account.
e Estimated on the basis of the cumulative c.i.f. value in imports, increased first by 50 per cent to make allowance for all installation expenditure and then by 20 per cent to cover additional investment in sites and buildings.

Figure VI

PERU: FLUCTUATIONS IN INDUSTRIAL PRODUCTION AND PRODUCTION CAPACITY, 1945–55

(Values in millions of soles at constant 1955 prices)





latively greater capital intensity. This fact alone would tend in the future to exert a depressive influence on the product-capital ratio unless a steady parallel improvement were achieved in the utilization of the existing stock of capital in other branches of industry.

On the behaviour of these two opposing factors—the extent to which industry is diversified by the incorporation of new activities with greater capital intensity, and subsequent improvements in the utilization of the equipment already available—the future evolution of the product-capital ratio in industry will therefore depend. This in turn will help to determine whether, in order to meet future development needs, the manufacturing sector's investment effort will have to be proportionally higher or lower than in 1945-55.

6. *Domestically-produced and imported raw materials and intermediate products*

Peruvian industry is based on a wide range of internal resources which can be drawn upon for the raw materials and intermediate products that are most essential in the production processes concerned. These include a great variety of agricultural resources, an extractive industry which is already fairly well developed and which covers a comprehensive selection of commodities, and plentiful availabilities of different kinds of fuels, etc. Hence the basis for industrial development is very sound from the standpoint of the capacity to import, since there is no reason why fluctuations in this capacity should affect domestic production of manufactured goods as severely as is the case in many other Latin American countries.

Table 49 gives a break-down, by domestic production and imports, of inputs of raw materials and intermediate products in industry as a whole and in its main branches during 1955. Not more than 15 per cent of total requirements of this kind was purchased abroad, and in practically all branches of industry direct information indicated a higher proportion of domestic than of imported raw materials.

It is worth while to compare this situation with that registered in other countries. In Colombian industry, for example, in 1953, more than 20 per cent of total requirements of raw materials and intermediate products was imported,[10] and this ratio would rise to 37 per cent if the foodstuffs industries were excluded.[11] The problem is certainly still more acute in the case of Chilean industry, which is entirely dependent upon imports for supplies of such essential raw materials as sugar, cotton and specific chemicals.

Nevertheless, for a more accurate evaluation of the statistics given at least two points must be borne in mind. The first relates to the fact that statistical comparisons reflect the position only as to direct, not as to indirect, dependence on imported raw materials and intermediate products; and it must be remembered that in the domestic manufacture of numerous intermediate goods which are regarded as domestically-produced raw material by the industry utilizing them, certain inputs which have to be purchased abroad may be of an importance so decisive that it extends beyond the line of production immediately concerned and affects even those industries that are the final buyers.[12]

Secondly, the comparisons referred to relate to a particular stage of Peru's industrial development, during which requirements of specific imported intermediate manufactures are not yet very intensive. It is particularly important to point out in this connexion that the chemicals and metal transforming industries have as yet reached only a very early stage of development. Inputs of imported raw materials in the former, even with their present composition, represented over 40 per cent of total requirements in 1955, and this proportion would undoubtedly be much higher if some of the traditional lines of production (soap and candles, for example) were excluded and certain new activities with a more rapid rate of growth—the manufacture of synthetic fibres and of most pharmaceutical

Table 49

PERU: INPUTS OF RAW MATERIALS AND INTERMEDIATE PRODUCTS IN REGISTERED INDUSTRY, 1955

(Values in millions of soles)

Branch of industry	*Total consumption*	*Domestic production*	*Imports*
Food	4 237	3 524	713
Beverages	247	191	56
Tobacco	25	18	7
Textiles	964	870	94
Footwear, other wearing apparel and made-up textile goods	722	638	84
Wood manufactures	138	113	25
Furniture and fixtures	108	81	27
Paper and papers products	104	78	26
Printing, publishing and allied industries	131	62	69
Leather and leather products	182	151	31
Rubber products	76	67	9
Chemicals and chemical products	338	204	134
Products of petroleum and coal [a]	864	832	32
Non-metallic mineral products	187	169	18
Basic metals	1 147	1 121	26
Metal transforming	342	188	154
Miscellaneous	754	746	8
Total [a]	*10 566*	*9 053*	*1 513*

[a] Including electricity.

10 See *Analysis and projections of economic development. III. The economic development of Colombia.* (E/CN.12/365/Rev.1), United Nations publication, Sales No.: 1957.II.G.3, table 235.

11 In the case of Peru, on the other hand, if foodstuffs industries are excluded the relative significance of imported raw materials drops to less than 13 per cent of the total.

12 In the Colombia study just cited, the production of artificial fibres is mentioned as an example of the highest degree of dependence on imported raw materials and intermediate products. These fibres are recorded in the relevant statistics as domestically-produced raw material for purposes of computing the textile mills' purchases; but the Colombian manufactures may have had to utilize a very high proportion of imported raw materials.

preparations, for instance—were taken into account. In the metal transforming industries, imports even now account for almost 50 per cent of the total input of raw materials, and this proportion is probably greatly under-estimated on account of purely statistical shortcomings.[13] Future expansion would undoubtedly be reflected in a substantial demand for imported raw materials and intermediate goods, if the parallel development of the appropriate supplier industries were not successfully promoted in Peru.

Lastly, although the imported raw materials and intermediate goods utilized by industry represented a relatively small proportion of its total requirements, they nevertheless accounted for over 20 per cent of Peru's total imports of goods in 1955. This is a proportion large enough to be considered a vulnerable point if the capacity to import contracted or even failed to increase sufficiently.

Although this aspect of the question presents somewhat favourable rather than unfavourable features at present, due attention should be paid to the possible incidence of future industrial development on import requirements in respect of intermediate manufactured goods and other raw materials. Unless domestic supply possibilities are developed in good time, Peruvian industry may gradually lose its almost exceptional degree of invulnerability to the fluctuations of the capacity to import, and at the same time hamper the progressive improvement in the composition of imports that would be represented by a steady increase in the proportion of capital goods, the indispensable requisites for ensuring a satisfactory long-term rate of economic development.

[13] The purchases effected by repair shops, for example, which include heavy buying from local dealers, may be registered as domestic raw materials, although a high proportion comes from foreign sources.

Chapter V

PRINCIPAL CHARACTERISTICS OF THE MAIN BRANCHES OF INDUSTRY

I. FOOD MANUFACTURING

The foodstuffs industries form a very comprehensive and varied group comprising more than 20 per cent of Peru's manufacturing establishments and about 16 per cent of its industrial personnel. As a separate study of every branch was impossible, it was decided to deal only with some of the most important, which are, or in the near future may be, of economic significance for Peru.

1. *Slaughtering of animals and preparation of meat*

Although in the last ten years of the period under review the meat industry developed at a satisfactory annual rate of over 5 per cent, its installations are antiquated and its output capacity lags far behind potential demand.

Per capita meat consumption averages about 14 kilogrammes annually; as it amounts to some 35 kilogrammes in the Lima-Callao zone, for the rest of Peru it is estimated at under 10 kilogrammes—a very low figure, especially in comparison with the 36 kilogrammes that might be taken as a normal level of consumption. There is only one large up-to-date establishment, situated in Lima, which accounts for one-third of installed capacity; the remainder of the industry is at a very elementary stage of development.

Table 50

PERU: LIVESTOCK SLAUGHTERED, 1945–56
(Thousands of tons of meat)

Year	*Beef*	*Mutton*	*Pork*	*Goat meat*	*Total*
1945	46.7	23.4	8.5	1.5	80.1
1946	37.5	16.7	5.7	1.1	61.0
1947	43.3	17.6	5.9	1.1	67.9
1948	29.7	18.9	6.3	1.4	56.3
1949	33.1	17.2	7.1	1.7	59.1
1950	57.9	24.2	8.4	2.6	93.1
1951	59.5	28.6	12.0	4.2	104.3
1952	60.3	28.0	12.5	4.4	105.2
1953	61.1	28.4	13.5	4.9	107.9
1954	66.0	29.7	12.5	5.0	113.2
1955	71.9	28.0	11.5	6.1	117.5
1956	60.4	22.8	11.0	9.1	103.3

SOURCE: Ministry of Agriculture (*Ministerio de Agricultura*), Department of Agronomics (*Dirección de Economía Agropecuaria*).

Table 51

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF MEAT, 1945–56
(Thousands of tons)

Year	*Meat*	*Poultry*	*Imports of frozen, dried and processed meat* [a]	*Apparent consumption*
1945	80.1	2.8	5.7	88.6
1946	61.0	3.0	6.3	70.3
1947	67.9	3.5	2.5	73.9
1948	56.3	3.7	14.9	74.9
1949	59.1	3.8	17.3	80.2
1950	93.1	4.0	4.6	101.7
1951	104.3	4.2	6.5	115.0
1952	105.2	5.0	10.0	120.2
1953	107.9	5.5	6.0	119.4
1954	113.2	7.0	6.2	126.4
1955	117.5	6.8	6.4	130.7
1956	103.3	7.3	5.0	115.6

SOURCES: *Banco Central de Reserva, Renta Nacional del Perú* (*National Income of Peru*) and Customs Statistics Department (*Departamento de Estadística General de Aduanas*), *Anuarios de comercio exterior* (Foreign Trade Yearbooks).
[a] Including import statistics given in table 52.

For this reason, too, the statistics on the slaughtering of livestock shown in table 50 could be only very approximately ascertained.

Annual output capacity is estimated at 120 000 tons; 103 000 tons are produced at present, and 5 000 tons of frozen, dried or processed meat are imported (see table 51). The deficit in supplies of butcher's meat in relation to an average national consumption equal to that of the Lima-Callao zone is in the neighbourhood of 196 000 tons yearly. Efforts to cover this deficit are hampered mainly by the smallness of the livestock population and the difficulties of transport from the producer areas or from mountain districts and others that are potentially important from the standpoint of pasturage.

Since it is unlikely that within the period covered in this report ways and means will be found to bring about a radical change in the livestock situation, dependence on imports of cattle-on-the-hoof or of frozen or chilled meat will be bound to continue. The impossibility of predicting availabilities of domestically-produced livestock or the proportions that each of these

types of imports will attain makes it difficult to express the meat deficit in terms of the investment and manpower required for the slaughtering and preparation of meat. Probably, however, there will be a tendency to import more frozen meat than cattle-on-the-hoof, as the price difference per kilogramme of meat fit for consumption delivered to Lima, is not very great. Were this to be the case, the expansion of the industry except as regards distribution, would depend almost entirely on availabilities of Peruvian livestock, which will be slow to increase.

At present, the only important project is the installation of a refrigerating plant in the south of Peru —probably on the railway from Juliaca to Arequipa— which, on the basis of locally-bred livestock, and investment amounting to 1.5 million dollars, will produce 10 000 tons annually.

As regards pork and poultry, which might supplement availabilities of beef, output levels are very low in comparison with those normally registered in other countries. Once again the reason is to be found mainly in the shortages of animal feeds, but in this case industry can make a more effective contribution to the solution of the problem, as there is room for expansion of the manufacture of certain types of feeds.

Table 52

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF SAUSAGES AND SIMILAR PRODUCTS, 1945–56
(Tons)

Year	Production	Imports	Apparent consumption
1945	295.2	209.2	504.4
1946	164.8	366.8	531.6
1947	404.0	132.5	536.5
1948	538.5	29.6	568.1
1949	547.2	6.4	553.6
1950	493.7	82.3	576.0
1951	586.7	101.5	688.2
1952	627.7	143.2	770.9
1953	592.7	157.2	749.9
1954	620.4	137.4	757.8
1955	569.7	193.0	762.7
1956	639.8	275.4	915.2

Sources: For production: estimates based on pork production and the ratio between this and the output of sausages and similar products in selected years. For imports: *Anuarios de comercio exterior*, op. cit.

One activity in this group which is under-developed is the manufacture of sausages. Foreign competition is relatively keen, as can be seen in table 52, but this is not the reason for the industry's low level of development, or at any rate is not the principal cause. More important are the limitations imposed on the expansion of production by the fact that there are so few pigs to supply the staple raw material. Another reason is the small price difference between high and low-quality beef, which prevents low-quality beef from being used as a raw material on an extensive scale.

Peru has 12 sausage factories, whose output capacity is sufficient for more than three times the current production. The industry could satisfy total consumer requirements over the next few years, if and when it could be sure of adequate supplies of raw material at favourable prices.

Table 53

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF MILK, 1945–56
(Tons)

Year	Production of fresh milk	Imports	Apparent consumption [a]
1945–49	270 000	12 374	282 374
1950	184 105	14 981	199 086
1951	198 000	5 081	203 081
1952	214 070	14 311	228 381
1953	236 000	13 851	249 851
1954	376 900	14 056	390 956
1955	377 900	21 712	399 612
1956	380 000	34 200	414 200

Sources: Ministry of Agriculture, Department of Agronomics; and *Anuarios de comercio exterior*, op. cit.
a Expressed in terms of fresh milk.

2. *Dairy products*

The position with respect to milk, both as a direct foodstuff and as raw material for industry, is very similar to the meat situation in the sense that current output fails to meet Peru's requirements. Annual production amounts to 380 000 tons; 414 000 tons are consumed and 915 000 would really be needed for *per capita* consumption to reach a normal daily minimum of 0.25 litres. Moreover, the gap between the production and consumption of milk seems to be widening since the rate of growth of imports is more rapid than that of production (see table 53).

(a) *Evaporated milk*

The evaporated and tinned milk industry in Peru started in 1942, when two plants, one at Arequipa and one at Chiclayo, entered production almost simulta-

Table 54

PERU: PRODUCTION AND CONSUMPTION OF EVAPORATED, CONDENSED AND POWERED MILK, 1945–56

Year	Production (Tons)	Apparent consumption (Tons)	Percentage relationship of production to apparent consumption
1945	3 650	4 734	77.0
1946	4 000	6 191	64.6
1947	5 900	12 900	45.6
1948	6 330	10 492	60.3
1949	6 760	15 947	42.4
1950	7 200	13 158	54.7
1951	7 640	9 354	81.7
1952	8 080	13 790	58.6
1953	8 520	13 479	63.2
1954	8 945	14 674	60.9
1955	11 126	19 038	58.4
1956	14 180	21 486	66.0

Sources: Producer enterprises and *Anuarios de comercio exterior*, op. cit.

Table 55

PERU: IMPORTS OF MILK, BY PRINCIPAL TYPES, 1945-56

(Tons)

Year	Evaporated milk products [a]	Dried milk products [b]			Skimmed milk products	Total [c]
		Total	For direct consumption	For industrial use		
1945-49	3 648	639	473	166	94	12 374
1950	5 484	474	402	72	167	14 981
1951	1 464	250	170	80	192	5 087
1952	5 325	385	180	205	461	14 311
1953	4 432	527	329	198	738	13 851
1954	5 462	267	185	82	778	14 056
1955	7 528	384	284	100	3 090	21 712
1956	4 546	2 760	1 884	876	3 801	34 200

SOURCE: *Anuarios de comercio exterior, op. cit.*

a Including both evaporated and condensed types. Tare: 16.5 per cent of the gross weight.

b Tare: 11.8 per cent of the gross weight.

c Totals are expressed in terms of fresh milk, equivalent, for which the following factors were utilized: 2.05 for evaporated milk products; 7.5 for dried milk products; and 1.1 for skimmed milk products.

neously. As can be seen in table 54, production followed an upward trend almost parallel to that of consumption, so that there was practically no change in the percentage relationship between the two. The composition of imports of evaporated and dried milk (see table 55) also remained relatively constant, except in 1956, when imports of powdered milk sharply increased, owing to the fact they entered the country virtually duty-free.[1]

The chief product of the Arequipa plant is evaporated milk, demand for which is the heavier; the Chiclayo factory processes condensed and powdered milk. Both operate under foreign trademarks and supervision. Output capacity has been gradually expanding, and there is at present enough available equipment to handle over 200 000 litres of milk daily, or more than sufficient to satisfy demand.

Owing to the shortage of milk, the Arequipa plant operates at a little over one-third and that of Chiclayo at about one-half of its existing capacity. To overcome this drawback, both enterprises have installed semi-evaporation plants in the neighbouring cattle-breeding areas. The Arequipa plant possesses an installation at Vitor—which in turn receives milk from the reception and chilling centres at Chuquibamba, Pampacocha, Puyute and Ongoro—and is planning to set up another at Tacna. The firm running the Chiclayo enterprise owns a semi-evaporation plant at Cajamarca. Although the fact that milk supplies have to be brought a long way raises the cost of raw material by as much as 51 per cent of total costs in the case of evaporated milk, the incidence of this surcharge is modified because a considerable amount of water is eliminated during the pre-evaporation process.

The supply of milk for these plants may improve as a result of the irrigation works under way or projected in the north and south of Peru. At the same time, however, herd selection should be practised, with a view to increasing productivity. In Arequipa and the surrounding districts, for example, stock farmers should be encouraged to replace animals with a low yield by high-quality dairy cattle, and to leave areas like Cuzco and Puno, where the pasturage is poorer, for the rearing of beef cattle.

The two enterprises manufacturing evaporated milk products employ 540 workers, mainly skilled. If those engaged in the manufacture of containers, in the factories's own installations, and those working on transport and maintenance are excluded, there remain some 295 workers directly employed in the manufacture of evaporated milk, with an average productivity of 17.5 kilogrammes per man/hour.

(b) *Other dairy products*

Again, Peru is not self-sufficient in cheese or butter, particularly the latter, imports of which represented on an average 43 per cent of consumption during the last five years of the period under consideration (see tables 56 and 57). As in the case of tinned milk, this dependency on imports is chiefly due to the shortage of milk. The techniques applied in many establish-

Table 56

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF BUTTER, 1945-56

(Tons)

Year	Production	Imports	Apparent consumption
1945	1 600	564	2 164
1946	1 700	1 358	3 058
1947	1 800	1 152	2 952
1948	2 313	395	2 708
1949	2 300	41	2 341
1950	2 250	591	2 841
1951	1 775	763	2 538
1952	1 635	1 413	3 048
1953	2 376	1 035	3 411
1954	2 420	1 560	3 980
1955	2 430	1 921	4 351
1956	2 450	2 648	5 098

SOURCES: *Banco Central de Reserva, Renta Nacional del Perú;* and *Anuarios de comercio exterior, op. cit.*

1 Over 50 per cent of imports of powdered milk consisted of semi-skimmed milk powder with no less than 12 per cent fat content for infant feeding, obtained largely through the UNICEF assistance programme.

Table 57

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF CHEESE, 1945–56

(Tons)

Year	Production	Imports	Apparent consumption
1945	6 400	227	6 627
1946	6 800	485	7 285
1947	7 300	120	7 420
1948	8 838	19	8 858
1949	9 200	56	9 256
1950	8 238	310	8 548
1951	7 778	319	8 097
1952	7 795	484	8 279
1953	8 640	543	9 183
1954	8 802	570	9 372
1955	8 805	777	9 582
1956	8 000	807	8 807

SOURCES: *Banco Nacional de Reserva, Renta Nacional del Perú;* and *Anuarios de comercio exterior, op. cit.*

ments must also be acknowledged to be somewhat backward, with the result that the quality and presentation of the products manufactured is not always all that might be desired.

3. *Canning industries*

The canning industries have developed fairly rapidly but unevenly, since in reality expansion has taken place in only one branch—that of tinned fish—which at present accounts for 95 per cent of Peru's output of tinned goods,[2] and thus for the increase in the entire sector. In recent years there has been no substantial increase in the manufacture of tinned meats, vegetables or fruit.

(a) *Tinned fish and allied industries*

The development of these industries dates from the end of 1940, since when their expansion has been so remarkable that in relative terms it has perhaps been equalled in no other industry in Peru. The great number and variety of fish to be found in Peruvian waters—owing to the abundance of plankton among other favourable factors—and the heavy external demand for this line of production, were the main factors that facilitated development. There are 69 canneries along the coast, and the investment they represent exceeds 800 million soles [3] (including every kind of craft) while they employ about 7 500 manual workers, excluding fishermen.[4]

During the five-year period 1952-56, on an average 29.5 per cent of the fish caught was sent to the canneries, 37.5 per cent was converted into meal and 6.5 per cent was frozen for export. The remaining 26.5 per cent consisted of fresh fish for direct consumption (see table 58).

The fish most commonly frozen for export are tuna (tunny) and skipjack, which are caught during the winter months, especially along the two extremes of the Peruvian coast (off Máncora, Talara and Paita in the north and Ilo in the south). There are six companies engaged in this industry, and practically the whole of their output is exported to the United States.[5] Their development has been hindered by a freezing capacity deficit which has not yet been remedied, especially where shore installations are concerned.

Peru's canneries constitute the most important part of its fishing industry. The plants installed have a maximum daily capacity of 25 000 crates (see table 59), which would mean that some 8 750 tons of fresh fish would be needed daily if the factories were to operate at full capacity. But for about six months of

[2] Excluding tinned milk.

[3] Of this capital, 70 per cent is estimated to come from domestic sources and the remainder principally from the United States.

[4] Peru's fishing fleet is calculated at 3 500 craft, and provides employment for about 8 000 men. These figures exclude whalers and their crews.

[5] Frozen tuna and skipjack constitute raw materials for the United States canneries. They enter the country duty-free, but there is still a possibility that an *ad valorem* duty may be levied to protect the interests of United States fisheries. No action of any kind was taken in 1956 because that was an excellent year for the United States fishing industry.

Table 58

PERU: DISTRIBUTION OF FISH CAUGHT, 1947–56

(Tons of fresh fish)

Year	Total catch	Fresh fish for direct consumption	Frozen fish exported	Fish for canneries [a]	Fish for meal [b]
1947	36 650	...	277	...	1 600
1948	47 652	...	712	...	3 100
1949	60 801	...	2 611	...	9 220
1950	83 641	...	9 106	...	12 740
1951	105 551	...	8 364	...	20 590
1952	113 000	36 880	8 210	38 150	29 760
1953	117 780	36 410	6 080	36 190	39 100
1954	146 090	35 551	10 877	46 200	53 460
1955	169 130	40 317	11 122	52 850	64 840
1956	230 000	57 854	12 686	56 000	103 460

SOURCES: Ministry of Agriculture (*Ministerio de Agricultura*), Department of Game and Fisheries (*Dirección de Pesquería y Caza*), and *Anuarios de comercio exterior, op. cit.*

a Estimates based on an input of 35 kilogrammes of fresh per crate of 48½-lb tins.

b Estimates based on the assumption that 88 per cent of domestically-produced meal is made from fresh fish.

Table 59

PERU: PERCENTAGE CONTRIBUTION OF EACH COASTAL AREA TO TOTAL CATCH AND GEOGRAPHICAL DISTRIBUTION OF TINNED FISH PRODUCTION CAPACITY

Area	Percentage contribution to total catch	Tinned fish production capacity	
		Crates of 48½-lb tins	Percentage of total
North [a]	14.6	500	2.0
Centre [b]	78.8	22 000	88.0
South [c]	6.6	2 500	10.0

SOURCES: Ministry of Agriculture, Department of Game and Fisheries, and direct information.
a Including Máncora, Talara, Sechura and Paita.
b Including Chimbote, Huarmey, Supe, Huacho, Chancay, Callao and Pucusana
c Including Ilo and surrounding districts.

the year the industry works at only one-third capacity, or, in other words, the average daily output amounts to approximately 4 000 crates.

As can be seen in table 60, the bulk of the output is shipped abroad, although the proportion absorbed by the domestic market is tending to increase, both as a result of the natural growth of demand and because of the difficulties which the export trade is encountering and which are compelling industrialists to push their sales in Peru.

Table 60

PERU: PRODUCTION OF TINNED FISH AND PERCENTAGE DISTRIBUTION BETWEEN DOMESTIC MARKET AND EXPORTS, 1952-56

Year	Production (Crates of 48½-lb tins)	Domestic market	Exports
		(Percentage)	
1952	1 090 000	10	90
1953	1 034 000	10	90
1954	1 320 000	12	88
1955	1 510 000	15	85
1956	1 600 000	17	83

SOURCE: National Fisheries Association (*Sociedad Nacional de Pesquería*).

Of the total output of tinned fish, 75 per cent consists of bonito and 25 per cent of tuna. Eighty-five per cent of the tinned bonito is exported to the United States [6] and to certain European countries. The export trade also absorbs 85 per cent of the tinned tuna, but almost all of this is shipped to the United Kingdom.[7]

Lima accounts for 65 per cent of domestic consumption of tinned fish; but the upward trend in consumption is more marked in the interior of the country than in Lima.

The canneries are dependent on imported raw materials as regards tinplate and prefabricated containers, and, in some cases, cotton-seed oil.[8] According to estimates, these items do not represent more than 25 per cent of production costs. Fish, the staple raw material, makes up the major share of the remaining 75 per cent.

Peruvian production is faced with a serious contraction of foreign markets, especially those of the United States and the United Kingdom, which is attributable to the following causes: (i) the fact that the last few years of the period considered were excellent ones for the United States fishing industry and that the output of tinned tuna therefore increased to a notable extent; (ii) the heavy United States imports of frozen tuna from Japan, as a low cost raw material for the United States canneries; and (iii) the rise in sales of Japanese tinned fish on the United Kingdom market. These circumstances have compelled the Peruvian industry to cut its prices in order to compete,[9] but it seems hardly likely that quotations can be kept down to these new levels unless production costs are lowered through the reduction of prices for the fish and containers, which together account for 68 per cent of the cost of tinned bonito for export.

However, the only cost item on which producers can exert any influence is the fish itself. One solution would be to regulate the supply and price of this raw material by installing large refrigerating-plants in the principal fishing-ports for the storage of surplus fish,

Table 61

PERU: GEOGRAPHICAL DISTRIBUTION OF FISH MEAL FACTORIES, BY NUMBER AND PRODUCTION CAPACITY

Situation	Number of factories	Production capacity (Percentage of total)
Chimbote	4	16
Samanco	2	11
Coishco	2	9
Huarmey	4	19
Huacho and Chancay	3	12
Callao	5	24
Ilo	1	9

SOURCE: National Fisheries Association.

6 The United States has usually been the principal buyer of Peruvian tinned fish. Only in 1955 did the United Kingdom, which was the second-largest purchaser, move up to first place. The United Kingdom market demand is for high-quality products in which the yield of the raw material is lower and greater care has to be taken in processing it. On the other hand the price paid is 25 per cent higher.

7 Peru's tinned tuna cannot compete on the United States market because the 45 per cent *ad valorem* customs duty constitutes an economically insuperable barrier. On the other hand, it is possible to export bonito, which also belongs to the tunny family and is sold on the United States market as "Peruvian bonito" to protect the local product. An *ad valorem* duty of 12.5 per cent has to be paid on Peruvian bonito, which represents under 10 per cent of United States consumption.

8 As domestic production of cotton-seed oil does not wholly cover demand, part of the oil used in the fish canneries is imported semi-refined from the United States and is subjected in Peru to a double refining process followed by "wintering". In the last two years of the period under review an average of about 6 000 tons of semi-refined oil was imported for this purpose.

9 Between 1954 and 1957 prices (in dollars per crate) fell by 14 per cent in the case of fish blocks and 27 per cent in that of loose fish.

which could be placed at the disposal of industrialists, at fair prices, during periods of shortage. This way out of the difficulty would benefit manufacturer and fisherman alike, as it would mean that fish prices could be kept at a more or less constant level throughout the whole year.[10]

Closely linked to the canning industry is the manufacture of fish meal, for which Peru has at present 21 plants with a total annual output capacity of 75 000 tons (see table 61).

Fish meal is manufactured from waste, from the canneries or by processing *anchoveta* and machete.[11] It is estimated that, on the average, 60 per cent of meal output comes from *anchoveta*, 22 per cent from machete and 18 per cent from the canneries.[12]

In the most efficient of the installations operating in Peru productivity reaches about 70 kilogrammes per man/hour, which must be regarded as quite high. For all the factories in the aggregate, however, it is estimated at less than 56 kilogrammes. These figures should be compared with the maximum of 100 kilogrammes per man/hour which can be attained in well-organized and up-to-date plants of optimum size, in which the raw material supply factor is no obstacle to the expansion of output. In recent years, only 5 per cent of the output of meal, on an average, has been sold on the domestic market; the rest has been exported, mainly to the United States, the Federal Republic of Germany and the Netherlands (see table 62).

Fish meal is sold on the basis of its protein content, which varies according to the raw materials and production technique utilized. *Anchoveta* generally yields from 65 to 67 per cent of proteins, machete from 65 to 70 per cent and waste 70 per cent. From a maximum of 142 dollars per ton (with 65 per cent protein content) at the beginning of 1955, the price fell to about 115 dollars in 1957. The earlier maximum was the outcome of the intensive demand for fish meal on the European market. In consequence of the resultant expansion of the supply,[13] the price dropped by 30 per cent, but it is still attractive.

Table 62

PERU: PRODUCTION AND EXPORTS OF FISH MEAL, 1947-56

(Tons)

Year	Production	Exports
1947	498.0 [a]	473.7
1948	711.0 [a]	675.4
1949	2 851.0 [a]	2 708.4
1950	3 939.0 [a]	3 741.9
1951	6 393.0 [a]	6 050.8
1952	9 204.7	9 096.1
1953	12 096.2	10 608.8
1954	16 535.4	14 040.4
1955	20 069.1	18 767.6
1956	32 000.0	27 791.7

SOURCE: Ministry of Agriculture, Department of Game and Fisheries.
a Estimates, based on the assumption that in the years indicated exports represented 95 per cent of production.

The by-product of the meal factories is fish oil, recovery of which was begun in 1946. The net oil yield of *anchoveta* and machete is 6 per cent in summer and 2 per cent in winter. On an average it can be estimated that 40 kilogrammes of centrifugal oil are obtained from one ton of raw material.[14]

(b) *Tinned meat, vegetables and fruit*

This activity has not been developed to any great extent in Peru; it expanded somewhat in the later 'forties, but thenceforth remained stationary. This is one of the cases in which foreign competition is keen, since consumer preferences favour imported goods, which are unquestionably of better quality and more attractively presented, while their state of preservation can be relied on and they are not always much more expensive than similar lines of domestically-produced goods. In 1955, domestic output amounted to only 324 tons and represented 6 per cent of consumption of tinned meat, vegetables and fruit. Although in 1956 it increased to 1 130 tons, owing to the entry into operation of a new factory and the resumption of activities in another, imported tinned goods continued to satisfy three-fourths of consumption (see table 63).

One of the reasons why domestic production has expanded so little is to be found in the shortage of such staple raw materials as mutton and pork and those varieties of fruit and vegetables which are of basic importance for the development of the canning industry, particularly tomatoes, peas and peaches. It does not therefore seem unduly risky to forecast that, so far as these lines of production are concerned, Peru

10 At the port of Chimbote, for example, there are days when the fishing-boats bring in as many as about 300 000 bonitos. As the area possesses a maximum output capacity for some 75 000 bonitos, the price falls so sharply that it is barely worth the fishermen's while to go out. This would not happen if adequate freezing plants were available ashore.

11 Since 1953 some impetus has been given to the production of cachelot meal, which has been exported almost in its entirety. According to the Ministry of Agriculture, Department of Game and Fisheries, the volume of these exports is as follows:

Year	Tons
1953	200.8
1954	647.3
1955	500.4
1956	1 130.3

This line of production is expanding, thanks to new installations which will utilize the sperm whale more efficiently, since the fishing-grounds are so far from the shore that formerly the cachelot used often to arrive in a state of decomposition. It was possible to restore the oil, although with heavy losses, by neutralizing the acidity; but the flesh could not be utilized for meal. Cachelot meal is quoted at a price 12 per cent lower than that of fish meal because, although it has the same protein content, it is poorer in assimilable salts.

12 The canneries utilize only the white fish, and about 40 per cent of organic material, such as entrails, skin, head, bones and tail, is left over as waste. For every crate of tinned fish there are approximately 15 kilogrammes of waste which can be used as raw material for meal manufacturing, and which give a yield of up to 33 per cent of dry meal. Smaller yields of 18 per cent and 20 per cent respectively are registered for anchoveta and machete; these figures are based on the assumption of a 10-per-cent water content, and vary with the season of the year and the length of time that elapses before the catch is processed.

13 Especially of fish meal from Angola, which is cheaper, although of poorer quality than the Peruvian product.

14 See section XII of this chapter on chemical products.

Table 63

PERU: IMPORTS OF TINNED MEAT, VEGETABLES AND FRUIT, 1945–56
(Tons)

Year	Meat	Fruit	Preserves	Vegetables	Condiments	Fruit juice	Total
1945	75	215	19	151	63	74	597
1946	324	473	16	390	79	100	1 382
1947	256	1 043	45	865	39	149	2 397
1948	78	265	20	280	88	18	749
1949	46	237	4	244	65	4	600
1950	184	586	157	469	132	19	1 547
1951	270	1 447	128	743	315	70	2 973
1952	276	1 529	148	857	250	137	3 197
1953	430	1 857	156	794	234	140	3 611
1954	422	1 871	130	648	257	154	3 482
1955	426	2 660	150	1 032	373	174	4 815
1956	568	1 200	122	869	332	206	3 297

SOURCE: *Anuarios de comercio exterior, op. cit.*

Table 64

PERU: PRODUCTION AND CONSUMPTION OF WHEAT AND WHEAT FLOUR, 1945–56
(Tons)

Year	Wheat production	Wheat imports	Flour production [a]	Flour imports	Flour consumption
1945	85 954	159 974	177 068	12 053	189 121
1946	90 649	110 178	144 595	5 373	149 968
1947	126 958	138 867	191 394	6 153	197 547
1948	136 773	144 273	202 353	6 445	208 798
1949	129 056	203 983	239 788	11 538	251 326
1950	143 807	242 601	278 214	2 288	280 502
1951	156 568	195 946	253 810	6 915	260 725
1952	162 110	232 952	284 445	6 208	290 653
1953	168 732	253 986	304 360	3 976	308 336
1954	162 502	240 719	290 319	11 404	301 723
1955	151 947	298 370	324 228	5 417	329 645
1956	123 308	285 202	294 127	7 013	301 140

SOURCES: For wheat production: National Statistical Service (*Dirección Nacional de Estadística*), *Anuarios Estadísticos del Perú* (*Peruvian Statistical Yearbooks*); for wheat and flour imports: *Anuarios de comercio exterior, op. cit.*
[a] Deduced on the basis of a 72-per-cent yield from milling.

will remain an importer, despite the development which domestic production can and must be expected to achieve.

There are five vegetable and fruit canneries in Peru: three in Lima, one in Chiclayo and one in Trujillo. Although their equipment is on the whole distinctly modest, their capacity was at least double their output in 1956.

4. *Grain mill products*

The chief activity in this sector is the milling of wheat. Although Peru is far from self-sufficient in respect of this cereal, it does not import much flour, but wheat to cover the deficit (see table 64). Hence the significance of the milling industry is considerable in Peru; it contributes 4.5 per cent of the net income of the manufacturing sector and its share in the capital invested in manufacturing industry is 5 per cent.

On an average, home-grown wheat covered 40 per cent of flour consumption in 1945-56. But while there were no substantial increments in wheat production between 1951 and 1954, and a downward trend was registered as from 1955 because of the drought [15] in the southern part of the country, imports were steadily increasing, and reached over 19 million dollars in 1957.

The wheat mills are concentrated mainly in the Lima-Callao zone, but the Arequipa milling industry too is on a fairly large scale.[16] Elsewhere there are small installations with old-fashioned millstones, which

Table 65

PERU: GEOGRAPHICAL DISTRIBUTION OF WHEAT FLOUR MILLS AND DOMESTIC MILLING CAPACITY

Department	Number of mills	Production capacity (Percentage of total)
Lima and Callao	5	83.5
Arequipa	7	12.9
Cuzco	1	1.9
Tacna	1	0.5
Other departments	...	1.2

SOURCE: Direct information.

[15] In the last two years of drought, demand for wheat notably increased in the affected areas because of the failure of their own maize harvests. Now that the inhabitants have become accustomed to using wheat flour, it is unlikely that they will replace it by flour made from any other cereal.

[16] Wheat production in Arequipa currently amounts to some 10 000 tons yearly, but approximately 72 000 tons are milled; Arequipa satisfies part of the flour consumption of Moquegua, Cuzco, Puno, Madre de Dios and Apurimac.

grind the wheat produced in the neighbouring areas [17] (see table 65). Peru's installed capacity is estimated at about 1 580 tons of wheat daily, or approximately 500 000 tons per annum.

Although in the later years of the period under review output capacity increased substantially, much remains that was installed a long time ago but can still be utilized.[18] If output capacity is related to the amount of wheat milled in 1956,[19] the resulting utilization coefficient is about 60 per cent. This shows that industry would be capable of meeting demand up to the end of 1962.[20]

5. *Manufacture of flour products*

In this group the main activities are bakeries and biscuit and noodle factories. The former generally operate at the artisan level, working conditions are sometimes defective and the quality of the bread produced is not always satisfactory. There is a great deal of room for improvement in this branch of industry. The biscuit factories are larger enterprises. Industrial statistics for 1955 register 13 sizeable factories, with a production of 7 745 tons, which in that year represented 98 per cent of consumption. The manufacture of noodles is a fairly widespread industry in Peru, but the major proportion of the output is contributed by three establishments in Lima. Domestic industry supplies practically the whole of Peru's consumption; as can be seen in table 66, imports are negligible.

6. *Sugar and its by-products*

The manufacture of sugar is one of Peru's most important industries. The technical level of sugar-cane cultivation has risen so high in recent years that Peru's yields of cut cane and saccharose extracted per hectare now exceed those of any other country. This is due to the introduction of new varieties of cane, a more

Table 66

PERU: IMPORTS OF BISCUITS AND NOODLES, 1950–56
(Tons)

Year	Biscuits	Noodles
1950	241.4	26.8
1951	283.2	137.1
1952	217.6	79.8
1953	198.5	88.0
1954	178.1	78.8
1955	166.9	68.4
1956	176.5	75.5

SOURCE: *Anuarios de comercio exterior, op. cit.*

intensive application of fertilizer to the fields, biological control of the sugar-cane borer, improved tilling and levelling of the land thanks to the use of modern machinery, the construction of numerous pools and dams to ensure a more regular supply of irrigation water, the mechanization of cane-loading, better transport and the total replacement of industrial equipment in the case of two mills and partial replacement in that of the others.

(a) *Sugar*

From 1946 to 1956, sugar production increased 70 per cent, domestic consumption 65 per cent and exports 33 per cent. The fact that the cultivated area expanded only 12 per cent confirms that a high level of productivity was attained (see table 67).

Sugar production in Peru is so highly integrated that it is difficult to establish the border line between agriculture and industry. It is estimated that 23 per cent of the 80 000 manual workers employed in this branch are active in the purely industrial sector.

There are 16 sugar mills in Peru, all in operation, with a total theoretical capacity of 920 000 tons per annum. A comparison of this capacity with the average

Table 67

PERU: AREA UNDER SUGAR-CANE, AND PRODUCTION, EXPORTS AND DOMESTIC CONSUMPTION OF SUGAR, 1946–56

Year	Area under sugar-cane [a] (Hectares)	Sugar (tons)		
		Production [b]	Exports [c]	Apparent consumption
1946	50 756	397 200	260 247	157 542
1947	50 346	431 970	274 545	166 130
1948	48 750	497 860	351 525	177 476
1949	50 228	493 075	285 360	186 160
1950	53 226	451 532	290 520	182 053
1951	54 566	489 873	263 758	192 015
1952	52 208	493 646	304 823	201 301
1953	55 041	626 373	408 386	199 524
1954	55 890	637 621	422 274	211 905
1955	56 923	677 526	482 864	220 600
1956	61 547	717 773	428 303	239 013

SOURCE: National Agricultural Association (*Sociedad Nacional Agraria*).
a Cane-growing takes up 10 per cent of the area under cultivation in the coastal belt and 3.5 per cent of that in the rest of the country.
b Also including production of *chancaca* (unrefined brown sugar), although its significance is slight, since it does not represent as much as 4 per cent of the total.
c Sugar exports accounted on an average for a little over 15 per cent of Peru's foreign exchange income.

17 Except in Cuzco, where there is a fairly large mill.

18 The machinery used in the mills generally has a long useful life. As fixed investment is very heavy, the combination of durability and high replacement costs reduces the incentive to bring equipment up to date. New installations are introduced as additions to output capacity as the pressure of demand requires, but not to supersede obsolete equipment.

19 Production is expressed in terms of milled wheat, because sometimes grain mill products are not separated and the so-called *"harina integral"* (wholemeal flour) is obtained. This however, is not what most commonly happens, for as a rule *harina flor* (white flour) is separated from *afrecho* (bran) and *afrechillo* (bran meal). These products represent 28 per cent of the wheat milled, and constitute valuable animal feeds.

20 In connexion with the growing and processing of grain in Peru, mention must be made of the tremendous possibilities of *quinua*, which has very high value as a cereal food. The current output (some 36 000 tons) is decidedly low as compared with what could be produced. In view of Peru's marked cereal deficit, an energetic *quinua* production campaign should be undertaken, consisting in the application of fertilizers to the nowadays impoverished soil on which this crop is grown, and the provision of mechanized equipment to supersede the primitive farming and harvesting practices in use. The conversion of *quinua* into an industrial product would help to improve the living conditions of the inhabitants of the *altiplano* (high plateaux of the Andes).

amount of cane crushed in the last three years—5.93 million tons—gives a utilization coefficient of 74 per cent for the equipment. But since at least one mill has to be closed down for a month every year in order that the repairs required to guarantee efficient work during the other eleven months may be carried out, the utilization coefficient drops to 81 per cent.

Five of the 16 mills have their respective refineries with an annual capacity of about 185 000 tons. The annual output of 154 200 tons of white sugar in 1954-56 gives a utilization coefficient of 83 per cent.[21]

Only two mills, representing 40 per cent of production, have all-electric crushing machinery. The other mills use steam as motive power, but the old system of piston-pumps has been virtually abandoned because of its low yield. High-pressure vats and steam turbines with partial condensation are becoming more popular, since they enable better use to be made of bagasse as fuel. On the whole, all equipment has been brought up to date and 20 per cent of output capacity may be estimated to have been installed within the last five years.

(b) *Molasses*

As the ratio of molasses production to sugar production is more or less constant, their respective annual yields have increased at virtually the same pace (see table 68). Most of the molasses output has been used for the manufacture of ethyl alcohol, since other uses, such as the preparation of poultry and livestock feeds [22] and the production of yeast,[23] represent a bare 8 per cent of domestic consumption.

Owing to over-production, molasses has had to be thrown away on several occasions.[24] As sugar production is expected to increase, and that of final syrup would inevitably follow after a short time, some way must be found to use up molasses since exports are tending to decline, owing to the difficulty of competing with countries nearer consumer centres that have the advantage as regards transport. Molasses consumption for livestock feed, especially for dairy cattle, might be intensified; another alternative would be to produce yeast on a much larger scale for fodder as well, while the third possibility would be to expand ethyl alcohol production, in which case favourable conditions would have to be created for heavier consumption, especially by industry.[25] A selective application of the consumption tax on ethyl alcohol might help to achieve this objective.

(c) *Ethyl alcohol*

In Peru, alcohol is produced from either molasses or the sugar-cane juice itself. The first type is a high-grade alcohol (94° on the Gay-Lussac scale) and is obtained in the sugar mills from the fermentation of final syrup. The second type of alcohol is low grade (50° on the Gay-Lussac scale) and 95 per cent of it is made into a beverage; it is prepared in small plants from sugar-cane juice.

Between 1946 and 1955, production and consumption of ethyl alcohol in Peru increased 6 per cent annually (see tables 69 and 70). During that period, an

21 There are two small refineries in the department of Arequipa which have not been taken into account. A new plant of 15 000 tons is also being set up and ought to begin operations by mid-1958.

22 Sixty per cent of molasses is composed of digestible elements. It can replace grain and has the additional advantage of making unpleasant tasting foodstuffs palatable to animals.

23 One enterprise in Lima consumes some 2 500 tons of molasses annually.

24 As, in practice, 1 ton of molasses with a 50-per-cent sugar content yields 268.6 litres of alcohol, losses from molasses thrown away in the last few years have been as follows:

Year	Loss (thousands of litres of absolute alcohol)
1948	2 806
1949	2 071
1950	5 580
1951	5 293
1952	5 007
1953	7 943
1954	7 178
1955	5 360

25 If the method of extracting sugar by ion exchange from solutions of uncrystallizable sugar such as molasses is economically successful, the quantity of final syrup would decrease substantially. The application of this procedure would mean a 10-per-cent increase in Peru's sugar output without enlarging the crop area. However, it is doubtful that it will be put into practice within the next nine years as it is still at the experimental stage.

Table 68

PERU: PRODUCTION, EXPORTS AND DOMESTIC CONSUMPTION OF MOLASSES, 1948-55

(Tons)

Year	Production	Exports	Domestic consumption		
			Total	Preparation of must	Losses and other uses
1948	110 660	17 416	88 674	68 915	19 759
1949	115 594	457	115 142	78 207	36 935
1950	119 185	...	119 185	79 942	39 243
1951	118 363	14 675	103 688	79 608	24 080
1952	117 541	1 007	116 534	76 557	39 977
1953	160 895	16 650	144 245	93 936	50 309
1954	167 602	36 107	131 495	93 550	37 945
1955	154 797	14 850	139 947	107 468	32 479

SOURCE: *Caja de Depósitos y Consignaciones. Departamento de Recaudación* (Collections Department), *Bulletin*, No. 602, February 1957.

Table 69

PERU: PRODUCTION OF ETHYL ALCOHOL, 1945–55
(Thousands of litres of pure alcohol)

Year	Total	Molasses	Sugar-cane juice
1945	17 864	12 313	5 551
1946	17 642	11 597	6 045
1947	18 703	12 026	6 757
1948	19 161	11 746	7 415
1949	20 751	13 043	7 708
1950	20 827	12 496	8 331
1951	22 867	14 183	8 684
1952	23 971	14 247	9 724
1953	26 053	16 372	9 681
1954	27 877	17 943	9 934
1955	28 985	20 556	8 429

SOURCE: *Caja de Depósitos y Consignaciones*, Collections Department, *Bulletin*, No. 602, February 1957.

average of 75 per cent of production was used for beverages and 20 per cent for fuel. This type of consumption is typical of a country that has not developed its chemical industry.

Peru has 16 large-sized plants for fermenting and distilling final syrup;[26] both operations are carried out in hygienic conditions and impurities are removed effectively. During the last few years, under the stimulus of higher prices for alcohol, several plants were renovated but old equipment giving low yields in fermentation and distillation is still in use.

Output capacity is estimated at some 25 million litres of absolute alcohol. Production could be increased by about 5 million without additional equipment.

7. *Edible oils and fats*

Production of edible oils and fats, which constitutes the largest share of domestic consumption of fats, reached a total of 55 000 tons in 1956[27] (see table 71), which is equivalent to 5.5 kilogrammes per annum or a *per capita* average of 130 calories daily. Experts in this field consider that a minimum consumption level of 260 calories daily should be attained.[28] In order to do so, present consumption would have to be duplicated.

Cotton-sced oil represents approximately 60 per cent of consumption and 80 per cent of domestic output of edible fats. Oils from other sources have so far been of little importance.[29]

Peru has 12 enterprises for the production of cotton-seed oil (see table 72). Current installed capacity is sufficient for processing some 200 000 tons of seed annually and extracting approximately 34 000 tons of oil in 300 working days with a 24-hour shift. If this capacity is compared with output in 1956, which was based on only 7 200 hours of work in the year, the utilization coefficient obtained is 85 per cent. But if the oil plants are considered to be in operation throughout the year, the utilization coefficient would drop to

[26] There are also ten rectifying plants which purify the 94° alcohol obtained to over 99° for pharmaceutical use and for the preparation of liquor. According to the Caja de Depósitos y Consignaciones, Departamento de Recaudación, production of rectified alcohol was as follows:

Year	Production (thousands of litres of absolute alcohol)
1945	2 144
1946	2 236
1947	2 323
1948	2 178
1949	2 242
1950	2 498
1951	2 759
1952	2 652
1953	2 561
1954	2 801
1955	2 785
1956	2 861

[27] Including butter, which was dealt with among other dairy products.

[28] Twelve per cent of a total intake of 2 190 calories daily which is estimated to be the average for Peru.

[29] Sunflowers were formerly grown and oil extracted from their seed. Cultivation of this crop was subsequently given up as its economic yield was lower than that of cotton for the farmer. In the department of Moquegua, in southern Peru, olive-trees are grown and some oil is extracted in small plants which have a very low yield. The departments of Cuzco and Madre de Dios export Brazil nuts almost entirely as a substitute for almonds. Its possibilities as a source of oil should be studied since, apart from reducing the gap between production and consumption of fats, it would help to develop the economy of these two departments.

Table 70

PERU: CONSUMPTION OF ETHYL ALCOHOL, 1946–55
(Thousands of litres of pure alcohol)

Year	Total	Alcohol from molasses				Alcohol from sugar-cane
		For drinking	For household fuel	For motor spirit	For other uses	For drinking
1946	17 315	6 776	3 732	709	378	5 720
1947	18 362	6 937	4 310	496	283	6 336
1948	18 920	7 112	4 004	295	334	7 145
1949	20 228	7 618	4 457	256	713	7 184
1950	21 083	7 238	4 628	106	524	8 587
1951	22 662	8 689	4 323	55	1 116	8 479
1952	23 222	8 846	5 212	22	167	8 975
1953	25 558	10 367	4 756	339	910	9 186
1954	27 581	11 978	5 188	451	327	9 637
1955	28 644	13 776	5 182	500	1 097	8 089

SOURCE: *Caja de Depósitos y Consignaciones*, Collections Department, *Bulletin*, No. 602, February 1957.

Table 71

PERU: PRODUCTION AND IMPORTS OF EDIBLE OILS AND FATS,[a] 1946-56

(Tons)

Year	Production			Imports				
	Cotton-seed oil [b]	Lard	Fish oil	Lard	Olive oil	Soya bean	Sun-flower	Others [c]
1946	19 040	...	...	3 455	16	0	0	913
1947	17 070	3 900	...	880	38	24	...	548
1948	16 060	...	...	2 384	36	112	1 552	680
1949	18 090		...	2 486	6	158	458	96
1950	19 010	4 100	...	6 683	464	319	814	549
1951	20 260	4 110	...	5 069	227	128	377	131
1952	24 910	4 110	...	11 062	243	211	34	147
1953	24 440	4 120	...	9 166	208	34	...	208
1954	28 670	4 200	340	6 494	241	...	0	208
1955	25 930	4 500	880	10 819	280	...	...	260
1956	29 165	4 500	1 550	15 601	112	29	...	274

SOURCES: Inter-American Food Production Co-operative Service (*Servicio Cooperativo Interamericano de Producción de Alimentos*); National Fisheries Association; *Anuarios de comercio exterior, op. cit.*; and direct information.

a Production and consumption of butter are shown in table 56.

b Series based on data as to availabilities of cotton-seed supplied by the Peruvian Chamber of Cotton (*Cámara Algodonera del Perú*), except in the case of the figure for 1956, which was obtained from the Ministry of Development and Public Works, Department of Industry and Electricity.

c Including margarine; vegetable shortening; peanut butter; and peanut, maize and sesame oils.

70 per cent. Thus, virtually one third of Peru's capacity is idle. Under optimum conditions, the industry could process some 245 000 tons of seed, which would give 41 500 tons of oil annually, i.e., almost 75 per cent of Peru's current consumption of edible fats.

The chief obstacle is the shortage of oil-seed. The fact that cotton-seed is the only available source of oil means that the domestic edible oil industry is extremely dependent on cotton growing.[30] It would therefore be advisable, while cotton planting is being expanded and other oil-bearing crops sown for the first time,[31] to import crude oil, instead of fatty end products, which could be processed in Peru and thus employ the current surplus output capacity.

There are two methods of manufacturing cotton-seed oil[32] which are often combined: expellers and extraction by means of solvents. Sixty-five percent is produced by using both systems together, i.e., expellers are used for the first extraction and solvents are then applied to the resulting cake.[33] Thirty-five per cent of the output is obtained by the use of expellers alone. The old system of hydraulic presses has disappeared owing to its low extraction yield and the large amount of labour required.

The 12 factories have 271 employees and 1 546 manual workers. Average productivity, including the preparation of vegetable shortening, is 205 litres per direct man/hour. In the United States it is 250 litres, which means that the Peruvian industry works at 80 per cent of the United States level of productivity. The figure is high for local industry and any difference that still remains between this and the United States figures is due almost entirely to the large average size of plants in the latter country.

The labour force accounts for 5 per cent of the sales prices of oil in the factory.[34] This small percentage illustrates the high level of technique which has been achieved, especially in the last few years. Half of the labour force, including the foremen, is considered to

Table 72

PERU: GEOGRAPHICAL DISTRIBUTION OF THE COTTON-SEED OIL INDUSTRY BY NUMBER OF FACTORIES AND PRODUCTION CAPACITY

Location	Department	Number of factories [a]	Production capacity (Percentage of total)
Piura	Piura	3	30
Huacho and Chancay	Lima	2	15
Lima	Lima	3	30
Cañete	Lima	1	10
Pisco and Ica	Ica	2	15

SOURCE: Direct research.

a In the district of Mainas, in the department of San Martín, a small plant was recently set up with an annual capacity amounting to 6 600 tons of seed, and equipped for the manufacture of cotton-seed and peanut oils.

30 The shortage of supplies is bound up with the problem of the constant rise in the price of seed, while the prices of the industry's products and by-products have risen much less. Between 1954 and 1957 the following increments took place:

	1954	1957
Cost of seed	100	170
Cost of oil production	100	140
Sales price of oil	100	118

As gross profits are sometimes not enough to provide reserves for adequate amortization, especially in the case of new plants, the industry may run into financial difficulties in finding the investment capital required for the constant modernization of the plants.

31 Apart from sunflower-seed and peanuts, which might become important sources of oil, conditions are suitable for the cultivation of sesame, soya bean and colza. The prospects are particularly encouraging for sesame; its average yield per hectare is 1 500 kilogrammes, with a 50-per-cent oil content.

32 Cotton-seed yields 17 per cent oil, 50 per cent cake, 31 per cent husk and 2 per cent fluff. After defluffing, 0.6 per cent of fibre is left in the husk. This husk and fibre residue is used as fuel and its calorific value is equivalent to one-fifth of its weight in petroleum.

33 The cake left by the expellers contains 8 to 12 per cent oil. After being treated with solvents, the oil content is 2 to 3 per mil. This flour has a protein content of almost half its weight and is suitable for human consumption. It can be used in baking up to an amount equivalent to 5 per cent of the weight of the flour.

34 At present 7 000 soles per ton.

be skilled. The period of training is estimated at two years apprenticeship in the factory. The relatively small number of manual workers and the fairly low level of training means that labour will present no problem as regards the future expansion of the edible oils industry.

Fish oil has recently begun to be utilized for foodstuffs, as may be seen from table 71. There are two plants in Peru which process the oil for this purpose. The procedure consists of the neutralization, refining and hydrogenation of oil, in order to remove the smell and prepare it for mixing with other oils and fats. The installed processing capacity is 2 500 tons annually; in 1956, 1 750 tons were utilized, which indicates that the utilization coefficient for this branch of the industry is 70 per cent.

Among edible fats, lard shows the most marked gap between output and consumption; production increased 8 per cent between 1946-50 and 1951-56, whereas consumption expanded 96 per cent owing to an increment of 200 per cent in the import quantum.[35]

There has been no appreciable expansion in margarine production either, which remains at an annual level of some 800 tons,[36] although it might well be increased in order to reduce the domestic butter deficit.[37]

8. *Cacao and its derivatives, tea and coffee processing*

Peru is a producer of cacao, tea and coffee. It imports a certain amount of cacao and derivatives, and exports its surplus coffee which up to now has found a good market abroad.

(a) *Cacao and its derivatives*

Industrial statistics cover only the 15 most important enterprises in Peru, which in 1955 recorded a total output of 3 125 tons of cocoa and chocolates. But production estimated on the basis of domestic cacao consumption considerably exceeds that figure (see table 73), which implies that a little over 60 per cent of Peruvian production is at the artisan level and that the techniques used are unsatisfactory. These facts, together with the structure of demand—which necessitates the manufacture of a high proportion of low-priced goods—have led to the predominance of the ordinary type of chocolate in total production. Nevertheless, some factories do turn out higher-quality goods at an estimated volume of some 15 per cent of domestic production and 60 per cent of internal consumption of high-quality chocolates.

[35] Lard imports are given extremely favourable treatment, since an *ad valorem* tax of 9.5 per cent is levied instead of customs duties.

[36] In 1956, margarine production was 813.5 tons.

[37] As Peru does not produce sufficient milk and fats for use in the processing of margarine, any plant operating on a large scale would have to import these commodities. It is estimated that with a fixed investment of some 300 000 dollars in buildings and equipment and annual imports of 125 000 dollars of milk and fats, approximately 250 000 dollars worth of annual butter imports might be replaced.

Table 73

PERU: PRODUCTION AND CONSUMPTION OF CACAO PRODUCTS, 1945-56

(Tons)

Year	*Apparent consumption of cacao*	*Estimated production of chocolate and cocoa* [a]	*Imports of chocolate and cocoa* [c]	*Apparent consumption of cacao products*
1945	3 120	6 240	40	6 280
1946	3 919	7 838	55	7 893
1947	5 165	[b]	82	...
1948	3 263	6 526	28	6 554
1949	4 144	8 288	45	8 333
1950	4 216	8 432	270	8 702
1951	5 088	[b]	320	...
1952	4 337	8 674	325	8 999
1953	4 132	8 264	410	8 674
1954	4 127	8 254	310	8 564
1955	4 211	8 422	345	8 767
1956	4 267	8 534	480	9 014

SOURCES: *Banco Central de Reserva, Renta Nacional del Perú*; National Agricultural Association; and *Anuarios de comercio exterior, op. cit.*

a The yield from cacao beans is made up of 40 per cent defatted cacao; 35 per cent cocoa butter; and 25 per cent husk or, in other words, the useful yield of cocoa and clean cacao amounts to 75 per cent. A good-quality chocolate contains not less than 40 per cent of defatted cacao. In view of the average quality of ordinary domestically-produced chocolate a mean content of 20 per cent is assumed here.

b The figures for 1947 and 1951 are doubtful, since it is very probable that at the close of both these years, the producers, wholesalers or manufactures had stocks on their hands. As the size of these stocks could not be ascertained, it was felt preferable not to give figures for production in the years in question.

c Tare: 50 per cent.

As the domestic raw material is poor in quality, apparently because of faulty technique in the care of the cacao while it is ripening, the larger enterprises import cacao beans or paste to mix with the local product and improve its quality.

(b) *Tea processing*

Most of the tea consumed in Peru is domestic in origin. During the last five years imports covered an average of only 18 per cent of demand (see table 74).

The development of Peru's tea industry after the

Table 74

PERU: PRODUCTION, IMPORTS, EXPORTS AND CONSUMPTION OF TEA, 1945-56

(Tons)

Year	*Production*	*Imports* [a]	*Exports*	*Apparent consumption*
1945	61	338	...	399
1946	73	468	1	540
1947	109	533	1	641
1948	300	413	32	681
1949	230	607	...	837
1950	250	136	11	375
1951	636	332	...	968
1952	632	152	13	771
1953	607	132	17	722
1954	660	90	53	697
1955	777	175	33	919
1956	850	136	1	985

SOURCES: Ministry of Agriculture, Department of Agronomics; and *Anuarios de comercio exterior, op. cit.*

a For purposes of calculating the net weight of imports, the tare was taken to be 13 per cent for tea in bulk, 22 per cent for tea in packets and 53 per cent for tea in tins.

Second World War was impressive. Up to 1949, a large amount of imported tea arrived in Peru free of duty and constituted a serious obstacle to a more rapid expansion of domestic production. But once a protectionist tariff was applied, demand for domestic tea became intensive and led to an increase in cultivation. Production grew more rapidly than consumption and after 1957, when over 1 000 tons of tea were produced, the industry entered upon a phase of over-production.

The most important tea-growing areas in Peru are the valley of Concepción, in Cuzco, and the vicinity of Tingo María, in the central east. There are four large enterprises with complete modern machinery, and a number of small-scale growers who still process the leaves by primitive methods.

The agricultural aspect of domestic tea production presents no problem; the difficulties are to be met with at the industrialization stage. Owing to the lack of technical knowledge, the quality of the tea is uneven, which is an obstacle both to the discouragement of domestic demand for imported tea and to the sale of surpluses on the external market. In order to expand the market for domestic tea, it is essential to improve manufacturing processes and to fix standards of quality for production.

Table 75

PERU: PRODUCTION, IMPORTS, EXPORTS AND CONSUMPTION OF COFFEE, 1945-56

(Tons)

Year	*Production*	*Exports*	*Imports* [a]	*Apparent consumption*
1945. . . .	5 500	2 497	25	3 028
1946. . . .	4 700	912	28	3 816
1947. . . .	3 500	832	610	3 276
1948. . . .	3 500	21	693	4 172
1949. . . .	5 520	881	489	5 328
1950. . . .	5 600	1 035	143	4 708
1951. . . .	6 000	2 201	3	3 802
1952. . . .	8 899	2 581	17	6 335
1953. . . .	9 602	4 697	183	5 088
1954. . . .	9 552	4 571	102	5 083
1955. . . .	12 119	6 814	155	5 458
1956. . . .	13 800	7 057	336	7 079

SOURCES: *Banco Central de Reserva, Renta Nacional del Perú;* and *Anuarios de comercio exterior, op. cit.*

a The relatively small imports of coffee consist mainly of low-priced coffees from Bolivia which, despite tariff duties, compete with the domestic product in the local markets of Cuzco, Puno and Arequipo.

(c) *Coffee processing*

Peru is a net coffee exporter. From 1950 to 1956, it exported an average 44 per cent of its output and imported 2.5 per cent of its total domestic consumption (see table 75).

The main producer areas are Chanchamayo in the department of Junín, Quillabamba and la Convención in the department of Cuzco, Satipo in the department of Pasco and Jaén in the department of Cajamarca. The first three produce good-quality coffee, and the last two a medium-grade mainly for the domestic market.[38] At present more or less 55 per cent of the coffee grown in Peru is of exportable quality and the rest of medium grade.

There are some 25 enterprises in the country producing green coffee, of which the 7 most important supply 97 per cent of exports, and approximately 60 roasting plants operating for the domestic market.

The leading enterprises have lately made great progress as regards their equipment and technical knowledge. Yet coffee production in Peru still requires a large labour force as the berries are delivered for threshing with a great many impurities which necessitate separation by hand.[39]

Over the short term, there will probably be a glut on the world coffee market, which may lead to a sharp drop in prices.[40] Since Peruvian output is fairly small, however, it will probably find a market abroad without much difficulty, although prices may be lower than the average recorded in the last three years.

[38] An agreement has been in force between the Government and the coffee-growers for the last six years, by virtue of which the latter undertake to sell coffee at a low price on the domestic market provided that they are allowed to export in the proportion of 2.5 quintals for each quintal sold in Peru. Exported coffee is dearer but is also of much better quality.

[39] According to data supplied by the Peruvian Association of Coffee-Growers (*Asociación de Cafetaleros del Perú*), the total labour force employed in coffee-growing and processing amounts to some 4 500 persons, of which 1 300 are engaged in the processing stage.

[40] In June 1957, Peruvian coffee for export was quoted at 64 dollars per quintal f.o.b. Callao, whereas in February 1958 the price had dropped to a little below 50 dollars.

II. BEVERAGE INDUSTRIES

Brewing is the most important branch of the beverage industries group as regards both the capital invested and the gross value of production. Next came soft drinks. The manufacture of wines and spirits, production of which has varied little in recent years, follows a good way behind.

1. *Beer*

Brewing developed to a notable extent during the last 12 years of the period under review. The average annual rate of expansion during 1945-56 was 10 per cent, one of the highest quantum increments in the various branches of manufacturing (see table 76).

There are eight breweries in Peru, two of which, situated in the Lima-Callao zone, account for more than three-quarters of the national output capacity (see table 77). During the summer months the industry works at almost full capacity; the average utilization coefficient for the whole year is estimated at 85 per cent.

The quality of the beer is quite good and production conditions are usually efficient.

Table 76

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF BEER, 1945–56

(Thousands of litres)

Year	Production	Imports	Consumption
1945	34 956	—	34 956
1946	36 158	—	36 158
1947	35 448	—	35 448
1948	31 634	—	31 634
1949	33 386	—	33 386
1950	44 436	7	44 443
1951	55 556	52	55 608
1952	66 264	108	66 372
1953	80 968	120	81 088
1954	92 266	12	92 278
1955	98 002	16	98 018
1956	98 462	405	98 867

SOURCES: *Caja de Depósitos y Consignaciones* and *Anuarios de comercio exterior, op. cit.*

Of the two principal raw materials used in brewing, malt is produced on a small scale but hops are entirely imported.[41] Peru's annual output of malt amounts to some 2 500 tons and is produced by three small establishments in the interior of the country. Imports of malt

Table 77

PERU: GEOGRAPHICAL DISTRIBUTION OF BREWERIES, BY NUMBER AND PRODUCTION CAPACITY

Department or province	Number of breweries	Production capacity (Percentage)
Arequipa	1	8.7
Cuzco	1	7.1
Huaraz	1	[a]
Huancayo	1	0.1
Lima	2	44.2
Callao	1	34.2
Trujillo	1	5.7
Total	8	100.0

SOURCE: Ministry of Development and Public Works, Industry and Electricity Department.
a Under 0.1 per cent.

(see table 78) are well on the way to being entirely replaced by domestic production, since, on the one hand, the area under barley is being enlarged, and, on the other, the installation of a modern plant near the capital, with an initial annual capacity for 12 000 tons of germinated barley, is nearing completion.

41 According to information received, some attempt has been made to grow hops in Peru, but nothing is known of the results obtained. Peruvian industry's chief supplier is the United States, and according to the *Anuarios de Comercio Exterior (Foreign Trade Yearbooks)*, in recent years the volumes imported were as follows:

Year	Tons
1950	53.4
1951	116.4
1952	127.6
1953	164.8
1954	188.5
1955	184.8
1956	202.6

Table 78

PERU: IMPORTS OF MALT,[a] 1946–56

(Tons)

Year	Volume
1946	5 521
1947	5 081
1948	3 409
1949	4 667
1950	5 921
1951	7 959
1952	7 585
1953	11 388
1954	11 204
1955	11 892
1956	11 815

SOURCE: *Anuarios de comercio exterior, op. cit.*
a The largest suppliers are Canada and Chile, which contribute 41 and 34 per cent of total imports respectively.

2. *Soft drinks*

Up to 1953, production of soft drinks showed a rapid upward trend. From then onwards it began to decline, and by 1956 had fallen 15.6 per cent below the peak 1953 level (see table 79), apparently because heavier sales taxes caused a partial contraction of demand.

The manufacture of soft drinks is fairly widespread in Peru. But the establishment of a few large enterprises in the main population centres for bottling under an internationally-known trademark and inter-provincial transport facilities, compelled several small procincial enterprises which were not in a position to compete to close down in the last few years of the period. The soft drinks factories in production at the present time number about 80, six of them bottling mineral waters only. Ten of the remainder, which are the largest establishments in Peru, bottle foreign brands of soft drinks. These are the most efficient plants in this branch of industry since they have the most up-to-date installations.

3. *Wine*

Wine production in Peru is stationary, showing no marked increments in quantity or improvements in

Table 79

PERU: PRODUCTION OF SOFT DRINKS, 1945–56

(Thousands of litres)

Year	Mineral waters	Carbonated beverages	Total
1945	7 858	11 283 [a]	19 141
1946	8 310	15 289 [a]	23 599
1947	9 015	25 424 [a]	34 439
1948	9 635	25 325 [a]	34 960
1949	8 562	25 818 [a]	34 380
1950	8 159	28 922 [a]	37 081
1951	9 652	33 406 [a]	43 058
1952	9 256	45 083	54 339
1953	9 104	52 485	61 589
1954	8 386	49 271	57 657
1955	8 766	46 440	55 206
1956	8 074	43 880	51 954

SOURCE: *Caja de Depósitos y Consignaciones* (Alcohol and Sugar Department).
a Estimates based on imports of concentrates.

Table 80

PERU: AREA UNDER VINEYARDS, AND PRODUCTION AND CONSUMPTION OF GRAPES

Year	Area under vineyards (Hectares)	Production (Tons)	Break-down of consumption (tons)	
			For wine and aguardiente [a]	For direct consumption
1945	9 315	43 688	39 360	4 328
1946	12 474	48 503	41 385	7 718
1947	11 357	53 264	45 404	7 860
1948	9 000	53 000	39 472	13 528
1949	9 000	57 000	43 275	13 725
1950	9 300	58 485	44 235	14 250
1951	9 385	63 258	48 258	15 000
1952	9 000	40 502	34 074	6 428
1953	8 290	41 221	36 200	5 021
1954	7 932	47 145	38 000	9 145
1955	7 550	45 437	37 000	8 437
1956	6 705	39 061	33 800	5 271

SOURCE: *Banco Central de Reserva, Renta Nacional del Perú (National Income of Peru).*

a Most wine producers also manufacture aguardiente, of which the good-quality types are made from grapes.

quality. The area under vineyards has decreased, and although statistics indicate an increase in productivity, production of grapes has followed a downward trend in recent years (see table 80).

Neither did consumption of wine increase between 1945 and 1956. The poor quality of the domestic product on the one hand, and the high price of imported wine on the other, restricted demand. Consumption closely followed the fluctuations of production, since wine imports represented barely 0.8 per cent of average consumption during the last 12 years of the period under consideration (see table 81).

Peru has about 60 wine presses, almost all of which obtain their supplies wholly or partly from their own vineyards; the largest are situated in the department of Ica, which contributes over 60 per cent of Peru's output of wine (see table 82).

Although it must be acknowledged that beer is a serious rival to wine in Peru for the reasons already given, consumption might undoubtedly be stimulated

Table 81

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF WINE, 1945-56

(Thousands of litres)

Year	Production	Imports	Apparent consumption
1945	10 926	70	10 996
1946	11 253	87	11 340
1947	11 967	88	12 055
1948	12 048	24	12 072
1949	11 566	21	11 587
1950	10 244	67	10 311
1951	10 308	118	10 426
1952	8 605	129	8 734
1953	7 531	94	7 625
1954	7 551	70	7 621
1955	10 858	87	10 945
1956	10 005	151	10 156

SOURCES: *Cajas de Depósitos y Consignaciones,* Collections Department (*Departamento de Recaudación*); and *Anuarios de comercio exterior, op. cit.*

Table 82

PERU: GEOGRAPHICAL DISTRIBUTION OF WINE-PRESSES AND WINE PRODUCTION

Department	Number of wine-presses	Production (Percentage)
Ancash	2	0.8
Lima	30	30.3
Ica	21	63.3
Moquegua	1	1.5
Tacna	6	4.1

SOURCE: Ministry of Development and Public Works Department of Industry and Electricity.

if the quality of domestically-produced wine were improved to an appreciable extent.[42]

4. *Spirits*

The production of spirits in Peru expanded rapidly up to 1951. Thenceforth production and consumption levels seem to have remained unchanged (see table 83), probably for the same reasons as in the case of wine. Throughout the period 1945-56, imports of spirits accounted on an average for about 20 per cent of consumption; they showed a rising trend from 1950 onwards, and in 1956, their value exceeded 800 000 dollars.

Table 83

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF SPIRITS, 1945-56

(Thousands of litres)

Year	Production	Imports	Apparent consumption
1945	733.8	256.6	999.4
1946	966.3	255.2	1 221.5
1947	1 096.3	343.5	1 439.8
1948	1 001.0	134.8	1 135.8
1949	1 102.8	97.4	1 200.2
1950	992.9	206.8	1 199.7
1951	1 146.7	252.9	1 399.6
1952	1 132.0	372.8	1 504.8
1953	1 132.9	413.9	1 546.8
1954	1 178.3	268.1	1 446.4
1955	1 161.0	280.2	1 441.2
1956	1 141.2	445.9	1 587.1

SOURCES: *Caja de Depósitos y Consignaciones,* Alcohol and Sugar Department; and *Anuarios de comercio exterior, op. cit.*

Of the 36 enterprises installed in Peru—which absorb 22 per cent of the national output of wine—only six have the technique and other requisites needed for the production of spirits of acceptable quality. Operating conditions are not very satisfactory in the remainder and the quality of their production is poor. It would therefore be a good plan to encourage the installation of enterprises manufacturing world-famous brands, which would provide, first and foremost, the technique needed in order to produce spirits of a quality such that they could partly replace imports.

42 The quality of Peruvian grapes and the experience of other countries where similar natural conditions are found suggest that possibilities of producing prime full-bodied wines might well exist in Peru.

III. TOBACCO MANUFACTURES

In recent years, the consumption of tobacco manufactures has been increasing at the slow rate of 3 per cent annually (see table 84).

During 1950-56 domestic production represented an average of 96 per cent of consumption. However, while the demand for domestic tobacco products increased in those six years by 14 per cent, that for imported manufactures went up by 206 per cent. The reason for this displacement of domestic tobacco is the poor quality of Peruvian cigars and cigarettes. If they do not improve considerably, the consumption of foreign tobacco products will probably go on rising, while domestic output will increase on a shrinking scale or stagnate.[43]

At the moment, there are two factories—one in Lima and the other in Iquitos—producing cut tobacco, cigarettes and cigars. The Iquitos factory turns out less than 5 per cent of domestic output. The rest comes from Lima where the plant may be considered 50 per cent modern, 25 per cent out of date but workable, and 25 per cent obsolete and inefficient.

The industry employs 844 persons distributed as follows:

	Total	*Technicians*	*Employees*	*Foremen*	*Direct workers*	*Others*
Lima . . .	804	2	147	8	474	173
Iquitos. . .	40	1	9	2	11	17

During the last ten years, on the average, 86 per cent of the raw material used has been of Peruvian origin. The rest was imported and consisted mainly of United States light tobacco.

[43] In 1956 the production of cigarettes fell by 18 per cent and that of cigars by 26 per cent as compared with 1955.

In 1956, the Lima factory produced 2 034 236 000 cigarettes and 1 102 000 cigars in 289 working days. Considering the capacity of the plant,[44] this gives an efficiency of 42 per cent; with completely modern equipment, the coefficient would be considerably less.[45]

Labour productivity is reckoned at 1958 physical units per direct man/hour and at 1 400 per total man/hour. This figure is very low and is due to over-employment in Peruvian factories.[46]

The standard of domestic production, both with respect to the raw material and the manufacturing process, is low. It must be improved if import substitution is to become effective. The annual average value of tobacco imports amounted to about one million dollars in 1950-56.

By virtue of an Act of 22 February 1904, the Government assumed a monopoly of the production and sales of tobacco manufactures. It was repealed in June 1955 but no workable formula has yet been evolved for liquidating the monopoly.

[44] The Tobacco Monopoly's factory in Lima has the following machinery: 4 cutting, drying and cooling lines each producing 360 kg per hour; 10 extra rapid cigarette machines each producing 1 500 units per minute; 22 rapid cigarette machines each producing 900 units per minute; 14 new packing machines each for 250 packets a minute; 4 old packing machines each for 110 packets per minute; 4 old cigar machines producing 1 250 units every 8 hours.

[45] In recent years, progress has been made in the design of tobacco-processing equipment. Although only small improvements have been made in the cigar- and cigarette-making machines, the feed systems have been considerably mechanized and the new machines are somewhat more rapid. Another important innovation has been the mechanical removal of fibres, with a consequent saving in staff. Advances have also been made in the mechanization of transport within the factory and in the cutting and packing stages.

[46] In other countries, the production increase has been accompanied by manpower reductions. For example, in the United States, between 1939 and 1950, output rose from 181 000 million units to 392 000 million but the input of man/hours dropped by 27 per cent.

IV. TEXTILE INDUSTRIES

1. *Production and consumption of yarns and fabrics*

Textile manufactures constitute the second most important industrial group in Peru after the processing of foodstuffs. According to the Census of Industrial Establishments *(Padrón de Establecimientos Industriales)* of the Department of Industries and Electricity *(Dirección de Industrias y Electricidad)*, there were 262

Table 84

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF TOBACCO MANUFACTURES, 1950-56

(Tons)

Year	*Production*			*Imports*			*Total consumption*
	Cut tobacco	*Cigarettes*	*Cigars*	*Cut tobacco*	*Cigarettes*	*Cigars*	
1950	0.6	3 389	3.7	6	75.3	1.1	3 475.7
1951	0.6	3 264	3.6	4	79.9	1.1	3 353.2
1952	0.6	3 457	3.8	10	98.1	1.4	3 570.9
1953	0.6	3 600	3.1	5	142.7	2.0	3 753.4
1954	0.6	3 823	2.7	4	176.5	2.5	4 009.3
1955	0.7	3 841	2.8	7	211.5	3.0	4 066.0
1956	0.6	3 853	2.4	4	244.6	4.0	4 108.6

SOURCE: *Caja de Depósitos y Consignaciones*, Tobacco Monopoly (*Estanco del Tabaco*).

Table 85

PERU: BREAK-DOWN BY AREA AND BY ACTIVITIES OF MILLS AND STAFF EMPLOYED IN THE TEXTILE INDUSTRY [a]

Department	Number of mills					Staff employed				
	Total	Yarns and flat fabrics	Knitted fabrics	Cordage	Others	Total	Yarns and flat fabrics	Knitted fabrics	Cordage	Others [b]
Arequipa	11	5	6	—	—	1 481	1 306	175	—	—
Cuzco	4	3	—	—	1	1 057	835	—	—	222
Ica	2	1	1	—	—	305	237	68	—	—
Junín	13	3	9	—	1	2 305	1 156	149	—	1 000
La Libertad	4	—	3	—	1	250	—	229	—	21
Lambayeque	2	—	1	—	1	187	—	12	—	175
Lima-Callao	223	89	115	11	8	17 978	13 478	4 089	308	103
Piura	1	1	—	—	—	97	97	—	—	—
Tacna	1	1	—	—	—	27	27	—	—	—
Total	261	103	135	11	12	23 687	17 136	4 722	308	1 521

SOURCE: Ministry of Development and Public Works (*Ministerio de Fomento y Obras Públicas*), Department of Industries and Electricity (*Dirección de Industrias y Electricidad*).

a The figures relate to registered industry. There is an appreciable indigenous output, particularly in woollen articles; the staff employed in such processing and its probable value are not covered by the statistics.

b Including the manufacture of felt and interlining and the recovery of fibres from waste and rags.

Table 86

PERU: CONSUMPTION OF TEXTILE MANUFACTURES, 1951–56

(Tons)

Year	Cotton articles	Woollen articles	Articles made of artificial fibres	Net external trade balance in made-up articles	Total apparent consumption
1951	11 357	1 699	1 741.5	39	14 838.5
1952	12 312	1 621	1 418.5	341	15 692.5
1953	13 267	1 645	1 550.0	369	16 831.0
1954	15 541	2 097	2 421.0	470	20 529.0
1955	14 381	2 148	2 791.0	278	19 598.0
1956	14 529	2 080	3 242.5	346	20 197.5

SOURCE: *Cámara Algodonera del Perú, Memoria Anual; Anuarios de comercio exterior; Banco Central de Reservas, Renta Nacional del Perú*; Ministry of Development and Public Works, Department of Industries and Electricity.

Table 87

PERU: PRODUCTION AND APPARENT CONSUMPTION OF FINISHED COTTON ARTICLES, 1945–56

(Tons)

Year	Production			Imports [b]	Exports	Apparent consumption
	Consumption of domestic cotton	Imports of yarn for fabric	Production of finished articles [a]			
1945	11 500	469	10 588	366	138	10 816
1946	11 114	516	10 295	425	139	10 581
1947	12 006	416	10 980	720	103	11 598
1948	13 683	85	12 126	407	93	12 440
1949	14 530	58	12 844	1 385	72	14 157
1950	12 429	75	10 853	889	234	11 508
1951	12 835	107	11 402	1 277	1 322	11 357
1952	12 121	107	10 767	2 222	677	12 312
1953	13 680	124	12 161	1 156	50	13 267
1954	15 914	52	14 056	1 527	42	15 541
1955	14 851	50	13 119	1 296	34	14 381
1956	14 841	57	13 117	1 560	148	14 529

SOURCE: *Cámara Algodonera del Perú* and *Anuarios de comercio exterior, op. cit.*

a The series has been obtained on the basis of the figures for cotton consumption by the mills and of yarn imports for weaving, a loss of 12 per cent being estimated in the first case and a loss of 2 per cent in the second.

b Excluding imports of made-up cotton articles because the statistics do not distinguish between types of fibre.

Table 88

PERU: PRODUCTION AND APPARENT CONSUMPTION OF FINISHED WOOLLEN ARTICLES, 1951-56
(Tons)

Year	Production				Imports [b]	Exports	Apparent consumption
	Consumption of domestic wool and hair	Imports of washed wool	Imports of wool yarns	Production of finished articles [a]			
1951	4 953	54	27	1 339	390	30	1 699
1952	4 658	23	45	1 364	365	108	1 621
1953	5 092	26	44	1 487	213	55	1 645
1954	7 068	29	27	2 025	190	118	2 097
1955	6 656	59	26	1 930	241	32	2 148
1956	6 350	61	36	1 856	244	19	2 080

Source: Ministry of Development and Public Works, Department of Industries and Electricity, and *Anuarios de comercio exterior, op. cit.*
a Production has been calculated assuming losses of 72 per cent for consumption, 32 per cent for washed wool imports and 2 per cent for wool yarn imports.
b Excluding imports of made-up wool articles for the reason explained in table 87, note b.

textile mills registered on 31 August 1956, employing 23 837 persons. They may be broken down by area and by activities as shown in table 85.

Textiles form one of the sectors in which artisan work is most common, particularly in the Peruvian sierra. This artisan production is not covered by statistics so that the production and consumption figures for Peruvian textiles are understated, particularly when expressed in *per capita* terms.

Between 1951 and 1956, the registered consumption of textile manufactures [47] increased at an annual rate of 6 per cent, a figure which must be considered satisfactory although not fully adequate in the light of the low average levels of consumption (see table 86).

Between 1945 and 1956, the consumption of cotton articles grew at the rate of 2.8 per cent per year and production at the rate of 2 per cent per year. As a result, the cotton industry lost its footing on the domestic market. These unequal rates of growth occurred because the very fragmentary demand for quality articles has been met to a large extent with imported fabrics. During the whole period 1945-56, except for 1951, Peru has been a net importer of cotton textiles. The year 1951 was an exception because of the heavy demand from the Argentine market which enabled factories to export 1 100 tons of yarn and 220 tons of fabrics (see table 87).

For woollens, the annual rates of increase between 1951 and 1956 [48] were 4 per cent in respect of consumption and 7 per cent in respect of production, a fact which indicates that partial import substitution was effected (see table 88).

Artificial fibres registered the most important increase. Between 1945 and 1956 consumption climbed at the annual average rate of 17.5 per cent as the result of an intensive demand for popular cut-fibre articles, especially in the last five years (see table 89).

The consumption of hard fibre manufactures also showed a marked increase which averaged 12 per cent in 1951-56. During this same period, domestic produc-

47 Except hard fibres.

48 Figures prior to 1951 are not reliable.

Table 89

PERU: PRODUCTION AND APPARENT CONSUMPTION OF FINISHED ARTICLES MADE OF ARTIFICIAL FIBRES, 1945-56
(Tons)

Year	Production				Imports	Apparent consumption
	Total	Of filament		Of cut fibre		
		Total	Domestic filament	Imported filament		
1945	322.3	319.5	—	319.5	2.8	129.0	451.5
1946	503 6	483.1	—	483.1	20.5	28.0	532.0
1947	789.7	730.1	194.0	536.1	59.6	243.5	1 033.5
1948	646.2	443.4	307.2	136.2	2.8	143.0	589.5
1949	553.6	552.7	552.7	—	0.9	135.0	689.0
1950	997.5	826.2	638.0	188.2	171.3	71.0	1 166.5
1951	1 533.3	1 262.3	598.8	663.5	271.0	209.0	1 741.5
1952	1 196.5	1 064.3	590.0	474.3	132.2	222.0	1 418.5
1953	1 414.5	1 195.6	616.4	572.2	218.8	136.0	1 550.0
1954	2 290.9	1 577.8	980.0	597.8	713.1	130.0	2 421.0
1955	2 578.9	1 304.4	1 171.1	133.3	1 274.5	187.0	2 791.0
1956	3 133.8	1 258.8	1 117.7	141.1	1 875.0	109.0	3 242.5

Source: Producing enterprises and *Anuarios de comercio exterior, op. cit.*

Table 90

PERU: PRODUCTION AND APPARENT CONSUMPTION OF HARD FIBRES, 1951–56
(Tons)

Year	Imports of manufactures				Domestic production [a]	Apparent consumption
	Total	Sacks	Burlap	Pita		
1951	8 057	7 062	796	199	158	8 215
1952	12 715	11 581	816	318	94	12 809
1953	14 996	13 614	967	415	365	15 061
1954	7 788	7 115	531	142	286	8 076
1955	12 698	11 951	616	131	733	13 431
1956	13 492	12 641	715	136	805	14 297

SOURCE: Ministry of Agriculture (*Ministerio de Agricultura*), Department of Agronomics (*Dirección de Economía Agropecuaria*), and *Anuarios de comercio exterior*, *op. cit.*
a Calculated on the basis of production and imports of fibre with an average yield of 90 per cent.

tion increased fivefold, although in 1956 it covered only 6 per cent of demand (see table 90).

2. *General considerations on the domestic textile industry*

There are no large textile mills in Peru. Only one factory has more than 20 000 spindles and only four have more than 500 looms (see table 91).

Much of the equipment is obsolete. Only 25 per cent of the total number of spindles are of long draught; somewhat less than 55 per cent of the looms are automatic. However, there is a marked trend towards modernization with a view to reducing the high costs of operating antiquated machinery.

Few mills have balanced equipment. There are usually too many looms in relation to spindles. Spinning mills sometimes have too many or too few carding machines for the capacity of the spinning machines.

Machinery lay-out is not always rational. Lighting is often unsatisfactory, while in some mills humidity control and dust absorption are poor. Such disadvantages reduce the output of both staff and machines.

The productivity of both labour and machinery is fairly low, especially in mills turning out wool yarns and fabrics, where old-fashioned equipment predominates.

Most of Peru's textile mills are now facing problems which so far have not arisen in other industries. They mainly concern worker-employer relations, markets and raw materials.

(a) *Worker-employer relations*

This is one of the acutest problems for which an urgent solution must be found. Existing legislation does not favour the fixing of rational work-loads.[49] Even in modern mills the number of spindles run by each spinner and the number of looms worked by each weaver are far below those obtaining in the industrialized countries, a fact which has an unfavourable effect on costs and on the ability to compete in foreign markets.[50] Moreover, industrialists are not given sufficient leeway to adjust the volume of production to

49 Mill-owners point out that the impossibility of increasing work-loads impedes the modernization of equipment.

50 There are, however, certain exceptions observable in a few modern mills which operate with work-loads similar to those of the best factories abroad.

Table 91

PERU: AVERAGE SIZE OF MILLS PRODUCING YARNS AND FLAT FABRICS OF COTTON, WOOL AND ARTIFICIAL FIBRES

Yarns			Fabrics		
Mills	Spindles	Production capacity (Percentage)	Mills	Looms	Production capacity (Percentage)
		COTTON			
13	Less than 5 000	20.5	4	Less than 100	7
7	5 001 to 10 000	32.0	5	101 to 250	23
6	10 001 to 20 000	41.5	5	251 to 500	39
1	Over 20 000	6.0	4	Over 500	31
		WOOL			
6	Less than 1 000	7.5	6	Less than 50	19
7	1 001 to 5 000	57.0	3	51 to 100	32
3	Over 5 000	35.5	3	Over 100	49
		ARTIFICIAL FIBRES (*filaments*)			
			9	Less than 50	9
			6	51 to 100	42
			2	Over 100	49

SOURCE: Direct information.

fluctuations in demand. In some cases, inventories of finished articles in the mills have far exceeded levels normally considered as maxima. Hence, textile enterprises have found themselves in a fairly difficult financial position. As the resistance of workers to any loss or cut in their wage is completely justified, this problem appears insoluble unless the measures taken form part of a co-ordinated programme of industrial development so that workers ousted from the textile industry find employment in other industrial activities.

(b) *The market*

The Peruvian market is potentially large but in practice small. Competition in textiles is strong but does not come from imports.[51] Rather, mills compete with each other, so that in recent years the price of domestic articles has not risen very much. However, as there is no proper collective bargaining, wages in textile enterprises are competitive and here new factories enjoy an advantage because they may fix heavier work-loads but pay the same wages.

As is logical in a country where most of the population have low incomes, the domestic market reacts very sensitively to price fluctuations. The bulk of the production is therefore of medium or low quality. The margin for import substitution is not large; in terms of volume, it is reckoned at 9 per cent for cotton products, 9 per cent for woollens, and 21 per cent for artificial fibres. Hence, large increases in the short-term demand for domestic textiles seem unlikely unless their prices are cut or the purchasing power of the population is augmented by a more rapid growth or a better distribution of income.

Yet Peru might well export textiles because it has such first-class raw materials as extra-long-staple Pima cotton and alpaca hair. These commodities are exported unprocessed although they might be marked abroad as semi-finished or finished products, for example, as alpaca blankets, knitting yarns,[52] poplins woven with combed cotton yarns, wool and alpaca carpets,[53] etc.

Organized exports of textiles would increase the volume of domestic production and reduce manufacturing costs for the benefit of Peruvian consumers. It would also be possible to employ more workers and thus partly reabsorb the labour surplus resulting from the modernization of existing equipment and the introduction of fair and rational contracts between employers and workers. Furthermore, the value added to the raw materials would remain in the country and foreign currency earnings would be increased. However, if the Peruvian industry is to acquire foreign markets on competitive conditions, it will have to modernize its equipment and eliminate out-dated equipment still in use, increase the productivity of labour and the efficiency of machinery, improve the quality of production and exempt textile exports from customs duties.[54]

(c) *Raw materials*

Generally speaking, the industry has no difficulty in obtaining the right quantity and quality of raw materials but prices are high.

Raw cotton is expensive because the fibre is of prime quality. That would be no disadvantage if the factories turned out high-class goods but, as about 60 per cent of their output is of ordinary standard, the raw material works out relatively dear, although fibre consumed in Peru is not subject to equivalent export duties. Domestic production absorbs some 9 500 tons of ginned cotton of the Tanguis type, the export price of which was 836 dollars per ton in July 1957. If, instead, Peruvian mills used short-staple cotton, of the United States or Central American type, free of import duties, priced at 653 dollars per ton, c.i.f. Callao, the country would acquire additional foreign currency earnings of 1 740 000 dollars in respect of the 9 500 tons.[55] At the same time, the cost of ordinary domestic textiles could be cut by 5 per cent.[56]

In the case of wool, the difficulty is one of supply,

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51 Customs tariffs for yarns and fabrics are high and protect the domestic industry from foreign competition, as may be seen from the following examples:

Item	*C.i.f. value*	*Duties*	*Total cost*	*Price of similar domestic product*
Cotton yarn 1/16, soles k/g .	22.80	25.20	48.00	29.00
Cotton fabric 110 gr/m 80 × 80 36 in, soles/m	5.25	4.94	10.19	6.25
Viscose taffeta 120 gr/m 36 in, soles/m	5.20	25.73	30.93	12.00

During 1958, this protection was extended even further as a result of the rise in the dollar and also of increases in specific customs duties which were as high as 200 per cent of the duties levied in 1957.

52 As an illustration, Latin American imports of knitting yarn amount to some 2 300 tons a year. Of these, 1 550 tons go to the southern zone and 750 tons to Mexico, Central America and the Caribbean. Almost all of these supplies come from the United States and certain European countries.

53 In 1956, 2 330 tons of alpaca hair, valued at 83.1 million soles (i.e. at an average price of 35.6 soles per kg) were exported. The unit price of exported carpets in the same year was 78.8 soles per kg. If 25 per cent of the alpaca hair had been used for the manufacture of carpets for export, a large amount of foreign currency (equivalent to 25 million soles) would have been earned.

54 Act 10797 of 1947 raised the export tax on cotton to 50 per cent of the difference between the sales price and the basic production price fixed annually by the Government. Exports of cotton yarns and fabrics had been shipped to Argentina for only a few months when the same tax was applied to the fibre contained in exported manufactures. The levying of such a tax was perhaps inexpedient, since this was the first large-scale venture by the Peruvian industry into foreign markets and occurred at a time when domestic demand was limited. Moreover, the Act in question refers to fibre, and producers consider that its extension to include manufactured articles violated its original spirit.

55 These imports could be effected until short-staple cotton is successfully grown in Peru itself. For this purpose, suitable land appears to exist in some parts of eastern Peru and in the tropical zone around Cuzco.

56 Just before this study was completed, conditions changed. As the result of the rise in the dollar, the price of home-produced cotton on the domestic market became less than the price of imported cotton of somewhat shorter staple. However, this situation will presumably be only temporary, since the price in soles of Peruvian cotton on the domestic market will tend to rise to a new level to offset the decline in the value of the sol.

since the wool market is not organized in Peru. There is no wool agency which records trading operations, nor are there any grading centres. Wool is sold in lots which include all grades of wool as they occur in the fleece. Hence, every wool merchant has to have a sorting unit, which pushes up the cost of manufacture. A large proportion of the wool market is in the hands of middlemen who profit considerably from the differences in the prices paid by merchant and producer. The situation is so anomalous that wool for domestic consumption—which is not always the best since high-quality wools are exported—costs more than that sold abroad. It would seem desirable to fix wool grades based on international standards and to establish in the producing areas purchasing and sorting centres which can deliver to merchants lots of the quality and quantity they stipulate.[57] In this way, they would not have to make bulk annual purchases of unsorted wool and manufacturing costs could be cut.

Up to 1954, domestic output of rayon covered 60 per cent of a consumption reckoned at some 1 600 tons. As a result of the increase in customs duties, imports slumped by 76 per cent. As domestic production of rayon staple failed to fill the gap, Peruvian rayon in 1956 covered 89 per cent of a consumption estimated at only 1 285 tons.

Peruvian rayon is good but very dear. There is no reason why its price should be more than double that of rayon imported c.i.f. Callao.[58] As the domestic market is too small to foster competition—a viscose rayon factory needs to produce a minimum of 3 000 tons to operate economically—it might perhaps be wise to consider a less protectionist policy which would tend to normalize prices and stimulate the manufacture of rayon fabrics.[59]

3. *Cotton yarns and flat fabrics*

The cotton branch is the most important activity in the Peruvian textile industry. Ninety per cent of the installed capacity is to be found in Lima and is provided by 20 combined spinning and weaving mills (mostly with out-of-date equipment and relatively large) and eight mills for spinning only (generally small and modern). On the whole, the spinning mills are too small while the weaving mills are of normal size. However, there has been a tendency to reduce mill size. In 1950, the average mill contained 8 000 spindles and 420 looms but at present only 7 000 spindles and 300 looms.

Total spinning capacity is 195 360 spindles, of which 24 per cent may be considered technically as modern. By contrast, of the 6 081 existing looms, 61 per cent are automatic and the rest mechanical, although in practice some of them are new (see table 92). This technological gap between spinning and weaving has become wider in recent years; in 1950, the corresponding figures were 25 per cent for spinning machines and 35 per cent for looms. The probable explanation is that until recently the modernization of looms meant a more drastic reduction of labour per unit of production than the modernization of spinning machinery. But it should be remembered that the defective quality of yarn produced by out-of-date spinning machinery greatly impairs the efficiency of weaving mills, a fact which undoubtedly helps to explain the relatively poor average yield of Peruvian looms.

Table 92

PERU: SPINDLES AND LOOMS IN USE IN THE COTTON TEXTILE INDUSTRY

Spindles in use: 195 360 [a]		*Looms in use: 6 081*	
Modern	*Old*	*Automatic*	*Mechanical*
47 500	147 860	3 700	2 381

Source: Direct information.
a Six hundred are mules and 194 760 continuous.

The fact that there are only 32 spindles per loom, when there should be at least 41 for the type of product manufactured, indicates a lack of balance which compels the spinning machines of integrated mills to work longer than the looms. This situation must be remedied if plant utilization is to be increased and, above all, if finer fabrics requiring a higher ratio of spindles to looms are to be turned out.

Seven of the mills have machinery for combing cotton. Although the present output capacity for combed cotton is 3 000 tons a year—15 per cent of the domestic capacity for manufacturing cotton yarns—actual output is less. Indeed, so far, combing has been on a fairly small scale because the use of combed cotton yarns has been restricted to certain knitted articles and sewing thread.

The average type of product is coarse, the fact that the normal thread is No. 19 (English system) and the average fabrics is 150 grammes per square metre, with an average density of 40 threads per inch in the warp and woof.

The average productivity of the spinning mills is 2.37 kilogrammes per man/hour, or 36 per cent of the productivity which could be achieved with a completely modern plant of adequate size and with a good staff distribution. An analysis of this deficiency shows that on the average overstaffing by itself lowers productivity to 57 per cent.[60]

57 The *Banco de Fomento Agropecuario del Perú* and a control body for the wool market could play an active role.

58 The price of domestic rayon filament (150 denier) is 2.62 dollars per kilogramme and that for imported filament 1.30 dollars c.i.f. Callao.

59 Rayon manufacture is dealt with in greater detail in section XII of this chapter.

60 This figure is deduced from the following equation:

$$\text{Standard productivity} \times \frac{\text{Average actual efficiency}}{\text{Standard efficiency}} \times \text{Influence of mill size} \times \text{Influence of type of equipment} \times \text{Influence of excess labour} = \text{Actual productivity}$$

The values used are:

The causes next in importance are the lower efficiency at which the machinery operates (which by itself lowers productivity to 77 per cent), the influence of the use of old instead of modern machinery (which apparently diminishes productivity to 89 per cent) and the small size of installations (which apparently lowers productivity to 91 per cent).

The average productivity of the weaving mills is 2.1 kilogrammes of fabric per man/hour or 55 per cent of the output obtainable in normal conditions if all looms were modern and if labour were rationally distributed with respect to the machinery. An analysis of this deficiency reveals that the continued existence of outdated looms, even on a small scale, apparently brings productivity down to only 79 per cent of the standard productivity obtainable with modern machinery. The low average operating efficiency of the looms (69 per cent as against the standard 87 per cent) produces an effect of the same magnitude. The influence of overstaffing alone apparently lowers productivity to 88 per cent of what it would be with a rational staff distribution.[61]

(a) *Spinning mills*

Poor conditions and outmoded spinning machinery considerably reduce the efficiency of equipment in this branch. By producing low-quality yarn, they also affect the yield of the weaving mills which, being mostly modern, require high-quality yarn for normal operation. This fact alone justifies the proposal that Peru should speed up the modernization of its spinning-mills which, as has been seen, are technically out-of-date compared with the weaving mills. In any modernization programme allowance should be made for the present disequilibrium between spinning and weaving capacity. Hence, the establishment of larger spinning plant or the extension of existing plant should be encouraged. Both in the plant to be modernized and in existing modern mills an attempt should be made to distribute the staff more rationally, since overstaffing is the major cause of losses in productivity.

(b) *Weaving mills*

The low efficiency of the weaving mills may be due not only to defects in the thread but also largely to the lack of proper training for weavers and loom-mechanics. Although the old looms still in use are few, they have an appreciable effect on aggregate productivity since the number of mechanical looms that can be operated by one worker is eight or ten times less than in the case of automatic looms. For this reason, the relatively few old looms that remain should be replaced as soon as possible. Although the weaving mills, including those that are up-to-date, are in a better position than the spinning mills, they are also overstaffed. This defect may, however, be remedied by a more rational distribution of the work-load and more thorough training above all for weavers.

4. *Woollen yarns and flat fabrics*

There are 16 weaving mills in Peru producing wollen yarns and fabrics and two spinning mills turning out woollen and alpaca yarns only, which together contain 46 640 spindles and 809 looms.[62]

Fifty-one per cent of the spindles are of the mule type. Sixty-nine per cent of the spindles and 62 per cent of the looms are installed in the capital. Seven of the mills (with some 20 000 spindles) produce carded yarns only, and ten carded and combed yarns and fabrics. A little less than 9 per cent of the spindles are modern and approximately 5 per cent of the looms are automatic (see table 93).

Table 93

PERU: SPINDLES AND LOOMS IN USE IN THE WOOLLEN TEXTILE INDUSTRY

Spindles in use 46 640 [a]				*Looms in use* 809 [a]	
Mules		*Continuous*			
Modern	*Old*	*Modern*	*Old*	*Automatic*	*Mechanical*
1 500	22 260	2 640	20 240	54	755

SOURCE: Direct information.

a Excluding 1 820 mule spindles, 8 590 continuous spindles and 99 looms which were out of operation owing to economic difficulties in the enterprises at the time the survey was made (1957).

The lack of specialized production is due partly to the fact that carded goods represent a considerable part of internal demand and partly to the wool-marketing system, which forces manufacturers of combed goods to set up carding plants in order to make use of the different grades after sorting.

Standard productivity: 6.65 kilogrammes per man/hour (for No. 19 thread, with modern equipment, of optimum size).
Average actual efficiency: 0.69 (Peruvian spinning mills produce on the average 17.25 grammes of yarn per spindle/hour expressed in terms of No. 19 thread, although the machinery as a whole could produce some 25 grammes per spindle/hour).
Standard efficiency: 0.90.
Influence of mill size: 0.91 (for spinning machines of from 1 500 to 8 000 spindles, as deduced in the study, *Labour Productivity of the Cotton Textile Industry in Five Latin-American Countries* (E/CN.12/219, United Nations publication, Sales No.: 1951.II.G.2).
Influence of the type of equipment: 0.89 (deduced from the above document).
Actual productivity of labour: 2.37 kilogrammes per man/hour (obtained by direct measurement).

61 In the case of cotton fabrics, the corresponding terms of the productivity equation are:

Standard productivity: 3.83 kilogrammes per man/hour (for an average fabric of 40 × 40 density, of 1 350 warp threads and 150 grammes per square metre, woven with No. 19 thread).
Average actual efficiency: 0.69.
Standard efficiency: 0.87.
Influence of size: 1.00 (nil).
Influence of the type of equipment: 0.79.
Actual productivity of labour: 2.1 kilogrammes per man/hour (obtained by direct measurement).

62 Two mills, with 10 410 spindles and 99 looms, closed down in 1957 owing to economic difficulties.

(a) *Carded woollen yarns and fabrics*

The factories turning out carded woollen yarns and fabrics have 70 carding machines in all, each feeding 285 spindles, which makes a total of 20 000 spindles, mainly of the continuous type. This ratio is very low for the yarn count manufactured which is 7.5 metres on an average, since the norm would be about 450 spindles per carding machine, and is attributable to the old age and low yield of the dressing machinery.

Production in the spinning mills amounts to 210 grammes per spindle for an eight-hour shift, while at least 855 grammes with a metric count of 7.5 could be produced with modern equipment. The fact that yield is so low is due in part to the use of very small spinning bobbins which, since the yarns are fairly thick, necessitate frequent changes of spindles.

The number of looms for weaving carded woollen goods is estimated at 470, of which 250 are mainly used for blankets. Production per loom is computed at 1.95 metres per hour at an average weight of 500 kilogrammes per linear metre of material 1.65 metres wide on the loom. This hourly output represents an efficiency of 40 per cent with respect to the equipment available.[63]

(b) *Worsted yarns and fabrics*

Worsted is spun on some 24 000 spindles which are chiefly of the mule type. The dressing equipment includes 116 combing machines, approximately half being rectilinear and the other half circular. Weaving is done on 335 mechanical looms.

The average thread has a metric count of 32.5 and the average fabric consists of a piece of material weighing 350 grammes per linear metre and 1.60 metres wide on the loom, with 20-ply warp yarn per centimetre and 30-ply weft yarn with the same metric count as above. Production of yarn with a metric count of 32.5 per spindle is 68 grammes in 8 hours. With modern equipment operating at an efficiency level of 94 per cent, output would probably rise to some 210 grammes per spindle in the same length of time.

The weaving mills manufacture 1.4 metres per loom/hour; this represents an efficiency of 70 per cent for existing looms and of 55 per cent if all the looms were modern and ran for the same length of time as the current working shift.

(c) *Productivity in the woollen yarn and fabric mills*

As several mills spin and weave carded wool and worsted concurrently, there was not enough time to make separate estimates of productivity for carded wool and worsted in the spinning and weaving mills respectively. The figures obtained were aggregate estimates for the spinning and weaving mills and amounted to 0.885 kilogrammes of yarn and 1.54 metres of fabric per man/hour. The respective levels that could be obtained with standard modern equipment would be equivalent to 19 and 36 per cent only.[64]

The obsolescence of the equipment is mainly responsible for such low productivity indices. In comparison with the average efficiency of standard factories of a proper size fitted out with completely modern equipment, that of the machinery installed in Peru actually has a coefficient of 30 per cent for the spinning mills and 68 per cent for the weaving mills. In other words, the use of obsolete machinery is sufficient in itself to reduce labour productivity by 70 per cent in the case of dressing and spinning, and by 32 per cent in the case of weaving.[65]

5. *Yarns and flat fabrics of artificial and synthetic fibres*

Warp and woof weaving with artificial and synthetic fibres is carried on in 20 mills in Peru,[66] of which 17 use filament and 3 cut fibre exclusively. In all, there are 10 950 spindles and 1 050 looms (see table 94). All the spindles and 91 per cent of the looms are in Lima.[67]

Table 94

PERU: SPINDLES AND LOOMS USED IN THE MANUFACTURE OF YARNS AND FLAT FABRICS FROM ARTIFICIAL AND SYNTHETIC FIBRES

	Spindles: 10 950		*Looms: 1 050* [a]	
	Modern	*Old*	*Modern*	*Old*
Filament	—	—	420	437
Cut fibres	10 950	—	168	24

SOURCE: Direct information.
a At the time the survey was made 72 looms were out of operation.

(a) *Weaving mills using artificial and synthetic filament*

Most of the mills which have been modernized in recent years manufacture fabrics from artificial and

63 Looms for blankets, capable of 30 shuttle strokes per minute, operate at an average of 22 strokes; looms for other fabrics are capable of 100 strokes and make 42. As the work is generally divided equally between blankets and other carded woollen fabrics, the weighted average that might be expected is 80 strokes per minute whereas in actual fact the looms make only 32.

64 The productivity of a standard worsted spinning mill is estimated at 2.6 kilogrammes per man/hour and that of a carded wool spinning mill at 5.6 kilogrammes per man/hour. As Peru's total production is 30 per cent worsted and 70 per cent for carded wool, standard productivity in the country should be 4.7 kilogrammes per man/hour. A standard worsted weaving mill may be expected to have a productivity of 2.6 metres per man-hour and a standard carded wool mill, 5.0 metres. If the foregoing percentages are applied, an average of 4.3 metres per man/hour ought to be registered.

65 The following values were used in the productivity equations:

Formula: *Standard productivity per man/hour* × *Ratio of real efficiency to standard efficiency* × *Influence of size* × *Influence of type of equipment* × *Influence of surplus labour* = *Real productivity per man/hour*

Spinning mills: 4.73 kg × 0.80 × 0.91 × 0.30 × 0.85 = 0.89 kg
Weaving mills: 4.30 m × 0.61 × 1.00 × 0.68 × 0.85 = 1.54 m

66 Excluding 6 mills for rayon ribbon.

67 A modern plant with 2 000 spindles and 36 looms had not yet entered into production by mid-1957.

synthetic filament. This is chiefly because of the fact that wages represented a relatively high proportion of production costs in the old mills. The only way of changing the situation was to increase labour productivity by modernizing equipment. Labour productivity is now estimated at 10 metres of fabric[68] per man/hour, i.e. 50 per cent of standard output. The productivity equation shows that the use of old equipment which can still function, combined with the abnormally low level of efficiency, reduce productivity by 42 per cent ($1.00 - 0.79 \times 0.66/0.90$), while overstaffing diminishes it by only 14 per cent.[69]

One of the biggest problems facing domestic weaving mills using filament at present is the exorbitant price of the staple raw material, whether domestic rayon or imported filament. As the raw material represents 40 per cent of the cost of the fabric, its high price acts as a brake on consumption of fabrics woven from filament. This is one of the reasons why the weaving mills which previously used nothing but filament are now tending to employ more cut fibre, either alone or mixed with other types of thread in the composition of the fabric. Some mills currently use as much as 70 per cent cut fibre and 25 per cent filament.

(b) *Spinning and weaving mills using cut fibre*[70]

Of the three mills using cut fibre exclusively, two undertake both spinning and weaving and the third spinning only. The amount of cut fibre utilized in 1957 is estimated at 2 475 tons, of which 1 300 were used by the mills working with cut fibre exclusively and 1 175 tons by the factories manufacturing cotton and woollen yarns and fabrics, in which cut fibres are usually mixed.[71]

The equipment for producing cut fibre articles is the most up-to-date in Peru and the only defect is the inadequate output capacity of the spinning mills in comparison with that of the weaving mills.

The average English metric count of the yarn produced is 17.5, and the average fabric weighs 252 grammes per linear metre, 1.4 metres wide on the loom, with 34 warp and 16 weft threads per square centimetre.

Productivity in the spinning mills was 2.16 kilogrammes of yarn and in the weaving mills 10.2 metres per man/hour. These figures represent 36 and 49 per cent respectively of the productivity levels that may be attained in standard factories. What is primarily responsible for lowering labour productivity in the spinning mills is overstaffing which, as illustrated by the productivity equations,[72] reduces productivity by 49 per cent in the spinning mills and by 41 per cent in the weaving mills.[73] This situation is improving, however, as a result of the gradual improvements in mill organization.

6. *Hard-fibre yarns and fabrics*

Three hard fibres appear to have immediate possibilities in Peru: *cabuya* (agave), *kenaf* and jute. Flax had a certain amount of success years ago, but after a few harvests yields declined and production failed to pay its way.

(a) *Hard-fibre production*

Little is known in Peru about the cultivation of hard fibres. For this reason, it would be premature to express a definite opinion on the advantages or drawbacks of specific crops before a technico-economic study has been carried out on the possibilities of each.

Cabuya or *maguey* grows wild in different parts of the sierra and on coastal headlands. It is grown in the department of Huánuco, although still on a small scale. The annual volume produced is estimated at some 60 tons of dry fibre which is spun and woven in a small plant near Lima, and fibre yield is usually 4 per cent. The technique of obtaining the dry fibre is already well known, but the resulting product is suitable only for the manufacture of rope and very coarse materials.

Kenaf cultivation is still at the experimental stage. Tests are being made in the zone of Bagua, in the department of Amazonas, latterly on a large scale and with more resources. Five hundred hectares were planted with *kenaf* for 1958. This malvaceous plant has a cycle of about 130 days, but it should be alternated with other crops, such as those for green manure, castor-oil plants, *lactao*, etc., so that crops are rotated

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68 The average fabric produced by weaving mills using filament is 136 grammes per linear metre 0.96 metres wide on the loom.

69 The productivity equation for weaving mills using artificial and synthetic filament is as follows:

Formula: *Standard productivity per man/hour* × *Ratio of real average efficiency to standard efficiency* × *Influence of size* × *Influence of type of equipment* × *Influence of surplus labour* = *Real productivity per man/hour*

20 *metres of equivalent fabric per man/hour* $\times \frac{0.66}{0.90} \times$ 1.00 *(Nil)* $\times$ 0.79 * = 10 *m of equivalent fabric per man/hour*

* Value obtained by observing its influence in practice on average production, consisting of 60 per cent flat products, 25 per cent articles woven on dobby looms and 15 per cent articles off jacquard looms.

70 The analysis of this branch of the textile industry includes mills that produce yarns and fabrics from cut fibres only. However, other factories—mainly cotton mills—use cut fibre as well, mixed with their principal raw material.

71 It is important to note that the use of cut fibre in mixtures encourages an increase in cotton consumption, and wool consumption in particular. Hence, it should not be regarded by the manufacturers of traditional-fibre fabrics as a possible substitute.

72 The following values were used for the productivity equations:

Formula: *Standard productivity per man/hour* × *Ratio of real efficiency to standard efficiency* × *Influence of size* × *Influence of type of equipment* × *Influence of surplus labour* = *Real productivity per man/hour*

Yarns: 6 kg × 0.85 × 0.91 × 0.94 × 0.51 = 2.16 kg
Fabrics: 21 m × 0.85 × 1.00 × 0.96 × 0.59 = 10.20 m

73 The large variety of fabrics also influences productivity, but this factor was not taken into account in the calculations.

every 15 months until the cycle has been completed.[74] About 40 tons of green stalks are obtained per hectare sown, which give 8 tons (20 per cent) of strip after the outer skin is removed and 1.5 tons of dry fibre (3.8 per cent) after retting. It would be premature to form an opinion about *kenaf* cultivation in Peru; in other countries it has not always been successful owing to serious difficulties in retting on an industrial scale. Labour costs are likely to play a decisive part in the obtaining of *kenaf* fibre; if so, work in the field and fibre extraction should be mechanized if this promises to be successful.

Prospects for jute seem to be more encouraging. So far, however, the areas sown have been small—an average of about 50 hectares annually—and the harvest volume negligible, as may be seen from table 95 which indicates how much fibre is consumed in Peru.

Table 95

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF JUTE FIBRE, 1951-56

(Tons)

Year	*Production*	*Imports*	*Consumption*
1951	21.8	154.0	175.8
1952	5.5	82.0	87.5
1953	4.7	401.0	405.7
1954	30.3	287.0	317.3
1955	12.2	801.0	813.2
1956	31.5	803.0	834.5

SOURCE: Ministry of Agriculture, Department of Agronomics, and *Anuarios de comercio exterior, op. cit.*

Jute is cultivated along the river banks when the rivers are low. Yield ranges from one to more than two tons of dry fibre per hectare, according to the variety grown. The *Bambú* variety, obtained by selection in Iquitos, is now being propagated, since it gives a high yield per hectare. Production costs fluctuate between 3 900 and 2 400 soles per ton of fibre, according to yield, for crops cultivated without machinery. The sales price received by the producer —4 500 soles per ton—is the prevailing price in Iquitos for one ton of dry, clean, unclassified fibre. Each ton pays an extra freight charge of about 900 soles for transport to the transforming industries.

The unsatisfactory development of jute cultivation up to now has been chiefly due to: (1) the lack of technical knowledge among the small growers experimenting with its cultivation; (2) the shortage and bad distribution of seed; (3) the occasional temporary replacement of jute by other crops such as rosewood, mullein and castor-oil plants, etc., when world market prices for these products shot up for brief spells; (4) limited official help; (5) little economic assistance to planters; and (6) labour difficulties at harvest time when crops have to be harvested rapidly before the rivers rise.

All the same, there are weighty reasons for assuming that it would be worth while to encourage jute cultivation in the Peruvian Amazon zone. Natural conditions seem to be favourable, since they are similar in every respect to those in the part of Brazil where jute is grown successfully.[75] Moreover, if jute fibre could count on a guaranteed internal market, this would stimulate the economy of the department of Loreto which is now rather precarious, depending, as it does, mainly on a few export items with widely fluctuating prices. Intensive cultivation, combined with the facilities afforded by the highways which are now penetrating into the selva, would reduce the price of fibre which is high for industrialists. Domestic production would enable the foreign exchange currently spent on imports of jute manufactures to be saved. Lastly, raw jute and sacks, which were difficult to obtain during the world wars, would be permanently available.

(b) *Production of hard-fibre manufactured goods*

At present there are four enterprises utilizing hard fibres in Peru (three in Lima and one in Chiclayo), of which three use mainly jute and one *cabuya*. Installed equipment consists of 2 361 spindles and 71 looms, of which 70 and 30 per cent respectively are in the capital.

Productivity and efficiency data could only be obtained for the leading factory in Peru, which absorbs the entire raw fibre output. Productivity is 5.2 kilogrammes of yarn and 3.2 kilogrammes of fabric per man/hour, while efficiency is 92 per cent in the spinning mills and 66 per cent in the weaving mills, for two shifts a day during 285 days in the year. These figures are high since they tally with those of factories in the United Kingdom, and some continental European countries and certain mills in India and Pakistan.

Peru's actual productive capacity is estimated at 60 per cent of the figure which might be attained if work were continuous for 300 days in the year. More intensive utilization of equipment might raise current levels of production by two-thirds, thereby enabling imports of raw fibre and twine to be completely replaced by domestic production.

The industry should also start to manufacture sacks. Apart from being a realistic objective, this would provide an economic basis for the cultivation of jute or other hard fibres of advantage to Peru. But although production of sackcloth is based on imported fibres, it would seem worth while to continue, since 45 per cent of the total value of the sacks consists of the value added to the fibre in the manufacture of the fabric and the sacks.

7. *Knitted fabrics*

Knitted fabrics are produced throughout Peru. There are 173 registered establishments, of which 80 per cent are in Lima (see table 96).

[74] As the practice of crop rotation was not followed, flax yields declined.

[75] Jute production in Brazil has grown impressively in the last 20 years. From 9 tons of fibre in 1936 it reached 9 600 in 1946 and

Table 96

PERU: NUMBER OF MILLS AND MANUAL WORKERS EMPLOYED IN THE KNITTED FABRICS INDUSTRY

Department	*Number of mills*	*Number of manual workers*
Lima-Callao	139	3 200
La Libertad	4	230
Junín	18	200
Arequipa	8	205
Ica	1	70
Lambayeque	1	10
Cuzco	1	10
Amazonas	1	10
Total	173	3 935

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Establishments of the artisan type predominate in this branch; 45 per cent have less than 10, and 70 per cent less than 20 workers (see table 97).

This activity is widely dispersed because little capital or technical knowledge is needed to produce knitted fabrics. Any moderately skilled workman with initiative and a certain amount of capital can become an entrepreneur.

Most of the equipment is modern and is estimated to consist of 850 circular and 1 200 rectilinear machines. Over 95 per cent of the factories have their own workshops for ready-made clothing, since the domestic market for fabrics proper is very small. For this reason, no production data could be obtained.

The quality of the fabrics has greatly improved in recent years, but could be even better if the quality of domestic yarns were higher.

Consumption of knitted fabrics manufactured abroad is small in volume, owing to the high customs duties on imports. Competition within Peru is fierce, however, mainly because of the small workshops, which are not obliged to conform to the regulations for established industry and are thus in a position to compete in spite of the fact that production on a very small scale nearly always costs more. This clandestine production is perhaps the biggest problem confronting the knitted fabrics industry.

35 000 in 1956. Mallow cultivation is also being intensified; its fibre resembles that of jute and its annual production is now about 10 000 tons of dry fibre.

8. *Hosiery*

There are five stocking factories [76] and 58 sock factories in Peru, eight of which are large or medium-size and the remainder small. The average production of the small ones is under 10 000 dozen pairs per year. All the stocking factories and 95 per cent of the sock factories, representing 90 per cent of total production, are in Lima. Output is estimated at 8.5 million pairs (6.5 million pairs of socks and 2.0 million pairs of stockings) and, in comparison with imports,[77] equals about 95 per cent of registered hosiery consumption (see table 98).

It is estimated that 70 per cent of the raw material inputs are imported and consist chiefly of nylon yarns —low twist for stocking and high twist for "stretch" socks. Domestic raw materials consist of rayon yarns and mercerized cotton.

The equipment comprises circular machines for seamless hosiery and flat sectional machines for stockings with seams. Sixty per cent of the machinery was installed in the last six years, which explains why the volume of output increased and its quality improved so considerably between 1950 and 1956. In fact, the introduction of better machinery has led to a notable increase in output per machine, although fashion demands the use of increasingly finer yarns. This expansion took place in the stocking factories in particular, owing to the introduction of machines with a large number of needles and more sections which knit simultaneously.

Utilization of installed capacity is 80 per cent for an 8-hour shift. Theoretically speaking, production could therefore be trebled if a few additions were made

[76] A factory with an annual capacity of 50 000 dozen pairs, set up in Lima by domestic and foreign capital for the manufacture of women's hose with the same trade mark and under the supervision of a well-known United States company, had not yet entered into production in 1957.

[77] In order to convert import figures expressed in kilogrammes into dozens, six dozen pairs are assumed to equal one kilogramme of average imports.

Table 97

PERU: DISTRIBUTION OF KNITTED FABRIC MILLS BY SIZE

Area	*1–10 manual workers*	*11–20 manual workers*	*21–30 manual workers*	*31–50 manual workers*	*51–100 manual workers*	*Over 100 manual workers*	*Total*
Lima-Callao	60	36	13	13	11	6	139
Junín	12	4	—	1	1	—	18
Arequipa	5	—	—	—	3	—	8
Lambayeque	—	1	—	—	—	—	1
Cuzco	—	1	—	—	—	—	1
La Libertad	1	1	—	—	—	2	4
Amazonas	—	1	—	—	—	—	1
Ica	—	—	—	—	1	—	1
Total	78	44	13	14	16	8	173

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Table 98

PERU: HOSIERY IMPORTS, 1945–56
(Tons)

Year	Amount
1945	106.5
1946	132.7
1947	124.2
1948	27.1
1949	3.9
1950	29.9
1951	122.6
1952	58.0
1953	46.0
1954	51.2
1955	51.3
1956	33.5

SOURCE: *Anuarios de comercio exterior, op. cit.*

to equipment, but manufacturers do not seem interested in having more than one shift a day.[78]

78 In the United States, hosiery factories usually work two shifts a day, while some work round the clock in every section.

The industry is now suffering from a slight recession owing to the contraction of demand and the considerable inflow of hosiery from the south. It is unlikely, however, that the rate of increase of production—which was 10 per cent annually in 1945-56—will slow down in the next few years, since there is a broad potential market. If indigenous production and unregistered imports are taken into account, it is estimated that current *per capita* consumption is no more than one pair of hose per year. This figure is very low and should increase considerably as average *per capita* income rises and a greater proportion of the indigenous population is incorporated into the monetary economy.[79]

79 The figures for the United States give some idea of consumption in highly-developed countries. According to the National Association of Hosiery Manufacturers, the total for 1953 was 158.79 million pairs in 1953 with the following per *capita* break-down:

	Pairs
Socks for adults	12.8
Socks for children	6.6
Women's hose	14.6

V. FOOTWEAR AND MADE-UP TEXTILES

This is one of the manufacturing groups for which it is most difficult to obtain approximate estimates of production and consumption, owing to the large number of unregistered artisan establishments. It is estimated that in 1945-56 footwear production doubled, while that of wearing apparel and other made-up textiles increased three and a half times. Consumption was almost the same as production in the case of the former and slightly higher in the case of the latter. Garment imports, which, during the period in question represented about 7 per cent of consumption on the average, should be added to domestic production of wearing apparel and other made-up textiles (see table 99).

1. *Footwear*

Although small workshops at the artisan level predominate among footwear factories, it is estimated that they are responsible for only 30 per cent of production (see table 100). Output from registered establishments amounted to 4 114 million pairs in 1955,[80] and that of Peru as a whole at 5.5 million pairs. Eighty-six per cent consists of leather, and the rest of rubber, footwear (see table 101).

Vulcanized footwear is produced entirely in factories. Of total women's leather footwear, 25 per cent only is manufactured in factories and the rest in small work-

Table 99

PERU: IMPORTS OF MADE-UP TEXTILES [a], 1945-56
(Tons)

Year	Amount
1945	164
1946	209
1947	285
1948	137
1949	61
1950	154
1951	308
1952	246
1953	250
1954	213
1955	355
1956	319

SOURCE: *Anuarios de comercio exterior, op. cit.*
a Wearing apparel only.

Table 100

PERU: PERCENTAGE DISTRIBUTION OF FOOTWEAR PRODUCTION BY SIZE OF ESTABLISHMENT

Type of establishment	*Percentage of production*
Factories employing more than 15 manual workers	70
Small workshops making women's footwear	15
Other small workshops	15

SOURCE: *Sociedad Nacional de Industrias, Comité de Fabricantes de Calzado.*

Table 101

PERU: FOOTWEAR PRODUCTION BY TYPES, 1955
(Thousands of pairs)

Type	*Amount*
Leather footwear for men and children	2 590
Leather footwear for women	2 134
Vulcanized footwear	776
Total	*5 500*

SOURCES: *Ministry of Development and Public Works, Department of Industries and Electricity; Sociedad Nacional de Industrias, Comité de Fabricantes de Calzado.*

80 Industrial statistics record 64 establishments only, of which three are in the provinces.

shops, while 85 per cent of men's and children's leather footwear comes from factories and 15 per cent from artisan-type establishments.

Footwear consumption is very low in Peru. Its annual *per capita* figure is 0.55 pairs for all types, excluding *hojotas*—a kind of coarsely-made sandal used particularly by the rural inhabitants. The corresponding figure for leather footwear is 0.47 pairs *per capita*; this is so small that Peru is one of the countries with the lowest *per capita* footwear consumption.[81] Over 50 per cent of footwear consumption is concentrated in the capital. It may be inferred from the data supplied by manufacturers, however, that the annual rate of increase in sales is 5 per cent in Lima, 7 per cent in other coastal departments, 10 per cent in the sierra and 15 per cent in the selva. The rates of increase are therefore in inverse proportion to present consumption levels (see table 102).

Table 102

PERU: DISTRIBUTION OF FOOTWEAR CONSUMPTION BY AREA

(Percentages)

Zone	*Leather footwear*	*Vulcanized footwear*
Greater Lima	55	25
Other coastal departments	25	30
Departments in the sierra	18	40
Departments in the selva	2	5

SOURCE: Direct information.

(a) *Leather footwear*

As indicated in table 103, production is concentrated in the Lima-Callao zone to a far greater extent than consumption. For this reason, and given the characteristics of footwear manufacture, the industry's future development could well be decentralized.

Four techniques are used in the manufacture of leather footwear: welting (Goodyear), McKay process, cementing and nailing. Seventy per cent of domestic production, mainly footwear for men and children, is based on the first method; 20 per cent on the second and third methods, largely women's footwear, and 10 per cent on the fourth, which is the method chiefly applied in artisan-type workshops.

Table 103

PERU: DISTRIBUTION OF LEATHER FOOTWEAR OUTPUT CAPACITY BY AREA

(Percentages)

Department	*Output capacity*
Lima	80
Junín	5
Arequipa	3
La Libertad	2
Other departments	10

SOURCE: *Sociedad Nacional de Industrias, Comité de Fabricantes de Calzado.*

Utilization of productive capacity is low. It is estimated at 75 per cent of the level that could be reached after eight hours of efficient work, i.e., it is not even 30 per cent of potential output with a system of continuous work. In other words, output might be tripled without substantial investment in machinery.

Productivity amounts to 0.3 pairs per man/hour,[82] which is not even 40 per cent of the average figure in United States factories.[83] Production could therefore be raised as much as 150 per cent with no extra personnel, if labour productivity were to reach the same level as in the United States. These targets are difficult to attain in Peru, however, since such a reduction of man/hours per pair would require: (*a*) a heavy demand for footwear necessitating a high and stable level of production; (*b*) large orders for footwear of a specific type; (*c*) the simplification and limitation of styles;[84] (*d*) unlimited, and immediate availabilities of standard quality raw material; and (*e*) a well-trained and competent labour force.

More than 95 per cent of the raw material used is of domestic origin, the imported portion consisting chiefly of calf-skin for high-quality footwear. Domestic leather and soles do not always meet the requisite standards of appearance, softness, durability, etc., and their shortcomings affect footwear quality; sole leather in particular could be greatly improved since it is not always well tanned.

Footwear imports are small and do not affect domestic production. The average for the last five years was some nine tons—which is equivalent to about 15 000 pairs if each pair is estimated to weigh 600 grammes—since a large part of the imports consisted of women's footwear (see table 104). If this figure is compared with production, it is apparent that the latter supplies approximately 99.7 per cent of consumption.

Table 104

PERU: LEATHER FOOTWEAR IMPORTS, 1952–56

(Tons)

Year	*Amount*
1952	6.8
1953	8.6
1954	7.3
1955	10.2
1956	12.7

SOURCES: *Anuarios de comercio exterior, op. cit.*

81 Some annual *per capita* consumption figures for other countries may serve as a yardstick: United States 3.45 pairs, United Kingdom 2.80, Canada 2.71, Netherlands 1.68, Cuba 1.32, Brazil 1.05, Argentina 1.01, Mexico 0.92 and Venezuela 0.59.

82 This figure includes leather footwear of all types, since the number of establishments manufacturing a single model or using a specific technique is too small to warrant separate productivity indices.

83 In the United States, an average of 0.79 man/hours or 47 minutes work is required to make a pair of shoes, according to the average figures for 235 factories in 1947. The range varied from 12 minutes for low-priced footwear to 2 hours 15 minutes for high-quality men's footwear.

84 United States footwear manufacturers consider that the cardinal factor in lowering man/hour requirements during the war was the reduction in the number of styles. In Peru, fairly small factories manufacture more than 80 different styles at the same time.

The price ratio of domestic to imported footwear is about 1 to 1.5. Competition is strong but restricted to domestic producers, owing to the surplus of productive capacity over market size. This has kept footwear prices in Peru fairly low.

(b) *Vulcanized footwear*

There are four factories manufacturing rubber footwear, with a capacity of 5 400 pairs per 8-hour day, but plant utilization is only 45 per cent of capacity since demand is limited. Production could therefore theoretically increase sixfold, although extra equipment—especially calenders—would have to be provided in order to bring their productive capacity up to that of the vulcanizing machines.

All the factories are in Lima, and one turns out virtually 75 per cent of production.

There are three types of vulcanized footwear: leather and rubber, canvas and rubber, and all rubber. The approximate distribution of total production is 25, 60 and 15 per cent respectively.

Nearly all the raw material used is domestic; only 15 per cent of the rubber is imported and consists of synthetic material used in the manufacture of hard soles.

The quality of the production is good, although it could be improved, especially as regards appearance. Sales prices are fairly low and would drop even further if output were increased.

2. *Made-up textiles*

Although the knitwear garment industry is of fairly long standing in Peru, the development of the made-up textiles industry dates from the last 15 years only, when production in this branch began to gain momentum. Between 1945 and 1956, it more than trebled and doubled from 1952 to 1956.

Industrial statistics record 415 establishments, of which 80 per cent are in Lima (see table 105). About 165 manufacture knitwear and 250 make garments from flat fabrics. There is no clearly-marked line of demarcation between them, however, since several of the knitwear factories also make clothing from warp and woof fabrics.

Over 62 per cent of the registered establishments are of the artisan type and account for 12.4 per cent of production (see table 106).

Seventeen of the factories are responsible for more than 51 per cent of output and have the highest levels of efficiency and productivity. The following observations are nearly all based on that group since the remainder were too widely dispersed for a representative sample to be taken of them. Some that were visited had lower quality and productivity levels, attributable, in the case of productivity, to the over-diversification of production and also largely to overstaffing.

Most of the factories are of the integrated type and undertake all operations from the purchase of raw material to the sale of the finished product. They seldom work for third parties, and it is even more rare for them to undertake for others only one or a few of the operations required in manufacture.

The industry operates at 80 per cent of capacity with an eight-hour shift. Manufacturers are apparently not interested in organizing other shifts in proportion to the increase in demand, since they believe such a procedure to be incompatible with the maintenance of quality and production control.

Over 95 per cent of production is based on domestic raw material.[85] For some garments a certain amount of imports are required to provide the great variety of types and colours of material which it would be uneconomical for domestic factories to produce as demand for each style and colour is so small.

Seventy-five per cent of the equipment is modern, since the industry has only recently expanded. Individual high-speed machines which make the operations more flexible have been installed in most of the establishments.

The use of machines with two to three needles has spread to nearly every factory.

In spite of the large proportion of modern machinery, productivity is fairly low (55 per cent of the United States level for shirts and not more than 40 per cent for women's frocks and men's outer garments): as

Table 105

PERU: DISTRIBUTION OF NUMBER OF REGISTERED ESTABLISHMENTS AN OUTPUT CAPACITY IN THE MADE-UP TEXTILES INDUSTRY

Department	*Establishments (Number)*	*Manual workers (Number)*	*Output capacity (Percentage)*
Lima.	320	4 520	84
Other departments. . .	95	760	16

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Table 106

PERU: WORKSHOPS, PRODUCING MADE-UP TEXTILES, BY SIZE

Type of establishment	*Number of establishment*	*Number of manual workers*	*Volume of production (Percentage)*
Less than 5 workers. . .	203	508	6.1
6 – 10 workers. . .	56	436	6.3
11 – 20 workers. . .	53	788	12.8
21 – 50 workers. . .	44	1 421	23.4
51 – 100 workers. . .	10	684	20.5
101 – 200 workers. . .	5	607	7.7
More than 200 workers. . .	2	620	23.2

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

[85] One enterprise in Lima, which manufactures 60 per cent of its output with the trade mark and standards of a world-famous firm, reduced its imported material input from 60 to 20 per cent in 1954-57.

regards the manufacture of men's outer garments, it is equivalent to 65 per cent of the level reached in the factories at Barranquilla, Colombia. This low productivity level is attributable to the lack of skilled personnel, since production per machine in the ready-made clothing factories is not in direct proportion to speed, the volume of production depending on the worker rather than the machine. Only one third of the operating time of a sewing-machine consists of effective work. Hence, an increase in speed will not always reduce the working time to any appreciable extent. On the other hand, changes in the handling of the material and in its passage through the factories from one operation to another may result in more substantial reductions in man/hour consumption.[86]

Ninety per cent of the annual workers employed constitutes the direct labour force of which at least 80 per cent is skilled. Ready-made clothing factories are usually organized in four sections (cutting, sewing, folding and pressing, and packing). The work in each section comprises different operations, none of which is duplicated in the others, and the staff is generally specialized. In the cutting section, in particular, the workers have to be competent, since the cost of material and the appearance of the finished garment greatly depend on their ability. On the other hand, the staff in the sewing and finishing sections does not have to be as highly skilled since it is estimated that after four weeks a person with no previous knowledge of the work can handle an industrial sewing-machine, although he will need about a year before he can become really skilful. Finishing workers acquire sufficient skill in six months on an average. The major problem for the ready-made clothing factories is precisely the inadequacy of skilled labour both as regards quantity and quality. Highly-trained production workers are few and there is an acute shortage of maintenance workers as well, who have to be experienced since the industry's efficiency largely depends on them.

The question of personnel training should be studied before it hampers the development of the industry. Apart from this, there seem to be no outstanding problems, on the side of either supply or demand. Demand is vigorous as the public is becoming increasingly accustomed to ready-made clothing, and it is unlikely to decline since the market to be exploited is relatively large, taking into account the fact that virtually 80 per cent of production is consumed in Lima.

[86] In many United States factories, the machines have been arranged in such a way that much of the internal movement of the material takes place by gravity. Moreover, improvements in the methods of work are constantly being studied including the rectification of certain habits and the adoption of more efficient techniques. As a result, man/hour productivity increased 16 per cent in the United States between 1939 and 1947.

VI. TIMBER

Although this section is primarily concerned with timber it also contains a brief review of other Peruvian forest products.

1. *Production and consumption of timber*

Timber production expanded at a fast pace during the years 1945-56. The quantum rose at the rate of 13 per cent per year, one of the highest increases registered during that period among the various branches of the manufacturing sector. Between 1945 and 1950, a period in which domestic production replaced imports to an appreciable extent, the annual rate of growth was 24 per cent. Between 1951 and 1956, on the other hand, it fell by 6 per cent annually, a figure which re-

Table 107

PERU: TIMBER PRODUCTION, 1945-56

(Thousands of square feet) [a]

Year	Domestic production	Controlled production								Consumed in the production zone	Uncontrolled production
		Sold outside the production zones									
		Iquitos	Pucallpa	Tingo María	Chanchamayo	Oxapampa	Satipo and Pangoa	Madre de Dios	Cuzco		
1945	14 675	1 051	1 413	2 274	3 262	1 413	1 034	—	300	3 225	700
1946	24 359	4 399	2 598	1 791	4 846	2 598	1 256	—	357	5 354	1 160
1947	29 758	5 249	3 836	1 633	5 688	3 836	1 221	—	336	6 540	1 417
1948	39 150	9 465	5 070	1 901	6 722	5 070	...	—	454	8 605	1 864
1949	39 553	7 881	4 901	1 789	8 922	4 901	...	—	572	8 693	1 183
1950	42 783	6 630	6 324	1 563	9 694	6 324	...	—	808	9 403	2 037
1951	43 520	11 646	7 208	2 787	8 980	8 980	31	56	1 175	9 565	2 072
1952	49 100	10 917	11 237	3 979	801	7 637	45	66	1 291	10 791	2 358
1953	46 545	8 304	10 939	5 204	1 007	7 012	62	70	1 530	10 230	2 216
1954	49 526	8 594	11 704	4 708	1 504	8 250	107	97	1 769	10 885	2 358
1955	55 684	7 176	14 235	5 041	1 397	9 786	169	97	2 894	12 238	2 652
1956	57 653	7 556	14 523	6 016	1 172	9 369	193	87	3 319	12 671	2 745

SOURCE: Ministry of Agriculture, Department of Settlement and Forestry (*Dirección de Colonización y Bosques*), and studies by experts of the United Nations Food and Agriculture Organization.

a The unit of measurement for timber in Peru is the square foot parallelepiped with a base of one square foot and one inch high. A cubic metre of timber is equivalent to 424 square feet.

presents the rate of increase in consumption since imports remained constant.

The official timber production figures in Peru are defective. They are normally based on transport guides for timber sales which do not always correspond with output, since a proportion of the timber felled and sawn is consumed locally, and not all the timber dispatched is recorded in the statistics. In order to work out a consistent estimate, it has been assumed that the equivalent of 30 per cent of the controlled output of each zone is used locally. Furthermore, 5 per cent has been added to the domestic total thus obtained to make allowance for uncontrolled production outside the forest districts (see table 107).

For some years, Iquitos was the largest timber centre in Peru. Almost all its output consists of mahogany and *cedro*, the former for export and the latter mainly for domestic consumption. From 1952 onwards, its production began to decline and in 1956 amounted to 65 per cent of the figure for 1951. This decline was mainly due to inadequate supplies of logs for the sawmills, competition from lumbermen at Pucallpa, who have the advantage of being nearer to the Lima market, and increased freight costs. The largest market for Iquitos *cedro* is Lima. Until 1942 the supply route was by river and sea, through the Panama Canal. Subsequently, the easier route from Iquitos to Pucallpa by river and thence to Lima by road was used. It is estimated that, in 1956, some 4.5 million square feet of Iquitos timber were sold in Lima.

While Iquitos was dropping from first to third place as a timber centre, Pucallpa rose from third to first place, almost doubling its output in the last five years. This rapid development was entirely due to the opening of the Tingo María-Pucallpa highway in 1942 and is an example of the importance of interior road development for the economy of the Peruvian selva.

Oxapampa is the second most important timber centre. In 1956, its share of domestic output was 22 per cent. More than half of its production consists of *ulcumano* (*Podocarpus sp.*), a conifer of excellent quality.

The timber output of Tingo María more than doubled during the last six years and its relative share of the Peruvian quantum rose from 8.7 to 14.2 per cent. This increase was due mainly to increments in the timber demand of local mines. As the timber for this purpose is used for only short periods of time, a wide variety of species will serve; a great advantage for sawmills.

The other timber centres, Satipo, Pangoa, Madre de Dios and Cuzco, are less important and, although they have increased their production considerably, together they only represent 8.5 per cent of the Peruvian total.

Table 108 may serve as a guide for the commercial species which are exploited. It is based on production during the last six years. About 84 per cent of the output is represented by five species—*cedro*, mahogany, *roble*, *tornillo* and *ulcumano*. In 1956, 93.2 per cent of the production of Iquitos and 95 per cent of that of Pucallpa was mahogany and *cedro*. In short, although thousands of different species exist in eastern Peru, very few have any commercial value at the moment.

Although timber is shipped to and from Peru, the net balance has always shown a deficit. Exports con-

Table 108

PERU: COMMERCIAL SPECIES* OF TIMBER WHICH ARE EXPLOITED, 1951–55

(Percentage of controlled production)

	1951	1952	1953	1954	1955	1956
Alcanfor (*Lauraceae sp.*)	a	0.1	—	a	a	a
Alfaro-lagarto-caspi (*Calophyllum brasiliense*)	1.3	1.8	0.4	0.5	0.6	0.9
Almendro	—	—	—	—	—	—
Canela mosna (*Ocotea sp.*)	—	a	—	—	—	0.2
Mahogany (*Swietenia macro-phylla King*)	20.6	13.9	13.6	9.9	13.3	13.8
Cedro (*Cedrela sp.*)	35.4	50.1	47.3	50.0	43.7	41.2
Congona (*Ficus sp.*)	2.0	1.4	1.3	0.8	0.8	0.7
Diablo fuerte (*Podocarpus sp.*)	0.5	0.3	0.3	0.7	0.7	0.7
Duraznillo (*Laplacense sp.*)	—	—	a	—	—	—
Eucalypt (*Eucalyptus sp.*)	0.7	0.7	0.9	1.0	1.4	1.6
Itahuba (*Iwartzo pencenla spruce*)	a	0.2	—	—	—	—
Pupuna (*Trichilia Tocacheana C.D.C.*)	—	a	—	—	—	—
Mapique	—	a	—	a	a	a
Marupa-simaruba (*Simaruba amara Aubi*)	—	a	—	—	—	—
Moena (*Lauraceae sp.*)	0.3	0.3	0.2	0.4	0.6	0.6
Nogal (*Juglans neotropica Diels*)	0.1	0.2	0.1	0.1	0.1	0.4
Palo amarillo (*Clarisia sp.*)	—	a	a	a	0.1	a
Pino rojo (*Podocarpus sp.*)	—	—	0.3	1.4	1.6	0.7
Quina-quina (*Miruxylon sp.*)	—	a	a	a	—	—
Roble (*Lauraceae sp.*)	12.6	8.6	9.0	1.7	8.3	9.3
Tornillo-huaira caspi (*Cedrelinga catanae, tormis. Ducke*)	0.7	3.3	3.8	5.1	4.0	4.9
Ulcumano (*Podocarpus sp.*)	10.3	10.2	10.6	12.6	14.1	10.7
Others	15.3	8.9	12.2	8.8	10.7	13.3

SOURCE: Ministry of Agriculture.

a Less than 0.1 per cent.

* *Translator's note*: In many cases, the English nominal rendering of these Peruvian species would be incorrect and misleading. They have therefore been left in the original Spanish.

Table 109

PERU: TIMBER EXPORTS, 1951–56

(Thousands of square feet)

	1951	1952	1953	1954	1955	1956
Trunks or logs	—	50	—	13	2 087	926
Sawn wood	6 006	4 273	1 252	5 799	3 458	3 090
Mahogany	4 226	3 664	1 105	4 337	2 700	2 511
Cedro	1 747	606	—	1 211	758	579
Others	33	3	147	251	—	—
Total	6 006	4 323	1 252	5 812	5 545	4 016

SOURCE: Customs Department (*Superintendencia General de Aduanas*), *Estadistica del Comercio Exterior*.

sist of high-quality timber in the form of logs, beams, planks and laths; they have not been very large and have been declining mainly because of freight difficulties and costs (see table 109).

A study should be made of the export prospects of Peruvian timber as it would indicate what action might be taken to recover lost or acquire new markets. It would be of particular significance for the Iquitos area as this appears best situated for exports.

During the last six years average timber imports have represented more than 40 per cent of consumption, a fact which might appear surprising in a country with Peru's forestry resources (see tables 110 and 111). Actually, it is not so remarkable if it is remembered that the Andean Cordillera, which separates the areas of production from those of major consumption, makes transport difficult and expensive to the point where, in certain cases, domestic production is hard put to compete with imported timber. However, it is interesting to note that in recent years imports have tended to remain constant and that the increase of almost 23 per cent in consumption between 1951 and 1956 was covered by production.

Peru can and must produce all the timber it consumes. The essential requirements for import substitution would be to open up the Amazon basin with more and better roads which would enable substantial reductions to be made in freight charges. Production

Table 110

PERU: TIMBER IMPORTS, 1951–56

(Thousands of square feet)

Type	1951	1952	1953	1954	1955	1956
Sawlogs	481	301	301	63	36	146
Conifers [a]	155	—	240	1	3	28
Non-conifers [b]	326	301	61	62	33	118
Beams and planks	30 252	29 645	36 894	21 421	28 498	30 343
Unfinished:						
Conifers [c]	29 515	28 299	36 070	21 227	28 137	29 687
Non-conifers	387	282	140	54	129	398
Unspecified	—	344	431	118	194	215
Finished:						
Conifers	344	700	253	22	38	27
Non-conifers	6	20	—	—	—	16
Sleepers [e]	1 267	4 605	972	510	318	879
Crates and barrels	325	267	370	111	374	115
Crates [f]	244	132	91	4	80	29
Barrels [g]	81	135	279	97	294	86
Veneers and plywoods [h]	142	311	398	334	731	658
Total	32 467	35 129	38 935	22 439	29 957	32 141

SOURCE: Customs Department, *Estadistica del Comercio Exterior*.

a Gross ton equivalent to 500 square feet.

b Gross ton equivalent to 333 square feet.

c Conifers have been estimated to weigh 1.4 kilogrammes per square foot.

d Non-conifers have been estimated to weigh 1.5 kilogrammes per square foot.

e Imported sleepers have the following dimensions: 6" × 8" × 8' with a volume of 32 square feet. The figures in square feet relate to the following numbers of units: 39 604 in 1951, 143 899 in 1952, 30 387 in 1953, 15 925 in 1954, 9 922 in 1955 and 27 462 in 1956.

f Average weight of 1.4 kilogrammes per square foot.

g Average weight of 1.5 kilogrammes per square foot.

h Average weight of 1.5 kilogrammes per square foot.

Table 111

PERU: TIMBER CONSUMPTION, 1951–56
(Thousands of square feet)

Year	Production	Imports	Exports	Apparent consumption
1951	43 520	32 467	6 006	69 981
1952	49 100	35 129	4 323	79 906
1953	46 545	38 935	1 252	84 228
1954	49 526	22 439	5 812	66 153
1955	55 684	29 957	5 545	80 096
1956	57 653	32 141	4 016	85 778 [a]

SOURCE: Production: estimates based on official statistics. Imports and exports: *Anuarios de comercio exterior, op. cit.*

a More detailed research on the year 1956 indicates a higher figure for consumption—some 87 million square feet—because it includes an estimate of the uncontrolled production of sleepers and the production and importation of pitprops.

expenses would also be cut by mechanizing the transport of logs, reducing sawing costs by modernization and improvements in the saw-mills and by increasing sawing yields by a better utilization of waste. In addition, it would be desirable to manufacture finished or semi-finished articles at the production sites in order to turn the timber to better account and reduce freight expenditure.

In Peru, timber is not often given the treatment its quality merits. Quite often, valuable woods, like *cedro*, are used for making panels, door- and window-frames, wainscoting, etc. It therefore seems desirable to develop output of plywood and of fibre boards overlaid with veneers of high-quality timber. Begasse would appear to be an excellent filling material.

2. *Means of production*

In 1956 there were 138 primary saw-mills and some 40 resaw-mills (see table 112).

With a few exceptions, the equipment is very defective. The various machines which constitute a mill are rarely well-balanced. Quite often, the secondary equipment needed to finish the work begun by the head saws is lacking. As a result, the latter must carry out secondary cutting operations to the detriment of their productivity. In the ideal saw-mill, the work of the head saw should be reduced to the minimum possible number of cuts in each trunk, in order to ensure maximum capacity. For this purpose, certain modern saw-mills install immediately in line with the head saw a horizontal band saw which makes a second cut in the logs. They are thus immediately transformed into planks, and the pressure on the head saw is eased. In this way, output capacity is boosted by more than 30 per cent.

Table 112

PERU: BREAK-DOWN OF PRIMARY AND SECONDARY SAW-MILLS BY AREA

Area	Primary	Secondary
Arequipa	—	2
Cajamarca	—	2
Cuzco	—	—
Chanchamayo	12	—
Ica	—	2
Iquitos	24	—
Junín	—	4
Lambayeque	—	1
Lima and Callao	—	27
Madre de Dios	2	—
Oxapampa	38	—
Piura	—	2
Pucallpa	37	—
Satipo y Pangoa	5	—
Tingo María	20	—
Totales	138	40

SOURCE: Direct information.

The layout of machinery is not normally satisfactory. Only one mill in Iquitos has a layout which may be considered good.

Many mills suffer from a shortage of power which seriously hampers the work, especially in the case of band saws. The maintenance of generating equipment is also deficient to the point where, in some of the mills visited, about 20 to 25 per cent of the working time was lost through break-downs in the generator.

The maintenance of band saws is also poor in most cases. The machines for sharpening and preparing the bands are obsolete and neglected. It is impossible to preserve the shape of the teeth with sharpening machines which do not work properly because of wobbly support and moving parts. The maintenance staff's lack of technical skill—a common feature in most tropical saw-mills—is one of the main causes of low efficiency, because break-downs recur and cause frequent stoppages. Thus, in the course of a time and movement study carried out in one important saw-mill in Pucallpa, it was noted that 20 per cent of the working time was lost in stoppages caused by mechanical break-downs.

The fact that few saw-mills recover waste reduces yields throughout the industry as a whole. Most of the mills lack the auxiliary machinery necessary for recovering waste. The problem is not a technical one, since factories exist for making such machines, but rather one of marketing. For this reason, it would be desirable to create a demand for timber in small sizes.[87]

The stacking and sorting of sawn wood are basic requirements for improving quality. However, such operations are carried on in very few mills because most of them do not have enough working capital to maintain large idle stocks of timber for any length of time. Much of the timber is dispatched when still damp and its quality suffers here again. Stacking and sorting would improve quality, raise prices, yield savings in transport and encourage the building of plants to process the timber in the vicinity of the mills, perhaps even in conjunction with them. The establishment of co-operatives among the mills, particularly the small ones, should be fostered so as to finance stacking and sorting.

87 In Thailand there are saw-mills which export timber of one cubic inch.

The most serious problem faced by the mills is the defective supply of logs. Supply difficulties are increasing and were particularly acute, for instance, in 1956 and 1957 when the levels of rivers dropped through lack of rain. Hence, the mills do not maintain a steady operating tempo so that production costs and overheads are high. The shortage of logs also affects labour productivity, because workers go slow in order not to lose wages. The solution to this problem would be to exploit more species per hectare of forest and to mechanize the movement of logs. The second condition is a corollary to the first because there would be no major technical difficulty in mechanizing the transport of logs if the density of exploitable species per unit of area justified investment in mechanized transport equipment. However, in Peruvian forests, as in many tropical zones, only a few out of many existing species are exploited. Consequently, in many areas only one or two trees are felled per hectare, an anti-economic proportion. Undoubtedly, there are places where, as a result of special soil or climatic conditions, certain species now in demand predominate. A forestry survey would certainly reveal a number of such places. However, the solution lies not only in seeking the areas most suitable for exploitation but also in finding more useable species in order to increase felling per hectare.

The first step is to improve the supply of logs; the next is to modernize the mills so as to raise output and productivity and hence cut costs.

The potential capacity of the saw-mills as a whole is much higher than actual production. The most marked lack of balance occurs in the Iquitos area where the coefficient of utilization is between 18 and 20 per cent. Indeed, if only one of the Iquitos mills worked efficiently throughout the whole year, it could produce much more than the present output of all the mills of that area. In Pucallpa, capacity is almost double current output. Although accurate data about other centres is lacking, it is known that in all of them the ratio between output and productive capacity is low.

Not only is the coefficient of utilization of machinery low but also productivity. It is estimated that productivity would be doubled merely by mechanizing the transport and feeding of logs. What is more, if the number of cuts per trunk by the head saw were reduced, it might even be trebled.

In short, the future prospects of the Peruvian timber industry are favourable. In addition to the rate of increase in consumption (6 per cent per year), imports still cover 40 per cent of demand. The volume of production might increase if more and better roads opened up the eastern part of the country and if the timber industry, which in general is far from being efficiently run, were reorganized. Indeed, the lack of basic technical knowledge, the utilization of unsuitable machinery in some cases and the lack of machinery in others, the shortage of equipment for the transport of logs, inadequate maintenance and the generally unsatisfactory conditions of work make it difficult to improve quality and reduce costs.

The development of timber production in Peru requires an efficient forestry service. In this respect, Peru is fairly well behind other countries. The future protection of the timber industry and the development of the Amazon basin would require a vigorous forestry programme. Some of its objectives might be: (*a*) a forestry survey of eastern Peru with maps and plans of exploitation areas; (*b*) research into the properties of Peruvian woods, together with an intensive technical publicity campaign to promote consumption of those which are suitable for specific uses; (*c*) the establishment of pilot plantations of species producing timber, resins, extracts, etc.; (*d*) exploration of the possibilities of natural replanting of commercial species in promising areas; (*e*) control of felling and transport of timber; (*f*) the building up of forestry reserves; (*g*) the setting up of a forestry department in the National School of Agriculture; (*h*) the inauguration of a training centre for supervisors and maintenance staff in saw-mills; and (*i*) the publication of a forestry yearbook containing information and statistics on forestry activities.

3. *Other forest products*

In addition to timber, other forest products are obtained from eastern Peru. From the economic point of view, the most important of them is rubber, for which statistics on production, imports and total consumption are given in table 113.

Two varieties of rubber grow in Peru: *Hevea braziliense*, which yields fine rubber, and *Hevea guayanense*, which is more abundant but which yields poor-quality rubber.

In 1945-56, Peruvian rubber represented about 95 per cent of domestic consumption. Yet, towards the end of that period, the quantum of imports and exports revealed opposing trends. In the face of growing

Table 113

PERU: PRODUCTION, IMPORTS, EXPORTS AND CONSUMPTION OF RUBBER, 1945-56

(Tons)

Year	*Production*	*Imports*	*Exports*	*Apparent consumption* [a]
1945	2 453	165	1 993	678
1946	2 836	47	1 794	1 162
1947	2 053	226	1 709	1 400
1948	1 442	330	—	1 571
1949	1 383	279	—	1 610
1950	1 573	71	—	1 827
1951	1 699	413	—	1 894
1952	1 768	102	—	1 941
1953	2 800	4	—	2 865
1954	2 765	89	—	2 811
1955	2 749	46	—	3 001
1956	2 589	620	—	3 018

SOURCE: Production: *Banco de Fomento Agropecuario del Perú*. Imports: *Anuarios de comercio exterior, op. cit.*, sections 1073, 1074 and 1076.

a Based on the moving average of three years of imports.

Table 114

PERU: EXPORTS OF OTHER FOREST PRODUCTS,* 1951-56

	Unit	1951	1952	1953	1954	1955	1956
Balata: white blocks	k.n.	2 389	7 693	9 981	11 356	20 407	47 417
ordinary crude	k.n.	—	5 249	—	2 684	—	—
not specified	k.n.	—	3 024	—	—	—	—
putumayo white sheets	k.n.	—	8 356	6 209	—	—	—
Cascarilla (quinine): bark	k.g.	41 168	17 134	6 055	8 650	26 764	17 958
powder	k.g.	—	—	248	—	—	—
Brazil nut	k.g.	40 971	124 305	80 850	347 340	395 262	633 382
Ceibo	k.g.	2 785	—	—	—	10 503	—
Chuchuhuasi	k.g.	—	—	413	51	75	130
Condurango	k.g.	115 718	39 909	2 329	67 579	75 042	44 317
Curare	k.g.	1 836	1 025	832	2 095	2 378	2 155
Zapote gum	k.g.	6 805	4 736	17 240	6 288	8 800	2 576
Leche caspi (chewing gum): sorvagum	k.n.	660 194	666 798	632 773	857 294	768 634	697 305
Leche ojé: gummy resin	k.n.	1 524	3 346	2 294	7 524	5 861	3 400
powder	k.n.	—	—	—	—	—	—
Powdered mangle	k.g.	9 292	—	—	—	—	—
Rosewood, oil	k.g.	1 687	122 682	28 269	66 413	157 844	227 504
Tagua (ivory nut): with shell	k.g.	40 500	—	—	—	—	—
without shell	k.g.	25 334	—	—	—	—	—
waste	k.g.	—	—	—	—	—	—
Tara (divi-divi or talla): seed	k.g.	154 880	584 760	375 465	346 600	230 000	321 920
crude	k.g.	432 244	221 413	278 946	746 000	473 230	663 181
powder	k.g.	858 020	498 480	562 298	582 895	607 180	818 200
Total		2 395 347	2 308 910	2 004 202	3 052 769	2 787 623	3 479 445
Barbasco (cube): powder	k.g.	1 004 812	904 301	392 339	1 383 824	1 289,242	1 077 598
crude	k.g.	1 259 507	1 107 431	1 543 519	1 829 889	1 375 313	1 884 441
Cúrcuma	k.g.	81 977	12 365	244 564	161 320	517 197	54 926

SOURCE: Ministry of Finance and Trade (*Ministerio de Hacienda y Comercio*), *Estadística del Comercio Exterior*.
k.n. = kilogramme net.
k.g. = kilogramme gross.
* *Translator's note*: In many cases, the English nominal rendering of these Peruvian species would be incorrect and misleading. They have therefore been left in the original Spanish.

rubber consumption, domestic supplies declined and hence imports rose. The causes of the drop in domestic output were the low yield per tree, the low density of trees per square kilometre and the high cost of labour. These are the disadvantages of Peruvian rubber tapping which are reflected in its high cost. The present sales price is almost 75 per cent higher than the international price. This situation will probably persist so long as production is based on trees as found in their natural habitat rather than trees grown in plantations.

Other forest products of some importance for the economy of the departments in the selva are *leche caspi*, Brazil nuts, *barbasco* and rosewood. Nearly all of them are exported. Figures covering the period 1951-56—together with those relating to other minor products—have been assembled in table 114.

Table 115

PERU: STRUCTURE OF THE FURNITURE AND FIXTURES INDUSTRY, 1956
(Units and thousands of soles)

Department	Number of establishments	Staff employed			Raw materials			Value of production	
		Total	Employees	Workmen	Total	Domestic	Foreign	Gross	Added
Lima	116	1 614	281	1 333	18 416	13 185	5 231	45 467	26 695
Arequipa	4	57	10	47	493	325	158	606	110
Cajamarca	1	2	—	2	10	10	—	14	4
Huánuco	2	5	2	3	25	25	—	53	26
Ica	3	3	1	2	120	85	35	270	146
Junín	12	112	34	78	1 164	1 160	4	3 845	2 679
La Libertad	3	51	5	46	419	375	44	1 055	626
Pasco	1	2	1	1	4	4	—	32	28
Piura	1	63	7	56	3 916	3 916	—	6 280	2 322
Total	143	1 909	341	1 568	24 567	18 085	5 472	57 622	32 636

SOURCE: Ministry of Development and Public Works, Department of Industries and electricity.

VII. MANUFACTURE OF FURNITURE AND FIXTURES

This section deals solely with the manufacture of furniture, doors, windows and other wooden articles. According to the International Standard Industrial Classification of all Economic Activities, the manufacture of metal furniture should also be included under this heading but, because of statistical difficulties and the lack of specialization in enterprises which produce such articles, it will be included in the metal-transforming industries.

The manufacture of furniture and fixtures from wood is perhaps the branch in which, relatively speaking, there are most small establishments. According to industrial statistics, 50 per cent of the enterprises registered employ less than five workers and possess very modest capital resources. But, the number of artisan workshops is much higher because more than two-thirds of the total number of establishments engaged in this activity, particularly in the provinces, are not included in the statistics. Consequently, the structure of the industry is not precisely as shown in table 115 in which the figures relating to the number of establishments and the staff employed appear to be considerably under-estimated. Proportionately, however, the differences should not be great as regards the gross and net value of production since the contribution of artisan establishments is relatively very small (see table 116).

Some 75 per cent of the value of the raw materials consumed is of domestic origin and consists almost entirely of timber. Of the foreign raw materials ironware and varnishes are the most important.

Quality woods, particularly *cedro* and mahogany, are used for more than 90 per cent of the production. A similar situation occurs here as in the cotton textile industry in that a valuable raw material is often used when its ordinary counterpart would suffice. As the technique for impregnating timber with preservatives becomes more widespread, this tendency to waste quality woods may disappear, since one of the most important reasons for use of these woods is their resistance to attacks by insects.

Table 116

PERU: BREAK-DOWN BY SIZE OF ESTABLISHMENTS MANUFACTURING FURNITURE AND FIXTURES, 1956

Number of establishments	*Number of persons per establishment*	*Percentage of gross value of production*
70	Less than 5	7.7
32	6 to 10	9.7
34	11 to 20	22.9
13	21 to 50	15.2
7	51 to 100	26.6
2	More than 100	17.9

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

VIII. PAPER AND PULP INDUSTRIES

1. *Consumption of paper and board*

In 1956, the apparent consumption of paper and board was 62 900 tons of which 18 400 consisted of newsprint, 6 600 of printing and writing paper, 16 800 of wrapping paper, and 21 100 of other paper and board (see table 117).

Between 1947 and 1956, consumption remained stationary in the early post-war years but from 1950 onwards it began to soar at an annual average rate of 8 per cent. *Per capita* consumption also rose from 3.8 kilogrammes in 1957 to about 7 in 1956, which indicates an average annual increase of 6.3 per cent.

The accelerated growth of paper consumption from 1950 onwards was undoubtedly due to the rapid increase in *per capita* income referred to in Part One of this report. Indeed, as may be seen in the relevant part of figure VIII, there is a close correlation between both phenomena. It is believed, however, that the increasing availability of domestic paper made from bagasse must also have influenced the rise in consumption.

It is not easy to assess to what extent the absolute levels of consumption registered after this rapid increase may be termed satisfactory. The *per capita* consumption of paper and board in Peru is still lower than in most Latin American countries and even in Latin America as a whole. On the other hand, if allowance is made for differences in income levels and if the relationship between the consumption of paper and board and the *per capita* gross product is examined, it will be noted from the data in figure VII that the Peruvian figure is among the highest in the region. Although there are not enough numerical data to confirm it; these conditions are attributable—it may be said—to the fact that paper-consuming habits in the large towns, especially in the Lima-Callao zone, are similar to those in countries with a much higher *per capita* income. This is borne out mainly by the manner in which foodstuffs are marketed. Almost invariably purchasers are offered small made-up boxes or packages. Further important evidence is the relatively high efficiency of waste paper collection (23 per cent of the consumption of newsprint and wrapping paper), which in its turn promotes further consumption of wrapping paper. Unlike waste paper, wrapping paper is included in the statistics.

2. *Production and imports*

There are only three factories producing paper and board in Peru. Two of them also manufacture pulp from bagasse, in combination with sugar-mills. The

Table 117

PERU: CONSUMPTION, PRODUCTION AND IMPORTS OF PAPER AND BOARD, 1946-56

(Thousands of tons)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Newsprint:											
Production	—	—	—	—	—	—	—	—	—	—	—
Imports [a]	11.0	9.8	5.8	9.9	8.3	10.8	10.5	10.3	13.3	15.4	18.4
Apparent consumption	11.0	9.8	5.8	9.9	8.3	10.8	10.5	10.3	13.3	15.4	18.4
Printing and writing paper:											
Production	2.3	1.9	2.5	2.7	2.7	2.9	2.0	2.6	2.5	2.9	3.1
Imports [b]	1.6	1.2	1.1	2.0	1.9	2.5	2.2	3.0	3.3	4.0	3.5
Apparent consumption	3.9	3.1	3.6	4.7	4.6	5.4	4.2	5.6	5.8	6.9	6.6
Wrapping paper:											
Production	6.9	7.4	8.1	8.9	6.4	10.3	11.3	12.2	13.2	14.7	16.8
Imports	0.1	0.1	—	—	—	—	—	—	0.1	—	—
Apparent consumption	7.0	7.5	8.1	8.9	6.4	10.3	11.3	12.2	13.3	14.7	16.8
Other paper and board:											
Production	5.9	7.3	6.2	7.5	5.8	9.1	8.2	9.1	11.2	10.9	14.7
Imports	2.4	2.8	1.7	1.5	2.4	4.0	3.0	3.8	5.0	6.5	6.4
Apparent consumption	8.3	10.1	7.9	9.0	8.2	13.1	11.2	12.9	16.2	17.4	21.1
Total paper and board:											
Production	15.1	16.6	16.8	19.1	14.9	22.3	21.5	23.9	26.9	28.5	34.6
Imports [c]	15.1	13.9	8.6	13.4	12.6	17.3	15.7	17.1	21.7	25.9	28.3
Apparent consumption	30.2	30.5	25.4	32.5	27.5	39.6	37.2	41.0	48.6	54.4	62.9

Source: Official data.

b Imports in 1957: 17 800 tons.

b It is possible that imports of "newsprint" and "printing and writing paper" contain errors of classification, because the share of the former in total consumption is abnormally high compared with the unusually low of the latter; this supposition is based on the fact that the joint share appears to be normal.

c Total imports in 1957: 30 500 tons.

larger of these two factories is situated some 250 kilometres to the north-west of Lima and the other near the northern frontier of Peru. The third plant is close to Lima and employs as raw material waste paper, clippings and imported wood pulp. The total output of these three factories in 1956 was 35 000 tons of paper and board, a figure which represents 55 per cent of Peruvian consumption in terms of volume.

In 1956, the consumption of pulp was 21 200 tons, of which 15 000 were produced in Peru from bagasse. Peruvian imports also include a small quantity of mechanical wood pulp. As may be seen in table 118, imports of this raw material remained roughly constant from 1946 onwards and domestic production has continued to absorb the increment in demand.

Waste paper, collected mainly in the Lima-Callao zone, is an important fibrous raw material. Although no accurate figures are available as to its volume, it is estimated that, in 1954-56, paper manufacture absorbed an average of 8 000 tons per year, which is approximately equivalent to 34 per cent of the total inputs of raw material in this sector.

In spite of the rapid development of the industry, the percentage of domestic paper as compared with consumption did not change appreciably during 1946-56 (see table 119). On the other hand, fibrous raw materials substantially increased their share in domestic manufacture (from 64 per cent in 1950-51 to 77 per cent in 1955-56) as a result of the progress made in the production of bagasse pulp. In Part Three of this

Table 118

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF PULP, 1946-56

(Thousands of tons)

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Production:											
Chemical bagasse pulp	4	4	4	5	5	7	8	10	12	12	15
Imports:											
Mechanical pulp	7	5	6	—	0.8	1	1	—	0.5		0.2
Chemical wood pulp				6	7	6	7	6	9	9	5
Apparent consumption	11	9	10	11	12.8	14	16	16	21.5	21	20.2

Source: Production: direct information. Imports: *Anuarios de comercio exterior, op. cit.*

Table 119

PERU: PRODUCTION OF PAPER, BOARD AND FIBROUS RAW MATERIALS AS COMPARED WITH TOTAL CONSUMPTION, 1946-56

(Percentage)

	1946-47	*1950-51*	*1955-56*
Newsprint	0	0	0
Other paper and board	79	78	76
Total paper and board	52	55	54
Fibrous raw materials for the production of paper and board	64	64	77

SOURCE: Tables 117 and 118.

report it will be seen that this percentage is the highest which can be achieved in the use of bagasse pulp without lowering the quality of paper or changing the pattern of demand.

3. *Cellulose for rayon*

The cellulose used as raw material for artificial fibres —1 100 tons in 1955—is imported in its entirety. The possibilities of replacing these imports by domestic products will be dealt with in section XII of this chapter.

IX. PRINTING AND PUBLISHING

According to the quantum index of industrial production, these activities doubled their output quantum between 1945 and 1956 (see annex II, table 19). In 1956, they accounted for 2.2 per cent of the product generated in the industrial sector.

The most recent industrial survey records 172 printing enterprises (see table 120). This sample covers about 50 per cent of establishments which are responsible for more than 95 per cent of production. The disproportion between the number of establishments not covered by statistics and their relatively small output indicates that they consist mainly of artisan workshops which are numerous even among the registered establishments (see table 121).

The industry has expanded and modernized its equipment in recent years but is operating with a fairly low utilization of productive capacity (not greater than 30 per cent), since it has to grapple with certain difficulties. One of these, and certainly not the least important, is the high cost of paper. The only printing paper which pays low customs duties (a 7-per-cent *ad valorem* tax) is newsprint. Duties between 32 and 50 per cent are levied on other types of paper. The exemption from duties enjoyed by imported books and other publications contrasts with these taxes on imported paper which represents more than 80 per cent of consumption. As a result, the industry is in a very difficult competitive position[88] and many works by Peruvian authors are published abroad.

The shortage of skilled workers is another problem; it is estimated that not more than 15 per cent of the staff employed in the industry have the necessary quali-

Table 121

PERU: BREAK-DOWN BY SIZE OF PRINTING ESTABLISHMENTS, 1956

Number of establishments	*Number of persons per establishment*	*Percentage of gross value of domestic production*
68	Less than 5	3.0
29	From 6 to 10	3.1
35	From 11 to 20	9.7
25	From 21 to 50	28.0
12	From 51 to 100	17.2
3	More than 100	39.0

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

[88] Paper represents about 40 per cent of printing costs.

Table 120

PERU: STRUCTURE OF THE PRINTING INDUSTRY, 1956

(Units and thousands of soles)

Department	*Number of establishments*	*Staff employed*			*Raw materials*			*Value of production*	
		Total	*Employees*	*Workmen*	*Total*	*Domestic*	*Foreign*	*Gross*	*Added*
Lima	139	3 251	997	2 254	88 742	20 586	68 156	181 239	91 364
Arequipa	11	189	50	139	2 299	379	1 920	5 242	2 923
Huánuco	2	6	3	3	28	19	9	43	14
Ica	3	23	10	13	56	7	49	438	379
Junín	11	68	27	41	580	425	155	1 347	755
La Libertad	1	30	8	22	352	22	330	817	464
Lambayeque	2	52	17	35	932	588	344	1 068	123
Loreto	1	9	5	4	32	11	21	147	114
Piura	1	14	7	7	79	...	79	296	214
Tacna	1	6	3	3	26	26	...	92	65
Total	172	3 648	1 127	2 521	93 126	22 063	71 063	190 729	96 415

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

fications. This is one of the reasons why domestically-printed books are not always up to the standard of those of other countries.

From 1956 onwards, however, quality improved and efforts were made to secure a larger share of demand. Over a period of a year and a half, 1 265 000 copies of Peruvian and foreign works were published and, in 1958, 370 000 more copies were ready for delivery. These publications, in spite of their low price, are quite well printed.

X. MANUFACTURE OF LEATHER AND LEATHER GOODS (EXCEPT FOOTWEAR)

Tanneries occupy an intermediate position in the industrial pattern, since they depend on the leather-using industries—which constitute their market—for their output and on the slaughter of cattle for the supply of their raw material. Although some animals, such as lizards and snakes, are killed for their skins, their share is very small (0.5 per cent) in the total amount of raw material treated. The rate of expansion of meat production, therefore, sets the pace for development of tanneries. To judge by this expansion, it may be inferred that the tanning industry has grown in Peru at the rate of 6 per cent per year between 1945 and 1956. This figure reflects the increase in the consumption of hides during that time and parallels, to a fairly close extent, the increment in the productive capacity of tanneries.

Of the 57 tanneries in Peru, five account for 40 per cent of the output, ten for 23 per cent and 33 for 31 per cent. The first group includes the two largest tanneries in the country, situated in Arequipa, and the last group is made up of little workshops which treat most of the small hides (see table 122).

Production is now estimated at some 11.5 million square feet of ordinary leather and at about 3 500 tons of sole leather. This is almost the same as consumption, since the annual average of imports in the last five years was only some 200 000 square feet of leather and 2.3 tons of sole leather.

A little more than 90 per cent of output is absorbed by the footwear industry. The rest is used for other leather manufactures, mostly of a domestic and personal nature, since the output of industrial leather articles is very restricted. A tannery at Arequipa manufactures leather articles for the textile industry, such as pickers, picking straps, divider straps, etc.; part of its output has been exported to Mexico.

Table 122

PERU: DISTRIBUTION OF TANNERIES AND OF PRODUCTION CAPACITY BY AREA

Department	*Number of tanneries*	*Production capacity (Percentage)*
Arequipa	10	36
Lima and Callao	26	51
Piura, Lambayeque, La Libertad, Junín, Ica, Cuzco, Loreto and Amazonas.	21	13
Total.	*57*	*100*

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

The utilization of productive capacity is estimated at some 35 per cent of the theoretical maximum, which means that present plant could yield a considerable increase in production.

The labour force consists of 2 100 workmen, 22 per cent of whom are skilled and semi-skilled; of the rest, more than half are unskilled and consist mainly of indirect workers.[89]

Labour productivity is very low. It is reckoned at some seven square feet per man-hour,[90] which is equivalent to a third of that achieved in the United States.[91] The shortcomings which are the principal causes of low productivity and poor quality are: lack of technical knowledge of the different preparing, tanning and finishing processes, inadequate mechanization in internal transport operations and variations in the quality of raw material.

Tanning is the Peruvian industry where empirical methods are perhaps most predominant. This position contrasts with that in other countries which have made considerable efforts in recent years to make tanning a science. Very few establishments are managed by competent technicians and nearly all of them suffer from a lack of qualified foremen and skilled labour. The situation is rendered even worse by the high staff turnover, which adversely affects specialization. For example, in one important and well-established tannery, 17 per cent of the staff had less than one year's experience in the industry.

In recent years, some of the main establishments have installed a fair amount of new machinery, especially for drying and finishing the hides, but they pay insufficient attention to the mechanization of internal transport during manufacture. This is the main cause of the high proportion of indirect workers which reduces productivity.

Although the poor quality of the raw material has a greater influence on the quality of the finished products than on productivity, it does have an unfavourable effect on the latter because the material has to be sorted repeatedly during manufacture. Furthermore the excessive diversification of production, which un-

89 In the United States, 65 per cent of the staff is skilled or semi-skilled and 80 per cent of the workmen are directly concerned with tanning operations.

90 In arriving at this figure, the following equivalents were used: 36 square feet for each cowhide; 6 square feet for each calf-skin; 3.5 square feet for each sheep-skin or goat-skin; 16 kilogrammes of sole leather for each cowhide and 450 grammes for each square foot of sole leather.

91 According to data supplied by 330 United States tanneries belonging to 285 enterprises which submitted reports in 1947, average productivity is 21.2 square feet of leather per man/hour.

doubtedly also reduces productivity, is attributable to a certain extent to the uneven quality of the raw material, which makes it necessary to use skins from the same lot for different purposes. Peruvian skins are poor in quality because little care is taken of them at the cattle-raising stages and this in its turn is explained by the fact that large stock farms are rare in Peru. Indeed, most of the animals slaughtered come from small farms which are mainly concerned with fattening and where little or no care is taken of the hides. Brand marks for the prevention of theft, insect stings, scratches from barbed wire on fences and goad marks on the rumps of animals are very common in domestic hides, especially those from northern and eastern Peru.

Hides represent 70 per cent of the value of raw and other materials used in the tanneries;[92] they are roughly equivalent to 51 per cent of leather production costs. A proportion of 98.5 per cent of the skins come from domestic slaughter-houses and nearly all the other materials—quebracho, chemicals, colouring matter, finishing products, etc.—come from abroad.

The appearance of leather has improved in recent years as a result of the finishing machinery and equipment which has been installed but much still remains to be done to improve other aspects of quality, such as durability, softness, etc. This task will be achieved partly by taking more care of the skins at the cattle-raising stage and partly by the technical training of staff. In this respect, the tanning industry is one of those requiring more technical assistance.

[92] The remaining 30 per cent is broken down as follows: acids and salts, 6 per cent; oils, 2 per cent; colouring agents, 1 per cent; varnishes, 9 per cent; other products, 12 per cent.

XI. MANUFACTURE OF RUBBER PRODUCTS

The manufacture of rubber products is another industry which made great strides between 1945 and 1956. Taking the consumption of the staple raw material as a basis, the conclusion may be reached that during those years production increased at the high rate of 14 per cent per year. This expansion was mainly due to the boom in the manufacture of tyres which began in the second half of 1943. The rate of growth was slower in the other branches of the rubber sector, although in 1952 the production of miscellaneous rubber products, particularly for industrial uses which previously had nearly all been imported, was intensified. On the other hand, the tyre industry registered a slight decline as a rubber consumer from 1953 onwards (see table 123).

The industry comprises two types of establishments: those of the so-called "heavy rubber industry", mainly producing tyres, and those of the "light rubber industry" producing a wide range of light rubber articles.

1. *Tyres*

The production of tyres and tubes has so far been concentrated on models for passenger cars and lorries (see table 124). This fact, together with the failure of domestic industry in certain years to meet demand for various sizes, has given rise to fairly substantial imports of tyres and tubes. However, imported tubes represent only a small fraction of those which enter Peru as standard equipment on imported vehicles (see table 125).

During the period 1950-56, output represented on the average 62 per cent of apparent consumption.

Peru has two tyre factories, one of which began production in February 1957. Both were set up with the technical and financial participation of foreign enterprises. The present equipment can turn out daily 1 000 tyres and the same number of tubes, 60 per cent for lorries and 40 per cent for passenger cars. This capacity exceeds actual output by 45 per cent. Tyres and tubes for tractors are not made because at the

Table 123

PERU: CONSUMPTION OF RUBBER FOR TYRES AND RATIO TO TOTAL DOMESTIC RUBBER CONSUMPTION

Year	*Consumption of rubber for tyres (Tons)*	*Ratio to total domestic rubber consumption (Percentage)*
1952	2 175	89.5
1953	2 427	87.8
1955	2 363	85.9

SOURCE: *Banco de Fomento Agropecuario del Perú.*

Table 124

PERU: PRODUCTION OF TYRES AND INNER TUBES, 1943-56

Year	*Production*		
	Units		*Tons* [a]
	Tyres	*Inner tubes*	
1943 [b]	7 796	3 040	205
1944	28 256	18 627	770
1945	36 507	23 578	990
1946	57 994	40 996	1 585
1947	75 000	54 000	2 050
1948	87 180	54 185	2 360
1949	75 194	48 255	2 040
1950	76 710	53 478	2 090
1951	107 684	65 564	2 915
1952	121 659	73 615	3 290
1953	134 000	90 905	3 650
1954	138 000	100 000	3 775
1955	139 000	98 000	3 795
1956	152 521	103 193	4 155

SOURCE: Direct information.
a Estimated on the basis of an average weight of 25.4 kilogrammes per tyre and 2.7 kilogrammes per inner tube.
b Five months only.

Table 125

PERU: IMPORTS OF TYRES AND INNER TUBES FOR DIFFERENT TYPES OF VEHICLES, 1948–56

(Tons)

Year	Total	Brought in with imported vehicles		Imported separately									
				Tyres					Inner tubes				
		Passenger cars [a]	Lorries [b]	Aircraft	Passenger car	Lorry	Tractor	Bicycle and motorcycle	Aircraft	Passenger car	Lorry	Tractor	Bicycle and motorcycle
1948	589.6	100.5	318.4	5.8	46.4	77.0	20.0	7.2	0.6	5.0	4.6	3.2	0.9
1949	1 113.0	99.0	792.4	13.3	78.4	70.0	22.1	15.2	0.7	6.7	7.4	3.8	4.0
1950	1 756.6	298.0	1 329 8	11.1	9.3	9.3	69.3	21.3	0.9	1.0	0.2	0.9	5.5
1951	3 809.9	620.1	2 883.5	17.7	100.0	68.4	64.3	28.3	1.4	7.2	3.5	8.6	6.9
1952	1 833.4	459.8	898.8	14.7	129.4	164.6	100.0	23.6	3.0	9.2	11.0	11.9	7.4
1953	2 122.8	447.2	1 115.7	12.0	141.9	251.7	80.8	27.5	1.1	10.2	16.7	8.1	9.9
1954	1 810.3	35.8	1 150.5	10.8	125.5	299.3	84.2	38.1	1.7	10.4	29.6	10.4	14.0
1955	1 329.9	333.6	518.5	12.7	63.4	145.8	154.6	54.2	1.3	2.7	9.5	16.9	16.7
1956	1 734.3	414.5	775.0	15.4	67.5	222.9	117.2	60.9	2.1	3.6	16.1	12.3	26.8

SOURCE: *Anuarios de comercio exterior, op. cit.*

a Five tyres per passenger have been estimated, with an average weight of 11.8 kilogrammes per tyre and 1 225 kilogrammes per inner tube, i.e. 65 125 kilogrammes per car.

b Seven tubes per lorry have been estimated, with an average weight of 39.5 kilogrammes per tyre and 3 872 kilogrammes per inner tube, i.e. 305 kilogrammes per lorry.

moment demand is very limited; in 1957 the total number of tractors in Peru was 6 000.

The raw materials used by the industry are of domestic origin and represent 50 per cent of the weight and 37 per cent of the value, but the development of the reinforcing cord industry could soon raise the share of domestic raw materials by 18 per cent in terms of value. Because of the relatively high cost of domestic rubber and the strong dependence on imports for the other materials, the input of raw materials in the production costs of tyres is relatively high.[93] On the other hand, thanks to well-mechanized manufacturing processes and the usually efficient technical and administrative organization of the enterprises, certain other cost items are relatively low. As the result of this advantage, the price of domestic tyres can be maintained at a level 10 per cent lower than that of imported tyres, although the latter are subject to only moderate customs duties.

The labour force employed by the two factories amounts to 734 persons, of whom 70 per cent may be considered as skilled. However, there is plenty of room for improvement in productivity, which is estimated at 6.8 kilogrammes of finished product per man-hour,[94] i.e., 60 per cent of the output in United States factories.

The quality of production is comparable to that of good foreign tyres. This is only to be expected given the technical conditions under which the industry operates and the quality of the raw materials used.

2. *Other products of the heavy rubber industry*

Besides manufacturing tyres and tubes, the heavy rubber industry also turns out conveyor belts and power transmission belts, as well as reinforced and unreinforced hoses for conveying liquids and gases under pressure. Only a few types of small-diameter hoses are made. Other lines of production have not been tried because the main market for them is the mining sector, which has free import rights under the mining code in force. This eliminates any possibility of competition with foreign products, especially in view of the price

Table 126

PERU: IMPORTS OF RUBBER BELTS AND BANDS AND HOSES FOR FLUIDS, 1948–56

(Tons)

Year	Belts and bands	Hoses without wire	Reinforced hoses	Special hoses	Total
1948	86.3	42.3	45.2	21.4	195.2
1949	151.0	73.2	34.1	32.8	291.0
1950	95.8	44.4	26.4	19.2	185.8
1951	213.8	68.8	54.0	42.6	379.2
1952	242.4	84.2	65.8	51.6	444.0
1953	243.3	90.6	49.0	42.4	425.3
1954	109.5	58.4	35.9	39.9	243.7
1955	157.5	73.9	63.4	64.4	359.2
1956	213.8	78.7	88.3	90.8	471.6

SOURCES: *Anuarios de comercio exterior, op. cit.*

93 The share of raw materials in the cost of tyre manufacturing is as follows:

	Percentage
Tyres for passenger cars	54.6
Tyres for lorries	57.2
Tubes in general	48.1

In the total value of raw material, the following items were most important:

	Percentage
Rubber from various sources and in different forms (natural and synthetic, in balls, sheets and crepe)	39.5
Lamp black	25.6
Zinc oxide	0.7
Other chemical products (resins, dissolvents, accelerators)	16.0
Rayon cord	18.1

94 If it is reckoned that the equivalent product is a tyre weighing 56 pounds (25.4 kilogrammes), the resulting productivity would be 0.27 tyres per man/hour.

gap between Peruvian rubber and rubber on the international market. With suitable protection, such articles could be manufactured domestically, since a partial enlargement of tyre factories would be sufficient. It is estimated that with an investment of some 500 000 dollars at least 70 per cent of the quantum of annual imports could be replaced (see table 126).

3. *Light rubber industry*

This industry covers a wide range of products, usually light in weight. It is carried on in 20 somewhat small establishments [95] characterized by a wide variety of production (see table 127). One of the establishments visited was turning out about 300 different articles. Its total annual consumption amounts to 180 tons of raw material, so that its average production per article was some 600 kilogrammes per year. The cause of this diversification is the limited market.

Table 127

PERU: NUMBER OF FACTORIES PRODUCING MISCELLANEOUS RUBBER GOODS AND DISTRIBUTION OF THEIR PRODUCTION BY AREA

Department	*Number of factories*	*Percentage distribution of production*
Lima and Callao	15	94
Others	5	6

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

[95] Not including vulcanized footwear factories already studied in section V of this chapter.

The staff employed in the 20 establishments numbers 316 persons and the productivity of this industry is about 1.4 kilogrammes of finished product per man-hour (five times lower than in the tyre factories). The productivity index is very low because the small size of the production series prevents any further mechanization of equipment. The changing of matrices, however, takes very little time and does not affect productivity, which means that, given the small market and the corresponding level of technical production, the greater diversity of output does not lower yield.

Rubber represents about 42 per cent of the raw materials consumed in the production of these articles. It may thus be asserted that the annual volume of manufacture amounts to some 850 tons of finished product or about 70 per cent of consumption. The average value of imports is about 800 000 dollars per year.

Some 95 per cent of the rubber used in these establishments is of domestic origin. A small amount of synthetic rubber is imported for certain special uses such as the manufacture of gasket rings in oil pipelines.

XII. CHEMICAL AND PHARMACEUTICAL PRODUCTS

The manufacture of chemical products constitutes a relatively small sector of Peruvian industry. It accounts for no more than 8 per cent of the capital invested in manufacturing activities and not more than 6 per cent of the total value added of the manufacturing industry. But, it is tending to grow more rapidly than the industry as a whole, as may be seen from a comparison of the respective quantum indices (see annex II, table 32).

Domestic demand for chemical and pharmaceutical products in 1955 was 1 203 million soles, of which 611 million came from Peruvian industry. However, of the total raw materials consumed (339 million soles) 60 per cent consisted of imports so that the net contribution of Peruvian output to domestic demand was 40 per cent in that year.

In recent years demand for imported chemicals has been very strong; in real terms, they increased at an annual rate of 17 per cent during 1945-56. Of the imports effected during the years 1951-56, 38 per cent were of products made by the heavy chemicals industry (fertilizers, alkalis, acids and other basic compounds).

So far, the only basic chemicals manufactured in Peru have been sulphuric acid and caustic soda. Peruvian industry almost satisfies demand for the former, which is very limited, but imports of the latter amount to six times more than production.

The bulk of the Peruvian chemicals industry is of the light variety. Its products are distributed directly to the consumer (paints, detergents, pesticides, etc.) but they are nearly all based on imported raw materials and semi-finished products. Towards 1960 this situation may change as the result of the entry into operation of factories producing nitrogen compounds by synthesis, sodium alkalis and basic organic compounds. Such industries have a proliferating effect since they foster the establishment of other plants for the manufacture of semi-finished products and products for direct consumption.

The present section will deal with the industries turning out the following products: basic compounds, fertilizers, other chemical products, pharmaceutical products, synthetic fibres, non-edible oils and fats, paints, varnishes, soap and candles.

1. *Basic chemical products*

In this study, sulphuric, nitric and hydrochloric acids, caustic soda, sodium carbonate, ammonia and chlorine are considered as basic chemical products. Nitric acid, ammonia and sodium carbonate are not produced in Peru. Caustic soda, hydrochloric acid and chlorine are manufactured in small quantities by a plant working in conjunction with a paper mill which absorbs nearly the whole output. In other words, the only basic chem-

ical compound turned out on an industrial scale is sulphuric acid.

(a) *Sulphuric acid*

The two factories making this acid have a joint output capacity of 52 tons per day. Both employ the contact process, the larger plant using gases from the roast- in terms of 100 per cent acid, is given in table 128. far has been imported. Output in 1945-56, expressed ing of sulphurous ores and the other sulphur, which so

Table 128

PERU: PRODUCTION OF SULPHURIC ACID, 1945-56

(Tons)

Year	*Quantity*
1945	1 580
1946	7 301
1947	8 206
1948	7 787
1949	10 796
1950	10 768
1951	12 448
1952	13 056
1953	13 103
1954	13 600
1955	14 763
1956	13 220

SOURCE: Direct information.

During the last five years, average consumption has bordered on 13 500 tons per year. If the amount consumed by the producer enterprises themselves (metallurgy and rayon) is deducted, there remain some 2 500 tons for other uses, a figure which illustrates the modest demand of all the remaining industries.

The percentage break-down of consumption in 1955 was as follows:

	Sulphuric acid
Mining and metallurgy	75.3
Rayon production	10.8
Manufacture of copper sulphate	4.4
Petroleum refining	2.5
Tanning of hides	1.6
Textiles	1.2
Manufacture of chemicals	1.2
Other uses	3.0

SOURCES: Mining and metallurgy: Institute for Mining Research and Development (*Instituto de Investigaciones y Fomento Mineros*), *Anuario de la Industria Minero del Perú, 1955*. Petroleum refining: Petroleum Department (*Dirección de Petróleo*), *Estadística Petrolera del Perú, 1955*. Other uses: Department of Industries and Electricity, *Estadística Industrial 1955*, and direct research. Other items: direct research.

During the first half of 1957, a projected plant was almost completed with a capacity for producing 30 tons of sulphuric acid per day by the contact process. This will boost annual production by 10 000 tons, which will be used largely for the manufacture of superphosphates. During the next decade a factory capable of producing 450 tons per day will probably be built. It will operate in the port of Ilo and will utilize the gases obtained from the roasting of copper sulphate ores. Although much of this output will be absorbed in copper metallurgy itself, there should be a surplus which should far exceed demand unless in the meantime the production of superphosphates has developed on a scale of not less than 90 000 tons of fertilizer per year, which is the rough equivalent ot 18 000 tons of phosphoric acid. Otherwise, the Ilo project should be based on exports of sulphuric acid to certain countries on the Pacific coast in view of the low production costs. However, the difficulties involved in exporting a product like sulphuric acid are well known.

(b) *Hydrochloric acid*

The industrial centre of Paramonga has a plant with a capacity of 1 500 tons of hydrochloric acid per year. In 1955, it produced 1 086 tons and in 1956 only 1 005. Some 700 tons are marketed, while the remainder is used for other purposes at the production site, principally for obtaining ethyl chloride. The latter is made in a plant with a capacity of 300 tons a year but which operates at only 25 per cent of that figure.

(c) *Nitric acid*

Nitric acid is not produced on an industrial scale in Peru. Certain laboratories obtain it by breaking down sodium nitrate with sulphuric acid, but this process is uneconomic and the annual output very small. During the next few years nitric acid will be produced by the oxidization of synthetic ammonia; it will consist largely of ammonium nitrate used for fertilizing and technical purposes, while the balance—estimated at between 1 000 and 1 500 tons per year—will be mainly used for making explosives.

(d) *Sodium alkalis*

Sodium carbonate has so far not been manufactured but caustic soda is produced on a small scale, covering only 9 per cent of domestic consumption of sodium

Table 129

PERU: PRODUCTION AND CONSUMPTION OF SODIUM ALKALIS, 1945-56

(Tons)

Year	*Production of caustic soda*	*Imports*		*Apparent consumption in terms of caustic soda* [a]
		Caustic Soda	*Sodium Carbonate*	
1945	—	2 107	1 921	3 557
1946	—	3 007	5 094	6 851
1947	—	3 025	4 600	6 497
1948	703	4 245	7 346	10 492
1949	955	5 257	7 422	11 756
1950	945	4 857	3 032	8 082
1951	1 062	5 730	7 655	12 592
1952	1 036	3 501	4 529	7 957
1953	1 029	5 441	6 515	11 380
1954	1 000	7 180	7 504	13 840
1955	1 330	7 901	8 203	15 411
1956	1 362	8 844	6 992	15 486

SOURCE: Production: direct information. Imports: *Anuarios de comercio exterior, op. cit.*

a Conversion factor for sodium carbonate: 0.7547.

alkalis, at a plant consisting of 136 cells divided into four groups, with a daily production capacity of four tons. It belongs to the largest paper factory in Peru. Table 129 shows the production and consumption figures for sodium hydroxide and carbonate for 1945-56.

Excepting 1945, which was still a war year, consumption increased at the rate of nearly 8 per cent per year during the period 1946-56.

The rough percentage break-down of consumption is as follows:

	Caustic soda	*Sodium carbonate*
Soap production [a]	49.3	2.9
Glass production		76.2
Pulp production	29.2	0.8
Rayon production	13.4	—
Manufacture of chemical products	3.1	7.4
Textiles	1.8	6.5
Petroleum refining	1.7	—
Manufacture of detergents	0.7	0.2
Other uses	0.8	6.0

SOURCE: Petroleum refining: Petroleum Department, *Estadística Petrolera del Perú, 1955*. Other uses: Department of Industries and Electricity, *Estadística Industrial 1955*, and direct research. Other items: direct research.
a Estimated by multiplying the total consumption of fats by 0.2.

(e) *Chlorine*

As in other under-industrialized countries, the demand for chlorine is relatively small in Peru, since chemical compounds are not produced by synthesis, which is the process in which chlorine is used most.

In 1956, Peru consumed 1 690 tons of chlorine, as follows:

Product or destination	*Quantity*	*Equivalent consumption of chlorine*
Hydrochloric acid	1 005 (of 30%)	300
Calcium hypochloride	400	180
Local sales of chlorine		220
Consumption in paper manufacture		340
Total		*1 040*

In addition, 220 tons were exported to Ecuador, Bolivia and El Salvador, so that there is now a balance between supply and demand. As will be seen in Part Three of this report, it seems likely that the future production of chlorine—deriving from the increased manufacture of caustic soda by electrolysis—will find only a partial outlet in the next few years, unless the establishment of new industries to absorb it is encouraged.

2. *Fertilizers*

Peru is well placed as regards fertilizers because its renewable resources include one of great value—guano from its islands.[96] For some decades output fluctuated considerably, mainly as the result of changing weather conditions, but more recently it has increased greatly thanks to the action taken by the *Compañía Administradora del Guano*, a body subject to governmental supervision responsible for ensuring the collection of guano on the largest possible scale. In 1942-45, 80 000 tons of guano were gathered on the average per year and in 1956 336 000 tons. The amount gathered in 1957 may fall to some 250 000 tons because of the uneven weather prevailing over the whole Peruvian coastline in that year.

Output is divided into "rich" and "poor" guano. The former represents 98 per cent of the total volume and consists of fresh bird droppings, renewable every year. Its chemical composition varies from year to year because it depends on such uncontrollable factors as feeding of birds, climate, etc. During the period 1951-56, the average chemical break-down was as follows:

Nitrogen	15.1
Phosphoric acid	16.2
Potassium oxide	1.2
Calcium oxide	8.0

"Poor" guano is the fossilized product which has lost the bulk of its organic elements. It contains between 18 and 20 per cent phosphoric acid, it is not renewable and the capacity of the deposits is estimated at between 100 000 and 150 000 tons.

Guano is perhaps the cheapest fertilizer in the world per unit of nutritive element. The guano allocated, which represented 82 per cent of the total in 1956, is sold at 20 soles (1.07 dollars) per unit of nitrogen with no charge at all for phosphoric acid and potassium. In other words, the nitrogen alone is sold to farmers at about one third of the international price of nitrogen fertilizer. However, the supply of guano does not cover domestic requirements. The total amount requested by farmers was in some years more than double the quantity that the *Compañía Administradora del Guano* could sell them (see table 130). Of course, farmers may overstate their requirements in an attempt to obtain a quantity closer to their actual needs but this fact itself reveals the disequilibrium between supply and demand.

Table 130

PERU: GUANO REQUESTED BY AND SOLD TO FARMERS, 1946-56
(Tons)

Year	*Amount requested*	*Amount sold*	*Ratio between amount requested and amount sold*
1946	361 241	100 449	27.8
1947	369 736	146 931	39.7
1948	345 601	166 102	48.0
1949	354 878	160 338	45.2
1950	356 757	220 028	61.7
1951	366 047	243 394	66.5
1952	486 912	236 064	48.5
1953	437 004	240 767	55.1
1954	529 757	267 260	50.4
1955	559 804	306 680	54.8
1956	547 138	306 961	56.1

SOURCE: *Compañía Administradora del Guano.*

[96] Guano is classified as part of the extractive industry but it is dealt with here in conjunction with the chemical industry because of its similarity to the synthetic fertilizers produced by the latter.

The future production of guano depends on conditions beyond human control, so that it is difficult to assess. As regards guano production, the year 1956 was apparently a bumper one and is seldom likely to be surpassed or equalled.

The gap between the demand for fertilizers and the supply of guano is covered partly by imports. Between 1950 and 1956, guano production increased at the annual average rate of 6 per cent and imported fertilizers by 16 per cent. The consumption of fertilizers in 1956, expressed in tons of nutritive elements is shown in table 131.

Table 131

PERU: CONSUMPTION OF FERTILIZERS, 1956
(Tons)

	N_2	P_2O_5	K_2O
"Rich" guano	45 500	48 500	3 000
"Poor" guano		1 000	
Imported fertilizers	5 800	2 000	2 700
Total	51 300	51 500	5 700

SOURCE: Direct research.

It is difficult to assess the significance of these figures as regards ideal consumption on land now under cultivation. There are studies which state that some 20.7 per cent of the nitrogen and some 51.4 per cent of the phosphoric acid extracted from the ground by crops is returned to it in the form of fertilizer.[97] Others affirm that the present scale of fertilization in Peru is 30.4 per cent of what may be considered "efficient" in the case of nitrogen and 46 per cent in the case of phosphoric acid.[98] Obviously, there is a deficit which, although it may be reduced by using agricultural residues (compost), would always require a considerable additional quantity of chemical fertilizer to reach a level of fertilization which is still far from ideal. In spite of these deficits, Peru is by far the largest consumer in Latin America.

Two projects are under way, one for nitrogenous fertilizer and the other for phosphates. The former is connected with the building of a plant for producing 50 tons of synthetic ammonia per day. It is planned to double that capacity at a later date. Investment is reckoned at 160 million soles (8.5 million dollars), of which 150 million represents fixed capital. The main product would be ammonium nitrate. Annual output would be some 50 000 tons of agricultural grade (20 per cent) and some 5 000 tons of technical ammonium nitrate (33.5 per cent) for the manufacture of explosives. The project also contemplates the initial processing of 15 000 tons of ammonium sulphate per year and 1 000 to 1 500 tons of nitrate acid per year for marketing. The whole output will be equivalent to some 17 360 tons of nitrogen including the duplication of ammonia of which about 16 000 tons would be for fertilizers.

The second project concerns a plant for producing 50 tons per day of superphosphates with imported apatites and domestic sulphuric acid. Fixed investment is calculated at 300 000 dollars, and it was hoped to produce some 3 500 tons of P_2O_5 from the end of 1957 onwards.

In spite of the importance of these factories, there will obviously still be a wide gap between needs and supply. Over the short term, effective demand should rise as the result of a marked increase in the area under cultivation and the more intensive use of fertilizers. In Part Three of this study, which deals with projections for 1965, estimates are made of the growth in the consumption and production of fertilizers.

Finally, Peru should produce balanced fertilizers, i.e., mixtures containing variable amounts of nitrogen, phosphoric acid and potassium, depending on the nature of the crops and the qualities of the land. In this way, a more rational use of fertilizer would be achieved.

3. *Other chemical products*

The production of chemical compounds which are not basic acids or alkalis make up the bulk of the Peruvian chemical industry. However, this group is of minor importance, both absolutely and relatively. The smallness of the domestic market is a serious obstacle for the expansion of this industry, while the shortage of technicians, capital and many raw materials and semi-finished products have made it difficult to develop an export industry.

The most important of these domestically-manufactured products are calcium arsenate, copper and zinc sulphates, carbon disulphide, zinc oxide and sodium silicate (see table 132). In certain cases, they occupy a secondary position among the activities of the firms producing them but, in others, the manufacture of one or more of them constitutes the main line of production.

The prices of these Peruvian-made products are only very slightly lower than the c.i.f. value of similar imported chemicals plus customs duties. Sometimes

Table 132

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF SELECTED CHEMICAL PRODUCTS, 1955
(Tons)

Product	*Production*	*Imports*	*Apparent consumption*
Calcium arsenate	1 007 [a]	—	1 007.0
Ultramarine blue	72.2	185.4	257.6
Carbon disulphide	359.1	—	359.1
Litharge and minium	214.6	165.5	380.1
Zinc oxide	212.6	—	212.6
Sodium silicate	532.0	—	532.0
Copper sulphate	1 766.4	659.4	2 425.8
Zinc sulphate	1 075.7	82.6	1 158.3

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity: *Anuarios de comercio exterior, op. cit.*

[97] Oswaldo B. González Tafur, *Perú, población y agricultura* (Lima, 1952).

[98] Rodolfo Beck Navarro, *La industria nacional de fertilizantes sintéticos.*

their quality is up to that of imported products (e.g. zinc oxide); sometimes, they are inferior and cannot be used for certain scientific purposes (e.g. lead oxide for accumulators).

The organic chemical industry began making explosives in the last half of 1956. Output capacity is 12 tons of finished products per 8-hour shift, and the initial manufacturing programme provides for the production of 200 tons of gelignite, 2 200 of other dynamites containing gelatine, 1 800 tons of ammoniac dynamite and 600 tons of powdered dynamite. At the outset, production will be based on imported raw materials but in the near future, when the petrochemical industry is launched and glycerine is available in larger amounts, it will be able to rely on a higher proportion of domestic raw materials.

4. *Pharmaceutical products*

Pharmaceutical products represent more than 80 per cent of Peru's total consumption of chemicals.[99] The market is estimated at some 150 millon medicament/units, with a value of rather more than 290 million soles in 1956, distributed among nearly 13 000 specifics, of which 4 000 are processed or packed in the country and 9 000 imported. Although several of these specifics are based on the same formula, they are produced under different trade names; this necessitates intensive publicity in the form of samples directed at the medical profession in particular and thus raises the sales price for the general public. The gross contribution of domestic output to consumption in this branch is almost 50 per cent in value, but since 87 per cent of the raw materials and 9 per cent of the containers, labels, wrappers, etc. are imported, the net proportion is in fact only 38 per cent.

Statistics register 36 laboratories which prepare and pack specialized pharmaceutical products; 11 of them, supplying 44 per cent of production, use the trade marks of foreign companies or act as their agents (see table 133).

Table 133

PERU: STRUCTURE OF THE PHARMACEUTICAL INDUSTRY, 1956

(Units and thousands of soles)

Number of enterprises	36
Personnel	
Total	2 079
Employees	844
Manual workers	1 235
Raw materials	
Total	36 855
Domestic	4 763
Foreign	32 092
Value of production	
Gross	143 744
Added	54 956

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Peru's pharmaceutical industry undertakes few transforming operations. Nearly all the establishments confine themselves to packaging, making pills from, dissolving and blending the raw materials and semi-finished products which are virtually all imported. Only certain vehicles (sugar, glycerine, alcohol, etc.) are made from domestic raw materials. The branches of world-famous companies tend to limit their activities to packaging. No private laboratory[100] isolates or synthesizes any pharmaceutical compound on a commercial scale, as the domestic market is small and the profitability of production uncertain even in the case of the few medicaments that record a fairly high rate of consumption such as aspirin. This limitation could be overcome by exporting, but so far little has been done to discover or test raw materials that could be used in galenic pharmacy either direct or through their derivatives. The problem is not a simple one, since scientific progress leads to constant changes in the use of pharmaceutical products. A typical case is that of drugs for combating infections. The sulphonamides, after several years of inestimable service as the principal medicaments of this kind, were successively superseded by amorphous penicillin, crystallized penicillin G, procaine and associated formulas and, finally, by other antibiotics (terramycin, aureomycin, chloromycetin, etc.). Hence, there seems to be no justification at present for the manufacture of certain products based on domestic raw materials, in view of the competition offered by synthetic equivalents or substitutes. Such is the case with cocaine, which could become an important export item in Peru's pharmaceutical industry, but has been virtually ousted by non-habit-forming, synthetic drugs with a more powerful analgesic action, and less or no toxicity; with quinine, which began to be extracted again from *quina* bark on a large scale during the early years of the Second World War, only to be subsequently replaced by more efficient antimalarial remedies; and with caffeine,[101] which has lost its former prestige as a cardiotonic.

The specifics produced in Peru are rarely based on original formulae. The majority are copies of foreign inventions but are usually less therapeutically effective, which has made doctors rather chary of prescribing domestic drugs.

The industry offers a wide variety of products. It includes antibiotics, anti-infectious, anti-parasitic, antifebrile, analgic, anti-rheumatic, anti-histaminic and desensitizing drugs, antiacids, ataraxics, barbiturates, hypnotics and sedatives, anti-spasmodics, anti-cholinergics, coagulants and haemostatics, cardiotonics, diuretics, hormonals and corticoids, lipotropics and chemotherapeutics, general tonics and stimulants, vitamins, serums,

[99] Excluding guano, which is classified among the extractive industries.

[100] One State-owned laboratory isolates cocaine from coca leaves. Its output is very small.

[101] One study suggests that it might be advantageous to synthesize caffeine from uric acid found in the guano on the islands.

vaccines and medical foods such as milk specially prepared for paediatric use.

The preparation of some biologicals such as vaccines has reached a relatively high level, and domestic vaccines give excellent protection against smallpox, typhoid, piodermatitis, etc. In contrast, isotonic, hypertonic and hypotonic serums, which are very easy to prepare, cannot be compared with their imported counterparts owing to the packaging problem. In fact, it has not yet been possible in Peru to produce chemically neutral glass for containers, for want of which the contents often decompose and in some cases, pyrogens form. As a result, a few domestic laboratories have decided to import glass containers as well. Peru's pharmaceutical industry imports 2.4 per cent of its glass container requirements, consisting almost entirely of flasks and ampoules of neutral glass.

Owing to the great variety of drugs produced, no one medicament/unit can be chosen as a representative product from which to deduce the industry's physical productivity. Nevertheless, on the basis of the data supplied by 21 laboratories which control 65 per cent of production, monetary productivity per man/hour is estimated at 27.40 soles (at 1956 prices), which is considerably lower than that of other Peruvian industries, owing to the fact that much of the work of blending and packaging the products, which constitutes the laboratories' main activity, is done by hand.

Imported specifics have been shown to constitute a sizeable share of domestic consumption of pharmaceutical products. The industry can therefore expand considerably by replacing a large number of imports. Its expansion should, however, not be effected by means of greater tariff protection,[102] but by an improvement in the quality of the goods and in levels of productivity. The former is important, and in order to achieve it, official supervision should be intensified so as to give doctors and patients more faith in domestic specifics.

5. *Synthetic fibres*

With regard to the textile industries, it was pointed out in section IV of this chapter that, in 1951-56, artificial fibres represented an average of slightly over 12 per cent of annual textile consumption. Of the total synthetic fibre consumption in Peru (2 030 tons annually during the period in question), 42.5 per cent was supplied by domestic industry and consisted of viscose rayon and acetate filament. The rest was made up by 21.7 per cent of other types of filament and 36.8 per cent of cut fibres, both imported. However, these figures do not reflect the situation in 1955 and 1956, because consumption of cut fibre expanded more rapidly than that of filament, and imports of filament

Table 134

PERU: CONSUMPTION OF SYNTHETIC FIBRES, 1951–56

(Tons)

Year	Filament			Imported cut fibre	Total apparent consumption
	Domestic	Imported	Total		
1951 . . .	611	677	1 288	291	1 579
1952 . . .	602	484	1 086	142	1 228
1953 . . .	629	591	1 220	235	1 455
1954 . . .	1 000	610	1 610	766	2 376
1955 . . .	1 195	136	1 331	1 396	2 727
1956 . . .	1 141	144	1 585	2 014	3 299

SOURCE: Producer enterprises and *Anuarios de comercio exterior, op. cit.*

dropped sharply while domestic production remained at much the same level (see table 134).

The causes of the drop in filament consumption are: (*a*) a change in the trend of demand which can be observed in nearly every country in recent years, i.e., fabrics woven from filament are losing ground to those made from cotton and cut fibres so far as consumer preference is concerned; (*b*) some textile factories using filament closed down totally or partially in order to renew their equipment; and (*c*) the high price of domestic[103] and imported[104] filaments, attributable, in the case of the latter, to exorbitant customs duties and, in the case of the former, to the adjustment of prices to those of imported filaments on the domestic market and the consequent rise in the cost of fabrics manufactured from them.

As the high price of rayon filament in Peru is a serious obstacle to any increase in its consumption, possible amendments to the customs tariff should be studied[105] in order to encourage a certain amount of foreign competition. Owing to the smallness of the domestic market, no competitive industrial enterprises can be established now or in the near future, and the only way to stabilize prices would therefore be to import on a moderate scale. Textile manufacturers could thus begin to import small lots of special yarns again, which it is not yet worth while to produce domestically, but which they need to diversify their production.

Filament production is carried out by two enterprises under the same technico-financial management. One manufactures continuous yarns from viscose rayon and the other uses cellulose acetate filament. Production from viscose started in 1947 and from cellulose acetate in 1953 (see table 135).

The counts most commonly manufactured are 100, 150, 220 and 300 denier for viscose and 100, 150, 300 and 600 denier for acetate.

Acetate production capacity is one ton per day; as

102 This does not mean that the customs tariff should not be revised in order to place the raw materials used by the industry in an equitable position *vis-à-vis* imported drugs. Rather than raise the tax on imported specifics prepared with foreign raw materials, it would be more logical to exempt the raw materials in question from import duties.

103 Domestic rayon sells at more than double the price c.i.f. Peruvian port of its imported counterpart.

104 Imported rayon of 150 deniers, which costs 1.30 dollars per kilogramme c.i.f. Callao, soars to 3.25 dollars per kilogramme—i.e. 250 per cent dearer—by the time it reaches the textile manufacturer.

105 The governmental resolution of 14 April 1954 brought into force new duties which are now levied on imported rayon.

Table 135

PERU: RAYON AND ACETATE PRODUCTION, 1947-56
(Kilogrammes)

Year	Rayon	Acetate	Total
1947	197 942	—	197 942
1948	313 477	—	313 477
1949	564 327	—	564 327
1950	650 923	—	650 923
1951	611 149	—	611 149
1952	602 217	—	602 217
1953	616 197	12 432	628 629
1954	845 762	154 678	1 000 440
1955	979 319	218 530	1 197 849
1956	865 213	275 422	1 140 635

SOURCE: Producer enterprises.

regard viscoe, capacity for preparing cellulose xanthate amounts to seven tons daily, but spinning-machine capacity is only 3 tons. Real daily production in 1956 was 0.76 tons of acetate and 2.5 of viscose rayon.

The two factories employ 386 workers. Labour productivity—1 064 kilogrammes per man/hour of viscose and 1 982 kilogrammes per man/hour of acetate—is high and ranks with that of European and United States factories. This is due to the fact that both factories use modern machinery and methods which result in a short production cycle. In fact, there is a lapse of only 46 hours from the moment that manufacture of rayon viscose begins to the start of spinning; it has been possible to shorten the interval to this extent by considerably speeding up the maturing period of the cellulose-alkali in the process used.

All the raw materials used for acetate production (cellulose acetate, acetic anhydride, acetone and titanium dioxide) and 83 per cent of those required for viscose rayon (alpha-cellulose, caustic soda, titanium dioxide and ancillary products, excluding sulphur for the manufacture of H_2SO_4 and CS_2 in associated plants, which is also imported) are imported. In order to lower the price of viscose, for which the highest consumption is recorded, linters should be used experimentally, mixed with imported alpha-cellulose, which at present costs 318 dollars per ton c.i.f. Callao. Peru exports approximately 800 tons of linters annually at an average price of 27.6 dollars per ton. As the linters has an average yield of 70 per cent pure cellulose after bleaching and purifying, the 800 tons could give 550-600 tons of pure cellulose at a cost of not more than some 70 dollars per ton. In 1956, production required 1 124 tons of imported cellulose, at a factory value of 7.86 million soles. If one third [106] had consisted of domestic cellulose from linters, the average price per ton would have dropped from 318 to 244 dollars, i.e. by 23 per cent. As the cellulose represented 66.5 per cent of the total value of the raw material inputs (11.87 million soles in 1956), and the raw materials 29.5 per cent of the sales value of rayon production (40.23 million soles in 1956), the value could have been reduced by 4.5 per cent.

The utilization of linterns as a partial replacement for imported wood cellulose would have meant a saving of almost 120 000 dollars worth of foreign exchange in 1956. Moreover, the surplus of bleached and purified linters, which would have been about 200 tons, could have been exported as pure cellulose which is much in demand in the United States, Europe and Latin America.

6. *Non-edible oils and fats*

This group comprises the non-edible vegetable and animal oils and fats which are consumed or produced in Peru. Oils and fats of mineral origin are dealt with in section XIII of this chapter.

(a) *Vegetable oils and fats*

Of the non-edible fatty substances of vegetable origin consumed in Peru, the chief are, castor, linseed and almond oils.

The most important of those produced in Peru itself is castor oil. Cultivation of the castor-oil plant [107] and extraction seem to be expanding in response to world market demand for the oil,[108] attributable in turn to its multiple uses as a lubricant, as raw material for the manufacture of wax,[109] plastic materials, paint, soap and synthetic perfumes, for medicinal purposes, in the manufacture of insulating materials and in the leather industry.

There are two castor-oil factories in Peru, with an annual production capacity of about 1 300 tons of oil. One of these is situated in the Department of Piura; it is small, but has an interesting special feature, consisting in a patented operation system of its own, based on the use of liquid butane gas, which, after passing through the extraction tanks, is subjected to

106 Experience in Mexico has shown that a mixture of 33 per cent cellulose from linters and 67 per cent wood cellulose gives excellent results.

107 The castor-oil plant can be grown in conditions which would be unfavourable to the development of other crops. It is seldom attacked by insect pests or disease. It can be successfully cultivated in poor soil, and requires less water than most crops. Soils with a high alkali content are not as harmful to it as to the majority of the principal crops grown on a commercial scale. It can be sown at any time of the year; the first harvest is usually obtained 6 months after sowing, and thenceforth the ripe beans can be picked once a month for two to two-and-a-half years. After that the plantation has to be renewed, as otherwise yields would be very low. Between 1 200 and 2 000 kilogrammes of seed are produced per hectare. The *simestro* variety, locally known as "chocolate", has a life-span of 3 years. The growth cycle of the Baker or *cimarrón* variety is 5 months. There are also wild varieties, including those with red roots, which are rich in oil, and those with green roots, whose extraction yield is low.

108 A fall in price is forecast, however. India is gradually increasing its exports; bumper harvests are expected in Brazil, especially in Bahía, where everything suggests that the average of 71 000 tons recorded in recent years will be greatly exceeded; in Mexico, production will probably expand by 60 per cent in relation to the 1956 figure; and other minor producers—Yugoslavia and Ethiopia, for example—are also likely to obtain good yields. In the latter years of the period under consideration demand was substantial enough to keep prices high. But the price of castor oil is likely to decline when the new harvests are brought in, and as a result of competition from other oils.

109 Castor-oil, when subjected to selective pressure hydrogenation, becomes a substitute for carnauba wax which can be turned to a wide variety of uses.

a rapid expansion process, and on evaporation releases the oil. The gas is compressed again for re-use in the extraction cycle. The other plant of much larger capacity is in Lima and was installed recently by foreign capital. Here too the process used is based on a dissolvent, but a liquid one in this case.

Castor-oil seed is capable of yielding between 52 and 55 per cent of oil. Extraction with dissolvents usually results in a yield varying between 40 and 50 per cent,[110] with the additional advantage that the oil obtained is very pure and the pulp is left practically oil-free. Castor-oil cake has no food value but is an excellent fertilizer, with a 40-45 per cent protein content.

The extraction of castor-oil with dissolvents requires very little manpower: four direct workers on each eight-tour shift and three indirect workers on a single day shift can look after an installation handling 24 tons of seed per day and with a daily output of about 12 tons of oil. On a basis of 330 days, and with an effective oil yield of 45 per cent, 31 680 direct and 1 920 indirect man/hours would be needed for an annual output of 17 820 tons of oil. Consequently, the level of productivity ought to stand at some 560 kilogrammes per direct man/hour, but in practice it has been found to reach in Peru only 20 per cent of what might feasibly be expected from the available installed capacity.

It is shortage of seed that accounts for this low productivity. In order to meet the total supply requirements of the existing plants, from 18 000 to 20 000 tons of seed would have to be produced yearly. This implies an area sown to castor-oil plants covering from 7 000 to 10 000 hectares, according to the varieties used. At present there are not more than 4 000 hectares under seed. It is possible, however, to utilize untilled or marginal land for this crop, and in such an event a noteworthy short-term increment in oil production could be expected, provided that world market prices continued to represent an inducement.

(b) *Marine oils*

The by-product of meal factories is fish oil,[111] recovery of which was initiated in 1946. Up to 1952 the output was small, averaging about 60 tons annually, and was exported almost in its entirety. In 1953 meal production began to gather momentum, and a parallel increase was registered in the recovery of oil. In the same year, too, production of sperm and whalebone whale oil was begun (see table 136).

Most of the fish oil produced in Peru is exported in either crude or refined form. However, the volume processed domestically is following a rising trend. It was 374 tons in 1954, 980 in 1955 and 1 850 in 1956. Over 90 per cent of this last amount was utilized in the manufacture of edible fats.

There are two plants which treat fish oil for this purpose. The procedure consists in neutralizing, refining and hydrogenating the oil, in order to remove its odour and make it suitable for blending with other oils and fats. Installed processing capacity amounts to 2 500 tons annually; in 1956, 1 750 tons were handled, so that in this line of production the industry operates with a utilization coefficient of 70 per cent.

As was previously stated, the production of sperm whale oil is fairly new. Domestic processing of this product was initiated; still more recently it was begun in 1956 by the soap factories, which in that year utilized 20 per cent of Peru's output of sperm whale oil.

This oil is turned to account by three enterprises. One of them, installed not long ago, is equipped for the recovery of the fatty alcohols released by saponification.[112] The three installations can jointly produce about 4 000 tons of soap with a 60 to 65 per cent fatty acid content and some 830 tons of fatty alcohols which constitute the raw material for the manufacture of industrial detergents. Of the detergents produced, 40 per cent is obtained as a by-product of the sulphonation of fatty alcohols. If the whole of Peru's output of such alcohols were subjected to this process, consumer markets would have to be sought abroad, as there is little domestic demand.

Table 136

PERU: PRODUCTION OF MARINE OILS, 1953–56
(Tons)

Year	*Fish*	*Sperm whale*	*Whalebone whales (Right or baleen whales, sulphur-bottoms, etc.)*
1953	419.3	3 551.9	277.8
1954	757.4	5 017.9	...
1955	1 228.0	4 743.1	113.5
1956	1 720.7	4 028.5	249.1

SOURCE: Ministry of Agriculture, Game and Fisheries Department (*Dirección de Pesquería y Caza*).

7. *Paint*

The volume of paint consumed in 1956 is estimated at 640 000 gallons and its value at 3.2 million dollars.

110 The Baker or *cimarrón* variety yields up to 52 per cent of oil. This is the seed which is being introduced into Peru. It has the drawback that the beans cannot be machine-hulled because of their thick, hard shell.

111 Fish oil is included in this section so that it may be considered together with the other marine oils. Although it has industrial uses, it is also used as an edible fat, and might therefore have been dealt with in section I of this chapter. In the discussion of demand and production projections it is included among the foodstuffs industries, because its production is linked to the manufacture of fish meal and tinned fish.

112 Sperm whale oil is a glyceride of fatty acids and high-grade alcohols. In the saponification process, soap is formed and the high-grade alcohols are released. The average content of such alcohols in sperm whale oil is as follows:

	Percentage
Oleic alcohol	70
Cetylic alcohol	25
Myristic alcohol	4
Lauric alcohol	1

The average yield is about 330 kilogrammes of alcohol per ton of oil.

The share of domestic industry in this consumption was 78 per cent, and is following an upward trend. Imports consist mainly of enamels, lacquers and certain types of special anti-corrosive paint.

Production developed rapidly in the later years of the period under review. In 1945, there were seven plants which manufactured 87 000 gallons of paint; in 1956, 12 factories and an output of 500 000 gallons were registered (see table 137). Consequently, the quantum of production increased at the exceptional annual rate of 17 per cent.

Table 137

PERU: STRUCTURE OF PAINT INDUSTRY, 1956
(Units and thousands of soles)

Number of establishments	*12*
Personnel	
Employees	124
Workers	253
Value of production	*57 069*
Value of consumption	
Raw materials	27 982
Fuels and lubricants	103.9
Energy	133.2
Containers	4 099
Value added	*24 751*

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

With the exception of one factory, which accounts for 32 per cent of production, all the establishments are small, but in the more developed countries, too, the manufacture of paints is distributed among a large number of relatively small establishments scattered throughout the major consumer centres, as these prove more economic than a few big plants with heavier long-distance transport costs.

The total volume of production may be broken down into the following main groups.

	Percentage
Distemper	37
Liquid oil paint	30
Paste paint	8
Anti-corrosive paints	9
Marine paint	9
Enamels	7

Of the raw material used by the industry, 54 per cent in terms of weight and 20 per cent in terms of values is produced in Peru. Imported materials include most of the pigments, dissolvents, oils and drying agents; domestic manufacture is not for the moment warranted by the smallness of the consumer market.

About 60 per cent of the output is manufactured with modern equipment. Production capacity is estimated at about 700 000 gallons yearly, and the current utilization coefficient at some 70 per cent.

According to official statistics, the labour input in 1956 was 462 000 man/hours, or, in other words, average productivity stood at 1.08 gallons per man/hour. This figure represents only 42 per cent of that registered in Peru's most efficient factory, which operates with modern equipment and in accordance with the advice and technical standards of a foreign enterprise. Hence it can be seen that there is plenty of room for an improvement in productivity.

8. *Soap and glycerine*

No very marked expansion is being registered in soap production. Its average annual rate of increase between 1945 and 1956 was 4 per cent. If the rate of production is analysed from year to year, some degree of stagnation can be noted from 1953 onwards, in consequence of the interest attaching as from that date to the production and consumption of detergents. It is estimated that during the last three years of the period under review total soap production averaged about 11 500 tons (1 500 tons of toilet soap and 10 000 tons of washing soap). If imports, which amounted to about 140 tons annually during the years in question, are added to the foregoing figure, the result is an apparent average consumption of 11 700 tons of soap, which is extremely low if expressed in *per capita* terms, since the annual *per capita* figure barely reaches 1.17 kilogrammes. So low a level of *per capita* consumption shows that there is a wide field for the expansion of soap production in Peru, despite competition from detergents, because the area in which demand would probably be greatest is the sierra, where only limited use can be made of detergents, which do not lend themselves to the time-honoured custom of washing at the river's edge.

Three soap-manufacturing techniques are employed in Peru, namely, the old system of intermittent boiling and drying in moulds, which is that currently adopted in the small establishments; the system of intermittent boiling and continuous drying, which is that adopted by the principal factories producing toilet soap (with a 78 per cent fatty acid content); and the system of continuous boiling and drying, which is applied in the largest plant for the mass production of washing soap (with a 63 per cent fatty acid content). Of the total output, 10 per cent is obtained by the first method, 25 per cent by the second and 65 per cent by the third.

Raw materials come mainly from abroad. During the last five years of the period considered, the industry consumed on an average between 4 500 and 5 000 tons of imported tallow, 1 000 tons of domestically-produced tallow, 2 400 tons of cotton oil waste, 280 tons of imported coconut and palm oils, 200 tons of imported colophon, 830 tons of caustic soda and 280 of sodium carbonate, also from foreign sources, and 1 000 tons of sodium silicate, 75 per cent of which was domestically-produced.[113] To this list about 1 000 tons of sperm whale oil would have to be added for 1956.

[113] The trend of sodium silicate production is toward the satisfaction of domestic demand requirements. From 1951 onwards, annual domestic production figures, in terms of the dry product, were 629, 861, 695, 665, 774 and 1 482 tons; imports, on the other hand, gradually decreased (657, 392, 330, 196, 19 and 0 tons).

The manpower employed amounted to some 600 persons, of whom 70 per cent can be regarded as direct workers. Productivity is estimated at 80 kilogrammes of finished goods per direct man/hour, which represents almost 50 per cent of that registered in United States factories in 1947.[114] The figure given is an approximate average, as productivity varies very widely according to the establishments concerned, and is influenced by the technique applied, the quality of soap manufactured, the degree of mechanization and the length of the manufacturing series. This last factor is important, despite the fact that the relative saving of manpower takes place chiefly at one stage of the manufacturing process (that of saponification), as large boilers, while requiring no more manpower than small ones, yield a bigger output in a given period of time.[115]

Linked to soap production is the obtaining of glycerine, which is recovered from the saponification lye. There are three plants for the production of glycerine, with theoretical maximum capacity of 1 000 tons annually. One of them is a small plant capable of producing only crude glycerine. Its output is much smaller than the figure given, as it is limited by the availabilities of saponification lye. In 1956 it amounted to 190 tons.[116] Hitherto, the glycerine produced has been of the pharmaceutical kind, but the industry is in a position to manufacture the Nobel 21 type of glycerine which is used in the manufacture of explosives, an activity that will shortly constitute an important market for the glycerine factories.

114 In the United States in 1947, the labour input for all types of soap was 0.2961 man/hours per 100 pounds of finished product. The continuous saponification method, which is used in the largest of the factories, considerably raises average productivity in Peru. This process calls for highly experienced personnel, so that the considerable saving in manpower becomes apparent only after one or two years have been spent on the training of skilled workers.

115 Saponification constitutes the pivot of soap production. It needs personnel with a degree of experience that can be acquired only after several years of employment in the industry.

116 If the total fats used in soap manufacturing are taken into account, the output of glycerine must have come close to 500 tons, on the assumption of a 9.5 per cent glycerine content in the fats in question and a net recovery of 87 per cent. But only three soap factories—one of which is on a distinctly small scale—recover glycerine.

XIII. COAL AND PETROLEUM DERIVATIVES

The following are the main activities of the national coal and petroleum industry: petroleum refining, the production of metallurgical coke, the production of anthracite gas and the manufacture of coal briquettes. The washing of anthracitic coal, which is carried out in three plants with a total handling capacity of 32 000 tons a month, is not included in this group.

Petroleum refining is the most important activity from the points of view of capital invested, labour employed and gross value of production. As regards coal derivatives, the manufacture of metallurgical coke is the main industry but even it is not very active. Coal is not yet used as a raw material in the manufacture of blends for, as has been seen, the field of organic chemistry has been left virtually untouched in Peru. Consequently the pitch recovered from the coal distillery at the Oroya metallurgical plant is used only as fuel in the reverbatory copper-smelting furnaces.

1. *Petroleum refining*

About 80 per cent of the petroleum produced in Peru is refined. The proportion remained fairly constant throughout the period 1952-56, so that exports of crude petroleum during those years fluctuated according to the variations in the volume extracted.

Table 138

PERU: EXTRACTION OF CRUDES AND PRODUCTION IMPORTS AND APPARENT CONSUMPTION OF DERIVATIVES, 1945-56

(Cubic metres)

Year	Extraction				Total production of derivatives	Imports of derivatives	Exports of derivatives	Apparent consumption of derivatives
	Total	Crude petroleum	Natural petrol	Liquid gases and hexane				
1945	2 357 050	2 184 918	170 915	1 218	2 146 647	12 188	1 425 928	732 907
1946	2 147 994	1 982 058	164 667	1 270	1 755 005	22 086	1 052 970	724 121
1947	2 189 252	2 029 062	158 378	1 774	1 704 742	48 890	805 106	948 526
1948	2 409 577	2 236 530	169 988	3 060	1 897 849	27 013	896 672	1 010 190
1949	2 526 171	2 352 135	170 744	3 292	1 959 442	49 707	973 219	1 035 930
1950	2 563 611	2 388 975	168 087	6 548	1 934 850	46 880	863 650	1 118 080
1951	2 739 626	2 560 990	173 314	5 422	2 148 752	75 851	824 976	1 399 627
1952	2 776 385	2 607 598	162 935	5 852	2 179 767	55 358	786 336	1 448 878
1953	2 716 121	2 543 352	166 803	5 966	2 211 686	56 105	492 385	1 775 406
1954	2 905 950	2 728 168	168 488	9 295	2 316 045	145 135	659 933	1 801 247
1955	2 914 396	2 741 023	163 234	10 138	2 355 510	298 047	670 750	1 982 807
1956	3 101 554	2 922 410	167 432	11 712	2 500 690	330 350	816 857	2 014 183

SOURCE: Ministry of Development and Public Works, *Estadística Petrolera del Perú*, bulletin of the Petroleum Department (*Dirección de Petróleo*).

Table 139

PERU: PRODUCTION OF PETROLEUM DERIVATIVES IN DOMESTIC REFINERIES, 1945–56
(Cubic metres)

Year	*Crude processed*	*Petrol*	*Paraffin*	*Diesel-oil*	*Industrial fuel*	*Lubricants and greases*	*Asphalts*	*Gases and waste*
1945	2 146 647	613 492	156 992	482 130	856 248	8 491	8 825	16 387
1946	1 755 005	543 077	137 214	475 468	560 613	9 103	5 849	13 920
1947	1 704 742	569 628	121 733	512 111	456 496	11 269	11 542	16 991
1948	1 897 849	632 280	142 584	187 148	891 873	12 673	9 740	17 372
1949	1 959 442	627 923	172 400	219 437	894 010	10 851	13 308	15 144
1950	1 934 850	557 364	162 563	218 524	773 399	12 089	11 275	10 815
1951	2 148 752	605 850	201 453	246 427	790 355	12 717	21 558	15 719
1952	2 179 767	595 500	219 458	249 708	790 300	12 534	29 082	13 822
1953	2 211 686	560 858	248 514	255 552	740 898	10 212	35 307	9 370
1954	2 316 045	605 287	297 300	371 299	558 215	12 988	27 413	4 419
1955	2 355 510	601 372	338 829	527 460	379 977	13 063	29 627	14 677
1956	2 500 690	598 958	365 368	706 178	371 596	14 063	38 073	11 378

SOURCE: Ministry of Development and Public Works, *Estadística Petrolera del Perú*, bulletin of the Petroleum Department.

Petroleum derivatives are exported and imported and, although the net balance is positive it is tending to be cancelled out by the fact that consumption is increasing at a higher rate than production (see tables 138 and 139). In fact, during the period 1950-56, the domestic consumption of derivatives rose by 9 per cent per annum and production by 5 per cent. If these trends continue, the consumption of derivatives will exceed production by 25 000 cubic metres in 1962.

The slow rate at which refining has expanded is due to the limited capacity of the plants. If the artificially low prices of derivatives on the domestic market are maintained,[117] this capacity is not likely to increase, particularly in view of the substantial investment a petroleum refinery represents.[118]

As the petroleum extracted on the Peruvian coast —which constitutes almost the entire production—is rich in light products, the slow rate of expansion of the refineries has upset the balance between the structure of supply and that of demand, and since October 1954 Peru has had to import increasing quantities of residual petroleum to meet the liquid industrial fuel requirements not covered by domestic production.[119]

Furthermore, the low prices at which the derivatives have been sold have led to an overwhelming preference for liquid fuels, by contrast with other countries which are also producers of petroleum but in which a higher proportion of other sources of energy is used. Foreign currency earnings from exports of petroleum and its derivatives have therefore been less and the development of other sources of energy, such as coal and hydroelectricity, has been held back.

Peru's three petroleum refineries have a total capacity of 47 200 barrels of crude petroleum daily (see table 140). The largest refinery is equipped for direct distillation and also for cracking. Of the other two, equipped for direct distillation only, the smaller is fairly simple and can separate only the lightest products. The first refinery is supplied with petroleum from the fields at La Brea and Pariñas,[120] Lobitos, Zorritos, El Alto and Los Organos, all in the departments of Piura and Tumbesa. The second and third, however, use the petroleum from the field at Agua Caliente, in the vicinity of Pucallpa.

Table 140

PERU: GEOGRAPHICAL DISTRIBUTION OF INSTALLED PETROLEUM REFINING CAPACITY

Place	*Department*	*Number of refineries*	*Capacity (42-gallon barrels per 24 hours)*
Talara	Piura	1	45 000
Iquitos	Loreto	1	1 200
Agua Caliente	Loreto	1	1 000
Total		3	47 200

SOURCE: Direct information.

The coefficient of utilization of the plants is very high. A comparison of the production of derivatives with the theoretical annual processing capacity gives a 91 per cent yield for the equipment in 1956. This high figure is due to the operations of Peru's main refinery, since the two in the selva region have much lower coefficients of utilization, especially the one at Iquitos. In the case of the latter, the smallness of the consumer market in the area is a serious obstacle to its regular operation.

The three refineries employed a total of 632 persons in 1956—7.04 per cent of the total number of

117 In 1956, the profit derived from the export of derivatives did not make up the loss suffered through the sale of derivatives on the domestic market. The value added represented by refining was practically nil that year.

118 It is estimated that at current prices the Talara refinery, which is considered the best on the west coast of South America, would represent an investment of approximately 60 million dollars.

119 Residual petroleum imports amounted to 67 426 cubic metres in 1954, 211 246 in 1955 and 224 895 in 1956.

120 The La Brea and Pariñas fields are the hub of Peru's petroleum production. Talara is the refining centre and port of embarkation. It covers an area of 1 664 square kilometres on the north Peruvian coast in the Department of Piura. It is 57 kilometres from north to south and, on an average, 33 kilometres broad, and includes in all 47 614 holdings.

Table 141

PERU: PRODUCTION, IMPORTS, EXPORTS AND APPARENT CONSUMPTION OF COAL, 1945-56

(Tons)

Year	Production			Imports				Exports of anthracitic coal	Apparent consumption
	Total	Anthracitic	Bituminous	Total	Coal	Anthracites	Coke		
1945	117 263	36 848	80 415	2 098	713	...	1 385	28 673	90 688
1946	155 650	82 089	73 561	1 280	376	...	904	60 249	96 681
1947	147 332	82 969	65 287	597	311	...	286	49 434	98 495
1948	120 025	45 969	74 056	1 214	37	...	1 177	25 233	96 006
1949	99 686	27 994	71 692	573	...	...	573	16 386	83 873
1950	113 657	32 904	80 753	681	213	...	468	57 539	56 799
1951	119 720	63 762	55 958	4 159	4	3 376	979	41 298	82 580
1952	140 367	79 679	60 688	4 380	5	3 375	1 000	41 328	99 208
1953	136 156	68 916	67 240	961	72	1	888	35 700	101 417
1954	151 110	77 775	73 335	201	10	...	191	18 735	132 576
1955	83 801	15 636	68 165	1 104	5	...	1 099	305	84 600
1956	104 280	15 648	88 633	915	68	...	847	5 101	100 095

SOURCE: National Institute for Mining Research and Development, *Anuarios de la industria minera del Perú.*

workers employed in the petroleum industry in that year. The Talara refinery was operated for 343 days with 413 workers divided into three shifts and attained an average productivity of 2.16 cubic metres of crude processed per man/hour, which is excellent. At the other two small plants productivity is much lower but since they account for only 1.5 per cent of the crude refined in Peru, the average national productivity in petroleum refining is still high.

2. *Coke production*

Coal deposits in Peru are of different qualities; there are 55 of varying economic value distributed among 14 departments. The most important known veins are in the Andean areas in the northern and central parts of the country. The types found vary from anthracites to bituminous and sub-bituminous coals.

The coal extracted comes from three deposits: the Santa coal-basin in the department of Ancash; the Oyón mines in the north of the department of Lima, and the Goyllarisquizga and Jatunhuasi mines near the junction at Cerro de Pasco. The first of these produces the anthracite coal which is exported [121] while the other two produce bituminous coal for domestic consumption [122] (see table 141).

Of the washed bituminous coal produced,[123] 65 per cent is coked in order, primarily, to meet the needs of the lead industry (see table 142).

Almost the entire coke output comes from the battery of ovens at Oroya where the by-products are also recovered.[124] The coke yield from this plant is 71.5 per cent of the weight of the washed and crushed coal. The coking cycle lasts 13 hours 20 minutes; since the ovens function continuously, with automatic loading and unloading, the quantity of coal distilled annually is limited only by the maximum operating capacity of the ovens, which is about 35 000 tons of washed coal per annum.

Table 142

PERU: PRODUCTION OF METALLURGICAL COKE, 1950-56

Year	Tons
1950	25 212
1951	23 783
1952	26 984
1953	28 858
1954	29 315
1955	31 022
1956	24 352

SOURCE: Ministry of Development and Public Works, *Anuarios de la industria minera del Perú.*

Thirty-seven workers were employed in the Oroya coking plant in 1956; they worked 83 246 man/hours and produced 24 109 tons of coke, productivity for that year being thus 0.3 tons of coke per man/hour. In the United States, productivity varies from 0.4 to 0.9 tons per man/hour, the difference being due principally to the size of the plants.

The capacity of Peru's coking plants may increase in the near future. Indeed, it ought to increase if the

121 The Santa anthracites contain, on an average, 26 per cent ash. In order to bring the maximum content of solid residue into line with the requirements of the international market, the coal is washed by a floating process which reduces the ash content to 13 per cent with a recovery percentage of 45 to 65 depending on the type of coal.

122 Of the bituminous coal produced in Peru 90 per cent comes from the Goyllarisquizga coalfields. As the seams there are being exhausted, a start has been made on working the Jatunhuasi mine which will take the place of the one at Goyllarisquizga when that has ceased to yield. When distilled, Goyllarisquizga coal produces 10.634 per cent of tar rich in heavy hydrocarbons.

123 Bituminous coal is washed before being coked. The average yield from washing is 58 per cent.

124 A small quantity of coke (about 1 per cent of the national total) is produced in the vicinity of Cerro de Pasco by the old beehive oven method. In addition there is a pilot plant in the department of Ancash for coking anthracite briquettes by the Cobvertol method, using 2 per cent flotation oil and 9 per cent asphalt. It is a small vertical oven of two chambers, each having a capacity of 30 tons of briquettes; coking takes 3.5 to 5 hours. Production has not so far been an economic success owing to the high cost of the binders used in the coking process and to mechanical defects in the equipment. By this method 2 000 tons were produced in 1954.

supply is in any way to meet the demand for this product. The problem is to find deposits of coal which will give a good coke, in sufficient quantities and situated where it can be economically worked. Geological surveys are at present being made with this object in mind. This is a very important effort since the production of coke is essential to the expansion of the metallurgical industries, including iron and steel making. So long as future possibilities for the production of metallurgical coke remain unknown, doubts will persist as to the best method to adopt for the expansion of the Chimbote iron and steel industry.

3. *Production of gas*

In 1956 the *Banco Minero del Perú*, which is responsible for the State development of coal mining, set up a plant in Chimbote for the production of water gas from anthracite. It has a capacity of 50 000 cubic metres of gas a day, with a calorific power of 1 400 calories per cubic metre. It cost 1.7 million soles. This generator was installed primarily to meet the fuel needs of the Chimbote steelwork and of some tinned fish and fishflour factories. Up to now, however, it has operated at a very low level—15 per cent of capacity—owing to the limited demand.

4. *Production of anthracite briquettes*

In order to make use of the large quantity of fines produced during the extraction of anthracite the *Banco Minero del Perú* constructed a briquette factory with an annual capacity of 48 000 tons. At first asphalt was used as a binder but it was later replaced by residual molasses [125] which improves kindling quality but slightly reduces calorific power.[126] Production began in 1954 with 7 500 tons but was halted in 1956 so that the plant could be readjusted for the use of residual molasses, and in 1956 22 000 tons were produced.

The production of briquettes has not so far proved economically satisfactory. The mistake lay in trying to make them an export item. Since briquettes are fragile they did not travel well and reached their destination—usually the Argentina market—with a proportion of breakages higher than 10 per cent, the accepted maximum. Manufacture may be advisable when such disadvantages can be avoided through the consumption of briquettes on the domestic market. As stated earlier there is another plant for the production of anthracite briquettes by coking. It has an annual capacity of 36 000 tons of uncoked briquettes.

125 Twelve per cent residual molasses is used with a moisture content of 20 per cent.

126 There is only one other plant, at Monterrey in Mexico, which uses residual molasses as a binder in the manufacture of briquettes.

XIV. MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS

This group includes industries manufacturing cement and cement products; builder's plaster, quicklime and slake lime; glass and glass products; pottery, china and earthenware; marble and onyx in sheets and cut blocks; and miscellaneous baked clay products. Some industries such as those manufacturing floor, wall and roof tiles and bricks, include a proportion of establishments of the artisan type. It is therefore difficult to obtain aggregate figures for production, manpower, raw material consumption and so on. The information in table 143 despite shortcomings with regard to certain industries, gives a rough picture of the structure of the activities comprising this heterogeneous sector.

1. *Cement*

Cement is one of the products the consumption of which has increased at the fastest rate in recent years. For the period 1945-56 as a whole, the annual rate of increase in demand was 8 per cent, but the average for the last six years went up to 17 per cent as a result of the building boom, both public and private (see table 144).

Table 143

PERU: STRUCTURE OF THE INDUSTRIES MANUFACTURING NON-METALLIC MINERAL PRODUCTS, 1956

(In single units and thousands of soles)

Industries	*Number of factories*	*Personnel*		*Value of production*	*Raw materials*			*Fuels and lubricants*	*Energy*	*Packing*	*Value added*
		Employees	*Workers*		*Total*	*Domestic*	*Foreign*				
Cement	2	212	1 295	178 233	20 301	20 301	—	29 756	3 071	20 974	104 131
Cement products	30	159	748	50 888	22 799	8 465	14 334	90	402	—	27 597
Plaster and lime	10	24	234	8 428	2 318	2 318	—	1 782	63	409	3 856
Glass	14	167	1 840	66 368	12 107	3 582	8 525	8 318	1 532	415	43 996
Pottery, china and earthenware	8	58	462	15 347	3 273	2 045	1 228	844	503	248	10 479
Marbles and onyx [a]	5	45	250	12 000	4 800	3 600	1 200	42	300	—	6 858
Bricks and tiles	26	62	530	21 558	3 251	3 191	60	4 026	52	—	14 229

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity, and direct information.

a Including only those establishments which cut and polish marble.

Table 144

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF CEMENT, 1945-56

(Tons)

Year	Production	Imports [a]	Apparent consumption
1945	264 908	12 851	277 759
1946	260 718	28 023	288 741
1947	255 659	35 036	290 695
1948	282 390	7 506	289 896
1949	289 038	1 090	290 128
1950	331 297	1 379	332 676
1951	368 351	8 647	376 998
1952	371 256	53 718	424 974
1953	449 269	91 994	541 263
1954	482 664 [b]	30 485	513 149
1955	544 566	18 347	562 913
1956	551 934	56 453	608 387

SOURCE: National Institute for Mining Research and Development, *Anuario de la Industria Minera del Perú, 1956.*

a Including clinker cement and special cements.

b In this year the second factory established in Peru began production.

Per capita consumption in 1956 was 63 kilogrammes. This figure is almost 20 per cent below the average for Latin American consumption that year (75.5 kilogrammes) (see table 145).

Up to 1956, Lima accounted for 80 per cent of consumption but this proportion may be reduced owing to the setting up of new cement factories in other departments.

The average contribution of domestic production to consumption during the period 1950-56 was 92 per cent. Cement imports were consumed in areas distant from the capital (64 per cent in the northern zone, 25 per cent in the southern zone and 11 per cent in the Amazon area).

Table 145

LATIN AMERICA: APPARENT CONSUMPTION OF CEMENT, 1956

Country	Total (Thousands of tons)	Per capita (Kilogrammes)
Latin America	*13 544*	*75.5*
Argentina	2 080	105
Bolivia	40	12
Brazil	3 240	54
Chile	770	111
Colombia	1 200	93
Costa Rica	62	63
Cuba	730	114
Ecuador	160	42
El Salvador	92	40
Guatemala	92	27
Haiti	60	18
Honduras	31	18
Mexico	2 200	72
Nicaragua	44	34
Panama	119	127
Paraguay	14	9
Peru	*608*	*63*
Uruguay	464	177
Venezuela	1 360	228

SOURCE: Based on the *Economic Survey of Latin America, 1956* (E/CN.12/427/Rev.1), United Nations Publication (Sales No.: 1957.II.G.1), table 56; United Nations, *Monthly Bulletin of Statistics*, Vol. XII, No. 2, February 1958, and direct information.

In 1956, two factories were in operation, both in Lima; three other factories were in course of erection in the provinces (in Pacasmayo and Chiclayo in the north, and in Tarma in the central area) and the setting up two further factories, in the south (at Arequipa and Sicuani), was under consideration.

The annual production capacity of the factories in operation was 719 000 tons in 1956 (see table 146). Output capacity in relation to actual production for that year gives a coefficient of utilization of 77 per cent. Since in practice 90 per cent of theoretical maximum capacity is considered normal use, these factories could produce some 100 000 tons more. The reason for their not doing so and for cement in fact being imported was that the domestic product could not compete with the foreign product in departments further away from the capital, especially in areas near the ports through which it entered free of duty.[127]

Table 146

PERU: CAPACITY OF THE CEMENT INDUSTRY, EFFECTIVE PRODUCTION AND COEFFICIENT OF UTILIZATION, 1956

(Tons and percentages)

Enterprise	Annual output capacity (Tons)	Effective annual production (Tons)	Coefficient of utilization (Percentage)
Fábrica Nacional de Cemento Portland	564 000	464 400	82.0
Fábrica Nacional de Chilca	155 000	87 500	56.5
Total	*719 000*	*551 900*	*77.0*

SOURCE: Direct information.

As a result of development plans in execution and under consideration domestic production capacity may increase to more than 1.2 million tons annually in the next five years (see table 147). Since the plants under construction or in prospect are not to be built in the capital, productive capacity should be distributed in a fairly rational manner by the end of 1961.

The larger of the factories in operation in 1956 produced cement by the dry and the other by the wet mixing process, the first representing 78 per cent of installed capacity and the second the remainder. Almost all of the factories at present in construction or projected will use the wet mixing method since it guarantees a more uniform blending of the ingredients before burning.

Of the labour force engaged in the industry in 1956 about a quarter were considered skilled. Productivity

127 Governmental resolutions of December 1955 and January 1956 exempted from duty cement imported through the ports of Talara and Paita in the north and Matarani, Mollendo and Ilo in the south. A later governmental resolution of October 1957 annulled this exemption in respect of cement imported through Talara and Paita because it was considered that, with the opening up of the Pacasmayo and Chiclayo factories, the importation of cement for consumption in the Norte Grande was no longer justified.

Table 147

PERU: PROBABLE EXPANSION OF CEMENT OUTPUT CAPACITY, 1957-61

	1957	1958	1959	1960-61
Factories (number) . . .	2	3	5	7
Output capacity (thousands of tons)	719	843	1 060	1 215
Geopraphical distribution of installed capacity (percentage):				
Lima	100.0	85.0	68.0	59.0
Pacasmayo		15.0	11.7	10.4
Chiclayo.			11.7	10.4
Tarma.			8.6	7.6
Arequipa.				5.0
Sicuani.				7.6

SOURCE: Direct investigation.

per man/hour was 0.180 tons by dry and 0.140 tons by the wet process, giving a national average of 0.172 tons. But as these factories employ many workers in auxiliary services (machine-shops, power plants, transport, etc.) only 50 per cent of the total labour force is directly employed in production. Thus productivity in Peru was some 0.34 tons per direct man/hour, whereas in the United States it is estimated at 0.45 tons. This difference is due primarily to the difference in the average size of the United States and Peruvian plants, but it is clear that the productivity of Peruvian factories can be raised, especially by the more intensive use of installed capacity.

2. *Cement products*

Among the industries manufacturing products with a cement base, the most important are those making fibre cement sheets, pipes and other articles, and cement tiles and slabs. The manufacture of cement blocks, lintels, beams and posts is less important economically.

(a) *Fibre cement and similar products*

The manufacture of these products began in 1942 with foreign technical and financial help.[128] Up to 1948 the only items manufactured were smooth or corrugated sheets and certain articles, usually with flat sides. From 1949 onwards pipes of different diameters (from 1.5 to 12 inches) began to be manufactured and later other items for building. Fibre cement articles at present make up 65 per cent of production; the remainder consists of cellulose-asbestos-cement sheets and asphalt and vinyl floor coverings.[129]

The production of fibre cement articles has filled an important gap for Peru did not produce sheets, plates and pipes of metal and the manufacture of substitutes with an asbestos-cement base has meant a saving of foreign currency for imports of these items. Indeed, the quality and price of these products have made it possible to export certain quantities to Bolivia, Ecuador, Nicaragua and Panama.

Between 1942 and 1957, the volume of production of fibre cement articles multipled some 15 times. The entire supply comes from a single enterprise which has been expanding in such a way that capacity has always exceeded demand. In 1956, the coefficient of utilization of the plant was estimated at 66 per cent.

The fact that there is only one enterprise producing these articles does not, however, mean that it has a privileged position, for the sales prices of domestically produced sheets and pipes are 30 per cent below those which would prevail for their foreign counterparts. Naturally the prices of the latter include freight charges, insurance costs and customs duties, but the fact that there have been exports proves that the prices asked for the domestic product are within the range of those prevailing on the international market.[130] These competitive prices are due to efficient production methods and the low costs of labour, for the majority of the workers are unskilled.[131]

As the production of fibre cement articles includes a number of different manufactures—smooth and corrugated sheets of different sizes and thicknesses, pipes of eight different diameters and two different lengths designed for various pressures—45, 75 and 105 pounds per square inch—and miscellaneous prefabricated items—it was necessary to find an equivalent product in terms of which to express the total output. The one used is the "standard sheet", a fibre cement plate 5 millimetres thick weighing 10.4 kilogrammes per square metre. In 1956, production was equivalent to 1 250 000 square metres of standard sheets. In relation to the labour employed this gives a productivity of 1.78 square metres or 18.5 kilogrammes per man/hour, which is high in relation to the United States average (about 19 kilogrammes per man/hour). Twenty-four workers were employed in the production of asphalt floor coverings, 19 of them directly. Productivity was 5 square metres per direct man/hour and 4 squares metres per total man/hour which is also high.

Eighty per cent in weight and 22.5 per cent in value of the raw materials used by the enterprise are domestic. The most important of them is cement, of which about 7 260 tons were consumed in 1956. Of the raw materials imported, 76 per cent in weight and 64 per cent in value consist of asbestos.[132] Among the other products imported were cellulose for cellulose-asbestos-cement sheets and binders for asphalt and vinyl floor coverings; 193 771 square metres of asphalt floor coverings and 129 214 square metres of vinyl floor coverings were produced in 1956.

128 Of the capital invested in this industry 44 per cent is Belgian.

129 Under the licence of an important United States company. Asphalt and vinyl floor coverings are included here only because they are made by the enterprise which produces fibre cement articles.

130 Orders have been received from the United States but the factory has not been able to fill them owing to its limited productive capacity.

131 Of the 210 workers employed in 1956, 14 were considered skilled (principally maintenance staff).

132 The asbestos used in the manufacture of fibre cement products is of the chrysotile variety which comes mainly from Canada.

Despite its surplus productive capacity the enterprise is expanding its production line for water piping even further to enable it to manufacture pipes capable of withstanding 150 pounds pressure per square inch, using a process already employed in other countries, of aligning the asbestos fibres before moulding to impart greater resistance. The programme includes the installation of a water-bath to reduce the setting time, the construction of large bins for storing cement brought in bulk in bottom-dump lorries and a pneumatic system for conveying the cement to the machines where it is used. It is hoped thus to satisfy the growing demand by producing a wider range of items in greater number and at prices constantly below those of the products for which fibre cement articles are substitutes.

(b) *Cement slabs, tiles and pipes*

The manufacture of cement slabs, tiles and pipes represents 36 per cent of the value of the domestic output of cement products. Of the remainder, 60 per cent is made up of fibre cement items and 4 per cent of concrete lintels and posts. Cement slabs, tiles and pipes are manufactured in 30 establishments for 90 per cent of which statistics are available (see table 148).

Table 148

PERU: NUMBER OF TILE FACTORIES AND GEOGRAPHICAL DISTRIBUTION OF PRODUCTION, 1956

Department	*Number of factories*	*Percentage of national production*
Arequipa	2	1.7
Junín	2	0.5
Lima	17	90.8
Lambayeque	1	1.6
La Libertad	3	3.2
Piura	1	1.7
Tacna	1	0.5
Total	27	100.0

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Some 80 per cent of the output comes from 5 establishments in Lima; most of the other plants are of the artisan type and usually have between three and fifteen more or less manual workers.

Most of the tile-making factories also manufacture cement drainage pipes. Total output in 1956 was 477 300 square metres of tiles and 175 300 metres of cement piping.

Eighty per cent of the raw material used in the industry is domestic. Imported raw materials consist mostly of pigments used to colour the tiles.

In 1956, 522 workers were employed in this industry, most of them directly. Productivity, as recorded, was 0.45 square metres per man/hour for tiles and 1.35 metres per man/hour for cement pipes. To express both in terms of a single article, for example, an average tile costing 26.80 soles per square metre in 1956, the mean productivity for the 27 factories would be 0.485 square metres per man/hour. This is 70 per cent of the productivity found in Peru's most efficient factory (0.59 square metres per man/hour). This is not a high level either,[133] and a higher output could be hoped for if productivity were to be improved.

3. *Builder's plaster and lime*

The processes of burning and grinding plaster are closely linked to construction, but the use of plaster in building has declined considerably in recent years owing to the introduction of new methods of finishing walls. Consequently, despite the great expansion of building in recent years, the production of plaster has not shown a comparable increase. Demand was not so great as to prompt an appreciable growth of productive capacity; on the whole, factories responded to the moderate increases in consumption by making more intensive use of existing plant.

Output in 1956 was 40 000 tons from nine establishments, four in the capital and five in the provinces. In terms of installed capacity, 96 per cent is in Lima and the remainder spread among the departments of Ancash, Junín and Lambayeque.

Since the yield of ground builder's plaster is 88 per cent of the weight of the chalkstone processed, it can be seen that the above production came from some 49 000 tons of chalkstone. Good quality deposits of this raw material are found in Peru, usually well placed. Easy accessibility is essential if production is to be economical because it is a commodity which is cheap per unit of weight.

The average number of hours worked in the industry in 1956 was 2 190. This meagre utilization of installed capacity was due to the limited demand and in turn led to fairly low productivity indices. The average for 1956 in fact was 0.170 tons per man/hour, somewhat less than half the rate in the cement industry, which is considerably more complicated.

Despite the surplus of idle productive capacity, Peru's most important factory, contributing about 60 per cent of total production, is at present in process of doubling its equipment. The industry will thus be able to satisfy needs for plaster in coming years even if, in order to widen its market, it also produces certain special types such as acaustic and sheet plaster.

The production of quicklime and slake-lime is of very little economic significance. Statistics record four establishments which produced 17 282 tons of lime in 1956. Most of this was used as a binder or in the preparation of chemical compounds such as bleaching powders. Just recently, however, they have begun making bricks with a lime base, which appear to be proving generally acceptable. It is possible, then, that in the

[133] Tile-making is an industry which requires a fairly large labour input, since almost all the work is done by the worker himself. This is why productivity figures are so different from those met with in the automatic manufacture of asphalt floorings where, as has been seen, the output is 5 square metres per man/hour.

next few years both the productive capacity and the actual production of lime will increase.

4. *Glass and glass products*

The consumption of glass products quadrupled between 1945 and 1956. The share of domestic production in total supply increased from 78 to 86 per cent during the same period, signifying import substitution on a substantial scale (see table 149).

Table 149

PERU: PRODUCTION, IMPORTS, EXPORTS AND APPARENT CONSUMPTION OF GLASS PRODUCTS, 1945-56

(Tons)

Year	*Production* [a]	*Imports*	*Exports*	*Apparent consumption*
1945	6 516	1 883	98	8 301
1946	10 278	3 244	39	13 483
1947	15 076	4 646	54	19 668
1948	17 150	3 370	16	20 504
1949	15 787	3 861	19	19 449
1950	10 722	1 915	65	12 572
1951	16 143	4 561	803	19 901
1952	16 913	5 524	770	21 667
1953	24 733	6 176	5	30 904
1954	29 620	3 155	274	32 501
1955	30 242	4 668	140	34 770
1956	30 515	5 325	150	35 690

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity and *Anuarios de comercio exterior, op. cit.*

a Calculated from the physical volume of production in 1956 and the quantum indices given in annex II, table 28 of this study.

A small fraction of production—0.6 per cent, on the average in the most recent years—was exported. This consisted mostly of crystal items and bottles, and the main consumer countries were Colombia, Ecuador and Panama. There were also certain exports to Barbados, Trinidad, and British Guiana despite the increase in cost resulting from their transit through the Panama Canal, but exports to these territories are facilitated by the fact that they are within the sterling area and Peru already trades with the sterling area countries.

The glass industry covers a broad range of products varying in quality and purpose. In this study the 14 establishments concerned—they are all in Lima—have been classified as producers of "glass containers", "other glass articles", "crystal articles" and "flat glass products", as illustrated in table 150.

Table 150

PERU: NUMBER OF FACTORIES MAKING GLASS PRODUCTS AND PERCENTAGE DISTRIBUTION OF VALUE OF PRODUCTION BY TYPES

Type of production	*Number of factories*	*Percentage distribution of value of production*
Glass containers	10	49
Flat glass	1	7
Crystal articles	3	24
Other glass articles	10	20
Total	24	100

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

(a) *Glass containers*

The production of glass containers satisfies somewhat more than 90 per cent of total demand (see table 151). Certain special types are imported, especially phials and ampoules for pharmaceutical use, for the reasons given in section XII of this chapter.

Table 151

PERU: PRODUCTION OF GLASS CONTAINERS

Type	*Units*
Bottles for wine, spirits and oil	7 814 294
Beer-bottles	8 533 911
Bottles for soft drinks	7 395 738
Flasks, phials, jars, etc.	22 826 248

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

Three techniques are used for making glass containers in Peru: fully automatic manufacture (60 per cent of the value and 64 per cent of the volume production), semi-automatic manufacture (22 per cent of the value and of the volume of production) and manual production (18 per cent of the value and 14 per cent of the volume of domestic supply). The last of these is usually preferred for containers produced in small series as, for instance, those used by factories making perfumes and toilet waters.

Some factories combine the semi-automatic and manual methods, depending on the size of the series, but in general hand-blown glass is tending to disappear owing to low productivity, high cost and damage to worker's health.

Average productivity is 47 physical units per man/hour on the automatic lines, 24 on the semi-automatic and 13 when hand-blown. The average for total domestic production is 37 physical units per man/hour. This is 67 per cent of the productivity in Peru's most efficient factory, which is the principal manufacturer of containers and contributes about 60 per cent of total domestic supply. It functions extremely efficiently because of its excellent organization and the modernity of its equipment.

Some 82 per cent of the weight and 27 per cent of the value of the raw materials used are domestic. Sodium carbonate and pigments are the main imports, but in the near future they will be reduced to 2 per cent in weight and 4 per cent in value as a result of the entry into production of the new alkali factory referred to in section XII.

(b) *Flat glass*

Flat glass constitutes 7.2 per cent of the output and 16.7 per cent of the domestic consumption of glass products.

A square metre of flat glass weighs on an average, 9.4 kilogrammes and consumption in 1956 apparently amounted to 630 000 square metres. This is four times more than the minimum necessary for a plant to function efficiently. National production is in excess of the economic minimum.[134]

There is only one factory in Peru making flat glass and in 1956 it met 40 per cent of consumer demand (see table 152). Although the plant was ready to start

Table 152

PERU: PRODUCTION, IMPORTS AND CONSUMPTION OF FLAT GLASS AND DERIVATIVES, 1954 AND 1956
(Tons)

Year	*Production* [a]	*Imports* [b]	*Apparent consumption*
1954	1 920	1 873	3 793
1956	2 193	3 762	5 955

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity, *Anuarios de comercio exterior*.
a Calculated from the raw material consumed, taking 85 per cent as the yield by weight.
b Including mirrors and similar items made of flat glass.

operations about the middle of 1947, it did not begin normal production until 1954, after certain technical and economic difficulties which arose had been overcome. The enterprise is now functioning very efficiently. The replacement of imports of glass items 2 and 4 millimetres thick is now practically complete and it is likely that in the near future the factory will turn out glass more than 6 millimetres thick which now forms a large proportion of imports, and so increase the contribution of national production to consumption.

(c) *Other glass products and crystal articles*

Crystal objects and miscellaneous glass products come second to window glass among glass imports, which is surprising since domestic production is very advanced in these lines.

There are in Peru eight factories making miscellaneous glass articles and three specializing in crystal. It is estimated that total production in 1956 was 5 400 tons, covering a wide range of articles.

The manufacture of these products, especially those of crystal, demands a great deal of skilled labour. A high level of productivity cannot therefore be expected. In the largest and best organized factory it was 0.95 kilogrammes of finished articles per man/hour. (Compare this with the 27.8 kilogrammes per man/hour registered at the main glass container factory in Peru.)

A number of factories visited in 1957 were enlarging their productive capacity in order to cover new lines such as the production of fluorescent lighting tubes and other such items. It can therefore be assumed that the share of domestic production in consumption—60 per cent in 1956—will increase markedly in coming years. Furthermore, the quality of the domestic products, especially crystal articles, is such that these would probably be important items in Peru's contribution to a Latin American regional market.

5. *Pottery, china and glazed earthenware*

The manufacture of these products has not developed at the same rate as other industries, perhaps because in no other was the level of technical knowledge so low among the workers concerned. It is only in recent years that there has been any improvement in quality in certain lines, as for instance in the production of sanitary fittings and glazed earthenware, but not in chinaware for domestic use, so that it is difficult to stem the growing demand for imports of these goods despite import duties and higher prices due to freight costs (see table 153).

A comparison of the volume of production in 1956 with that of imports shows that in that year the domestic industry contributed less than a quarter of the total consumed. To break down the total figure into its main components, the industry's contribution to total supply was 16 per cent for chinaware and similar articles, 16 per cent for sanitary fittings and 50 per cent for glazed earthenware.

(a) *Chinaware*

There are two good-sized factories and five small ones which together could produce 4.5 million units an-

134 The minimum monthly demand necessary in order that a factory may begin to function economically is estimated at 133 000 square feet (12 000 square metres).

Table 153

PERU: IMPORTS OF CHINAWARE AND CERAMIC PRODUCTS, 1954-56
(Tons and thousands of soles)

Products	*1954*		*1955*		*1956*	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Chinaware for household use	927.6	8 396	1 477.8	12 810	1 901.0	16 676
Porcelain articles	138.9	4 664	185.2	4 576	165.0	3 737
Glazed earthenware	2 773.2	10 419	3 309.1	16 233	1 373.0	6 595
Sanitary fittings	1 665.6	19 816	1 430.5	18 050	1 197.7	15 925
Other ceramic products	287.7	4 080	211.9	4 147	296.6	5 623
Total	*5 724.0*	*47 375*	*6 614.5*	*55 816*	*4 933.3*	*48 556*

SOURCE: Foreign Trade Yearbooks, *op. cit.*

nually; in 1956 they supplied 3.1 million, thus operating at 68 per cent of their capacity on the average. Of the installed capacity 91 per cent is concentrated in the Lima area; the rest consists of a plant at Chimbote which produces insulators and other ceramic articles. The largest plant in Peru is responsible for practically 78 per cent of the production; this factory and the second largest together contribute almost the entire domestic supply of chinaware for household use.

The capital and certain provinces form the most important market. The vast mass of the indigenous population uses very little chinaware since primitive utensils made of baked clay are still very common.

The industry's equipment is generally rather antiquated. Only one of the factories has tunnel-shaped ovens; the other use the oldfashioned low-yield beehive ovens. This lack of incentive to modernize appears to be due to the limited means of the enterprises in this branch, which prevents them from bringing their equipment and manufacturing methods up to date. This situation, in turn, is due to the fact that the financial returns have been so modest that it has not been possible to accumulate reserves for reinvestment and further investment has been discouraged. There is no doubt too, that the relatively severe competitive conditions in so limited a market have hindered the industry's development. But it is also clear that domestic industry could replace imports if only it could supply better quality products.

Somewhat over 70 per cent of the raw materials used in the industry are domestic. Imported raw materials consist mainly of frits, dyes and decalcomanias. On the other hand some of the materials found in Peru —kaolin, quartz, feldspar and clays—are not always of sufficiently high quality to produce a good biscuit. In order to improve the quality of domestic china manufactures, therefore, it would be necessary to begin by selecting the raw materials to be used, from the technical point of view. It would be of great help to the industry if a pilot plant making ceramic products were to be set up at a technological centre, together with a well-equipped laboratory for analysing the type and quality of domestic raw materials.

In 1956, the total consumption of raw materials was 3 230 tons. As the net yield is 70 per cent for dishes, 65 per cent for sanitary fittings and 60 per cent for artistic ceramics, this represents a total production of 2 235 tons of finished articles produced in 1 077 600 man/hours. Productivity was thus 2 kilogrammes of finished products—or its equivalent, 8 units per man/hour. This figure is low, less than 45 per cent of that reached in the industrialized countries.[135] More technical knowledge and the modernization and improvement of the machinery and equipment used by the industry could raise it.[136] It would thus be possible, too, without any appreciable increase in costs, to improve the quality of the production, which is essential if Peru's chinaware factories are to widen their markets and compete with imports.

(b) *Sanitary fittings*

Only one factory in Peru—the one which is the largest manufacturer of chinaware for household use—makes sanitary fittings.[137] Production is estimated at 54 000 units annually; present capacity is 72 000 units but even this could be increased if a proper dryer were installed; at present one of the factory's two tunnel-ovens is used for this purpose whereas it could be used for firing the biscuit.

Production began in 1948 and now, after a number of years of technical hitches, quality has improved markedly.

All the metal parts of sanitary fittings—chrome taps, brass float devices, etc., are imported. Since they are liable to duties higher than those charged on sanitary fittings imported complete, the cost to the enterprise is practically the same as that of the ceramic parts made in Peru. There is thus very little difference in price between the domestic and the imported product and demand thus tends to favour the foreign article. Until the domestic metal transforming industry produces such articles, it would be advisable to reduce the duties charged on imported taps and accessories or at any rate to import unassembled fittings and apply selective duties to the china and metal parts. Domestic production would thus be better protected.

(c) *Glazed earthenware*

The manufacture of glazed earthenware was begun in Peru in 1949 by what is now the largest establishment of its kind in the country. After a number of years of technical difficulties, the domestic manufacture began to gain foothold on the market and, after 1956, to oust the imported product (see again table 153). Two factories—one of them very small—were operating in 1956, and manufactured the following items: flat glazed earthenware (88.6 per cent of the total volume), glazed earthenware terminals (9.2 per cent), half-tubes (1.8 per cent) and corner pieces (0.4 per cent). In terms of an equivalent product (glazed earthenware of 15 by 15 centimetres), this makes a total of 4 456 000 units or, counting 42 units to the square metre, 106 127 square metres. Output capacity was 182 500 square metres and was being doubled.

The total consumption of raw materials was 3 090 tons, 74 per cent (in value) of which was domestic. As the yield from this raw material expressed in terms of net saleable production is 70 per cent, the latter

135 In the United States productivity is 18 units per man-hour, and as the average weight of the unit in that country is one pound (453.6 g.), a comparison by weight gives a much lower figure for the relative productivity of Peruvian industry.

136 Visits to establishments showed an almost total absence of mechanization of internal transport in the factories. The degree to which an establishment can become mechanized depends on its size. Mechanization, even if only partial, would help reduce the cost of production and improve the quality of the product.

137 Sanitary fittings make up 45 per cent of the total value of the enterprise's production.

may be estimated at 2 160 tons, 57 per cent more than the volume of imports (see again table 153). Thus the industry could soon satisfy all Peru's requirements. Import substitution could take place more rapidly if the factories managed to reduce production costs and sales prices by substantially increasing productivity levels, which are at present far too low since, according to 1956 industrial statistics, productivity is no more than 0.22 squares metres of glazed earthenware equivalent per man/hour.

6. *Marble and onyx in slabs and cut blocks*

The production of marble and onyx in slabs and cut blocks has developed considerably in Peru in recent years. There are good deposits, well placed, and they furnish about 75 per cent of the domestic supply of marbles and onyx. But the demand for certain special types of marble, such as white statuary marble, makes a certain volume of imports necessary. Some of this marble is imported in exchange for Peruvian marble. In 1956, for instance, 382.5 tons of marble were imported and 157.5 exported.

Marble consumption in Peru in 1956 is estimated at 900 tons. The marble was processed by five large enterprises and some 34 small ones, the latter being artisan establishments whose main line is decorated tombstones. The marble industry proper is centred in the five larger concerns, which account for 80 per cent of production. A single one of these supplies between 40 to 45 per cent of the domestic market.

Of the total labour force employed in the industry only 15 per cent can be considered skilled, and it is this scarcity of skilled labour which is one of the industry's main problems. The yield in finished products—slabs and artistic objects—is equivalent on the average to 80 per cent of the rough marble or onyx used. Judging by the consumption of basic raw material, therefore, average productivity can be estimated at 0.0012 cubic metres of finished products per man/hour, a fairly low figure. It was for this reason that, up to quite recently, the domestic industry felt the effects of competition from the Italian industry where the cost of production is lower owing, primarily, to higher productivity.

The utilization of productive capacity is low, amounting to scarcely 33 per cent of the theoretical norm. As it is unlikely that in the years to come consumption will increase by more than 200 per cent of present figures, it would seem that the industry will be able to meet demand during the period 1957-65.

7. *Miscellaneous articles of baked clay*

The most important activity under this heading is the manufacture of bricks. There are 29 establishments, 24 of which make ordinary red bricks, four, fire-bricks, and one, pressed lime and sand bricks (see table 154).

Table 154

PERU: NUMBER OF BRICK FACTORIES AND PRODUCTION BY DEPARTMENTS AND BY TYPES, 1956

Department	*Number of factories* [a]	*Production (Thousands of bricks)*	
		Common bricks	*Fire bricks*
Arequipa	1	2 008	
Huánuco	1	360	
Junín	3	242	
Lima	20	42 167	1 105
Loreto	1	259	
Tacna	1	238	
Trujillo	2	1 261	265
Total	29	46 535	1 370

SOURCE: Ministry of Development and Public Works, Department of Industries and Electricity.

a Not including the factory making bricks of lime and sand because in 1956 it was not yet in production, nor a factory making concrete bricks.

Most of these factories have intermittently operating kilns. The wet mixing process is used before moulding, since it allows a wider variety of clays to be used and requires less equipment.

Some 45 per cent of the output comes from the small factories. Their methods of working are fairly primitive, with hand moulding and natural drying. This together with the fact that even the large establishments are insufficiently mechanized, results in over-employment which raises production costs.

Productivity is very low. Expressed in terms of bricks per man/hour, it was 14.5 for fire-bricks in 1956 and 48 for ordinary bricks. These are approximately one third the usual figures recorded in other countries.[138]

The quality of the bricks is fairly satisfactory as regards uniformity and compactness, but it would be advisable to improve their appearance for their edges are not usually as true as is desirable in a good brick.

138 An average United States establishment with a capacity of some 245 000 bricks per week, has a productivity of about 130 bricks per total man/hour.

XV. THE IRON AND STEEL INDUSTRY

1. *Iron and steel production*

Iron and steel primary products are perhaps the most important and necessary of all replaceable imports, owing to the part that their production plays in the industrial and economic development of Peru. For this reason, when the *Corporación Peruana del Santa* was founded on 4 June 1943, primarily to harness the waters of the River Santa for electrification purposes,[139]

139 Although it was considered possible to produce some 750 000 kW by installing several power stations one above the other, the project was reduced to an initial power station of 150 000 kW scheduled to begin producing 50 000 kW by April 1958. In order to produce the 150 000 kW, the only factor lacking from the civil

it was considered that the electric energy thus generated could most appropriately be used for electric iron ore reduction furnaces and electric steel furnaces. It was therefore decided to set up a steel mill at Chimbote on the coast, 460 kilometres north of Lima.

Chimbote is the only centre in Peru which produces a pig iron and rolled steel. It consists of two Norwegian Tysland-Hole type electric reduction furnaces, of 13 000 kVA each, two electric steel furnaces, a rolling mill for bars and shapes, another for thin sheet and plate. It will have no roughing mill to begin with, but space has been left at the beginning of the line for setting up a reversing mill. The present mill of 600 mm. (26 inches), which will turn out slabs for sheet and plate and billets for bars, will first be used for roughing. The equipment is suitable for the manufacture of light shapes up to 51 mm. (2 inches), smooth and corrugated round bars 6.4 to 31.7 mm. ($^1/_4$ to $1\,^1/_4$ inches) in diameter, and sheet and plate 0.4 to 3.0 mm. thick ($^1/_{64}$ th to approximately $^1/_8$ th of an inch), 700 to 1 200 mm. wide and up to 2.75 metres long. The mill for flat products has recently begun to operate using slabs imported from France; to put it provisionally into operation thermoelectric energy was used, which was generated by the gas turbine and diesel power station at Chimbote owned by the *Corporación Peruana del Santa.*

The present capacity of the Chimbote mill can be measured in three successive stages: 56 000 tons of pig iron annually in the iron ore reduction furnaces, 66 500 tons of ingot in the steel mill—this figure is higher than the capacity of the production furnaces since scrap iron is included in steel manufacture—and some 50 000 tons of finished products, after passing through the rolling mill. The rolling mill for flat products has a capacity of 15 000 tons, while that of the mill for shapes and bars may reach 50 000 but is currently limited to 35 000 owing to insufficient steel-making capacity.

The output capacity of rolled products is estimated at some 120 000 tons of primary products annually and was barely more than 40 per cent of corresponding consumption in 1957; as a result, Chimbote is the smallest integrated steel production centre in Latin America.

Investments to date have exceeded 1 200 million soles; apart from the steel mill and the hydroelectric plant at Huallanca with its high tension cable to Chimbote, they include improvements to the port of San Juan in the department of Ica for the purpose of facilitating iron ore shipments; a thermal power station, workshops and civil engineering works at Chimbote; and the railway from Chimbote to Huallanca. The iron ore to be utilized by the Chimbote steel mill comes from the deposits at Marcona and is of excellent quality. Measurements made so far indicate minimum reserve of 100 million tons of high-grade ore (approximately 60 per cent); of these some 20 million tons consist of ore with a sulphur content of 0.4 to 0.5 per cent. The investment has been covered by public funds allocated to the *Corporación*, the income from royalties on exports [140] of Marcona ore and internal and external loans.[141]

Allegedly the main difficulty at Chimbote arises from its high production costs. To view this problem in a realistic light, these costs should be divided into three groups. The first relates to excessive investment in relation to actual plant capacity; the second covers the operation of the various services needed by any large or small plant, the cost of which in this case is excessive per unit of production; the third group comprises direct operating costs as compared with the volume of production.

As regards the first group, it is not felt that any advantage is served by forever burdening production at Chimbote with charges which, as the result of the type of installations which had to be built, especially for the purposes of transport and the generation of electric energy, or due to fortuitous circumstances, such as stoppages and disasters during the construction, should be considered by the State as social expenditure, like roads and dams. Only the expenditure normally incurred by a plant of the size and type of Chimbote should thus be placed on the books of the enterprise.[142] It is considered essential that general overhead per unit of production should be reduced by increasing the capacity of the plant as soon possible. For this purpose account should be taken not only of the present demand for iron and steel products but also of the demand which will inevitably arise when the metal-transforming industries develop on a large scale, as is expected. The situation as regards operating costs is typical of a plant still grappling with the task of or-

engineering point of view would be a catchment project in the Quitaraxa canyon to ensure a sufficient volume of water when the river is low.

The first 50 000 kW would be used as follows:

Steel mill at Chimbote	36 000 kW
Miscellaneous activities (coal-washing, fish canning, fish-meal manufacturing and public utilities) . . .	11 000 kW
Grid losses between Huallanca and Chimbote	3 000 kW
	50 000 kW

140 In May 1953, an agreement was concluded between the *Corporación Peruana del Santa* and a United States company, by virtue of which the former granted the latter the right to mine the Marcona deposits owned by the *Corporación* for a period of 30 years. According to the provisions of the agreement, the mining company was to pay a premium of 6 per cent on the first million tons exported in the year and one of 7 per cent on the surplus. The price of the ore f.o.b. San Juan is the same as that of all-range Bessemer iron ore shipped to the southern ports of the Great Lakes in the United States. With regard to supplies of ore for Peruvian iron and steel mills, it was laid down that the *Corporación* could buy up to 300 000 tons per year at a price equal to 28 per cent of that of ore for export. At the close of each operational year, the mining company was to submit an export programme for the following year together with research data showing that the volume of reserves was double the amount of ore intended for export.

141 The *Banco Industrial del Perú* has made a special loan of 200 million soles to the *Corporación*. A leading French bank has lent it a further 32 million dollars.

142 For various reasons outside the scope of this report, hydroelectric construction costs more than similar projects in other parts of the world. Operations also suffered from the destructive effects of a washout and an explosion.

ganizing its operations, with a little utilization of equipment and a large excess of personnel. Both defects may be remedied over the short term, but this requires a sound programme for normalizing operations which will include the gradual reduction of the number of workmen and a clearcut plan for the training of Peruvian technical staff to take over eventually from foreign technicians. Another operating cost which could be cut is that of coke now imported at high prices. Research should be continued to find ways and means of utilizing anthracite from the Santa valley, mixed with a relatively small portion of imported coke[143] or Peruvian coal, for instance from Oyón.

2. *Smelting*

Little is known of foundry capacity in 1955, as the figures usually appear in statistics under the heading of manufacture of machinery or machine parts. With regard to foundries that normally work for third parties and are therefore clearly part of the basic iron industry, their annual production capacity may be estimated at 1 000 tons of iron and 900 tons of steel, smelted in 18 foundries of which only one has steel smelters and six facilities for smelting non-ferrous metals as well. If imports of castings in the form of machinery or machined parts are excluded, the existing foundries may be considered as covering domestic demand, except in the case of cast iron tubing which is not produced domestically but imported to the extent of some 5 000 tons at an approximate value of 15 million soles. One of the foundries produces by itself more than a third of total output and has modern equipment for sand-processing and moulding operations. It also has excellent machine-tools for machining castings. Its standard of mechanization is adequate for the particular kind of work it does. The chief characteristics of this work is its great variety, which makes mass production impossible. There is another establishment of medium size which is not so highly mechanized. The remainder consists of small workshops which use rudimentary techniques and employ a large number of people. Of the total number of establishments, nine employ ten manual workers or less, seven 11 to 50 and only two more than 50.

The foundries in question have 530 manual workers in all with an average productivity of 1.7 kilogrammes of castings per man/hour. This figure compares unfavourably with that of 3.5 kilogrammes per man/hour in the most efficient foundries in Peru and that of 23 kilogrammes per man/hour in a modern establishment in the United States adapted to the conditions of the Peruvian market.[144] Hence, there is ample scope for an improvement in productivity, but whether it improves or not will depend mainly on whether demand increases and becomes relatively less diversified as a result of an expansion in the metal transforming industry.

The main raw material used by the foundries is steel and iron scrap and, more recently, pig iron from Chimbote. Ferromanganese, mainly imported from Chile, is also employed as well as small quantities of ferrosilicon, ferrocrome and ferronickel. The industry has no raw material supply problems to contend with at present, but a domestic scrap iron shortage is feared over the long term since Peru does not produce a sufficient amount, mainly because of the limitations of its rail network.

3. *Other iron and steel industries*

Because of the smallness of the market constituted by the transforming industries, there has so far been no justification for embarking on heavy forging in Peru. One small plant exists for forging milled balls which produces about 2 tons per eight hours with a steam drop hammer, and a project is underway for enlarging it in order to raise its production first to 12 tons per eight hours and later to an even higher level. The raw material used in this plant is a type of cast round bar.

143 This mixture is frequently used. The Mannesman electric plant in Brazil uses 60 per cent anthracite and 40 per cent coke.

144 This foundry apparently has 50 to 75 manual workers, a cupola furnace with an effective diameter of 60 inches, a mechanical stoker, complete equipment for sand processing and a mechanical moulding system. Approximately half the output is mass produced in specific sizes, to enable moulding machines to be used. The other half is of a type similar to that currently used in United States foundries. Estimates have been based on the following production break-down; 37 per cent 7-kilogramme parts; 57 per cent 45-kilogramme parts; and 6 per cent 160-kilogramme parts. (See United States Department of Labor, Grey Iron Foundries, August 1951.)

XVI. NON-FERROUS METAL INDUSTRY

Non-ferrous metals have been produced in Peru for some years. At the moment, 14 metals are obtained mainly as a result of the metallurgical treatment of copper, lead and zinc. This variety illustrates the complexity of the ores which are mined in Peru (see table 155).

The whole of this output, except some of the gold and silver, come from an enterprise which has its metallurgical centre at Oroya in the department of Junín, and from two small establishments which turn out metallic lead and blister copper respectively. Nearly all of it is exported.

In 1956, total output was valued at 1 323 million soles, i.e. 11 per cent of the total earnings of registered industry. Copper, zinc and silver accounted for more than 85 per cent of this amount (see table 156).

1. *Precious metals*

The two precious metals which are produced in

Table 155

PERU: OUTPUT OF THE NON-FERROUS METAL INDUSTRY

(Kilogrammes, tons and grammes of fine content)

		1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Refined gold (99.9 per cent) . . .	kg	—	—	—	—	—	233	994	1 181	1 385	1 348	1 691	1 091
Gold in bars of gold and silver [a] .	„	2 458	2 835	2 211	2 596	3 275	3 028	2 770	2 226	2 093	2 187	2 309	1 935
Washed gold.	„	716	376	208	110	63	86	71	70	100	100	100	100
Gold in bars of blister copper . . .	„	1 684	1 332	1 007	506	—	105	66	—	—	58	189	532
Refined silver (99.9 per cent) . . .	„	38 301	21 378	9 400	2 444	175 838	194 094	203 177	250 322	268 490	292 833	330 763	63 922
Sterling silver (925 fine)	„	59 984	57 548	65 766	94 010	42 215	23 806	16 035	18 969	27 455	22 672	18 241	23 256
Silver in bars of gold and silver [a] . .	„	851	847	739	2 027	1 934	2 268	778	15 903	6 516	1 302	19 383	22 590
Silver in bars of blister copper. . .	„	200 916	184 095	159 837	83 095	—	16 033	9 380	—	—	6 269	21 912	236 288
Refined copper (99.9 per cent) . .	tons	—	—	350	211	21 119	20 679	22 384	20 539	23 407	25 317	27 621	17 914
Copper in bars of blister	„	25 298	19 400	17 474	11 613	—	2 548	1 482	—	—	1 153	4 005	13 165
Refined lead (99.9 per cent) . . .	„	39 990	36 478	32 809	34 297	36 017	31 693	44 247	48 622	59 004	57 741	60 358	59 776
Lead in bullion and other smelting products.	„	1 597	1 608	681	439	1 221	263	108	1 644	97	79	106	33
Refined zinc (99.9 per cent) . . .	„	1 583	936	1 013	691	596	1 262	870	5 216	8 908	15 363	12 881	8 819
Refined zinc (98.6 per cent) . . .	„	—	—	—	—	—	—	—	—	—	—	4 175	633
Refined antimony (95 per cent) .	kg	269 065	227 551	199 039	206 737	47 456	35 672	79 631	79 118	210 739	207 554	263 343	216 279
Antimony in lead (bars)	„	92 146	168 281	128 136	80 200	10 587	—	8 014	200 572	—	—	83 909	66 705
Refined bismuth (99.9 per cent) . .	„	307 446	221 778	233 794	205 861	213 078	226 851	262 655	321 098	286 622	313 767	167 273	154 762
Bismuth in lead bars.	„	—	89 665	533	41 151	—	—	—	3 146	—	—	165 991	133 162
Cadmium	„	9 320	850	1 407	1 592	—	1 365	—	17 071	10 370	30 083	62 579	48 322
Tin in lead bars.	„	—	2 469	51 333	64 945	51 876	38 220	—	31 363	415	—	—	2 751
Refined indium (99.9 per cent) .	gr	41 459	155 692	304 955	450 727	645 354	513 773	80 853	—	—	—	—	149 000
Refined thallium (99.9 per cent) .	kg	—	—	—	—	—	—	—	46	—	—	25	22

SOURCE: *National Institute for Mining Research and Development (Instituto Nacional de Investigaciones y Fomento Mineros), Anuario de la Industria Minera del Perú*, 1956.

a Obtained by cyaniding and fusion of the precipitate.

Table 156

PERU: PERCENTAGE DISTRIBUTION OF THE VALUE OF THE PRODUCTION OF NON-FERROUS METALS, 1956

Metal	*Percentage*
Gold	5.9
Silver	15.2
Copper	41.6
Lead	30.6
Zinc	4.1
Bismuth	2.0
Antimony	0.3
Cadmium, tin, indium, mercury	0.3
Thallium and tellurium	...

SOURCE: National Institute for Mining Research and Development (*Instituto Nacional de Investigaciones y Fomento Mineros*), *Anuarios de la Industria Minera del Perú, 1956.*

Peru and which are delivered in the pure state or as alloys are gold and silver.

Of the annual gold production in Peru about 20 per cent is delivered as refined metal; 2 per cent as washed gold; 40 per cent is alloyed with silver by the cyanide process; 10 per cent is mixed with other metals which have been treated; and the rest is contained in concentrates and ores which are exported.

Some 35 per cent of the silver production is refined; 3 per cent is alloyed with gold; 10 per cent is mixed or combined with other metals; and the rest is contained in the ores and concentrates which are not smelted in Peru.

On an average, throughout the period 1945-56, more than 92 per cent of the gold produced in the metallic state, in pure form or alloyed with other metals, was exported. In the case of silver, the proportion was slightly higher, since more than a quarter of the silver refined during that period was used by domestic industry (see table 157).

(a) *Recovery by cyaniding*

Gold- and silver-bearing ores as well as the second washing of concentrates are subjected to cyaniding for the purpose of recovering most of their gold and silver content. From the cyanide solutions in which the precious metals are dissolved the gold and silver are precipitated in the form of a sediment which dries and is fused to produce gold and silver bars as end-products. The output, of these bars in 1945-56 is shown in table 155.

Cyaniding is carried on in seven domestic establishments which have a total productive capacity of 1 335 tons a day (see table 158). In 1956, 331 400 tons of ores and second washings of concentrates were treated. On the basis of 350 days continuous operation, a coefficient of 70 per cent is obtained. Productivity was of the order of 775 kilogrammes of ore per man/hour. Both efficiency and productivity may thus be considered satisfactory.

Table 157

PERU: CONSUMPTION OF REFINED AND STERLING SILVER BY DOMESTIC INDUSTRY, 1945–56

Year	*Consumption (Kilogrammes)*	*Consumption as percentage of domestic production of refined and sterling silver*
1945	67 720	68.9
1946	66 271	84.0
1947	79 454	105.7
1948	100 357	104.0
1949	50 393	23.1
1950	23 851	10.9
1951	17 327	7.9
1952	15 810	5.9
1953	21 717	7.3
1954	20 900	6.6
1955	21 960	6.3
1956	26 353	30.2

SOURCE: National Institute for Mining Research and Development (*Instituto Nacional de Investigaciones y Fomento Mineros*), *Anuario de la Industria Minera del Perú, 1956.*

Table 158

PERU: DISTRIBUTION BY AREA OF TREATMENT CAPACITY AND OF STAFF EMPLOYED IN THE CYANIDING OF GOLD- AND SILVER-BEARING MINERALS

Department	*Number of establishments*	*Treatment capacity (Tons per 24 hours)*	*Staff employed*	
			Employees	*Workmen*
Arequipa	3	285	4	72
Ayacucho	2	600	4	101
La Libertad	2	450	5	87
Total	7	1 335	13	260

SOURCE: National Institute for Mining Research and Development (*Instituto Nacional de Investigaciones y Fomento Mineros*), *Anuario de la Industria Minera del Perú, 1956.*

(b) *Recovery as by-products*

Most of the galenae, blendes and chalcopyrites found in Peru contain a certain amount of gold and silver which is separated from the main ore (lead, zinc or copper) during the refining stage. As this is normally done by electrolysis, the gold and silver are recovered from the anodic sediments of which an alloy constituting the raw material for obtaining the refined metals is formed.

Gold and silver of 99.9 per cent purity and sterling silver of 92.5 per cent purity, obtained by this method, are produced at the metallurgical centre of Oroya. It has an installed capacity of 4.25 kilogrammes of gold and 855 kilogrammes of silver per 24 hours. It employs 30 workers.

2. *Copper*

On the average, throughout the period 1945-56, 72.5 per cent of the copper mined in Peru was reduced to the metallic state (47.5 per cent as refined 99.9 per cent pure copper and 25 per cent as blister or impure copper). Of the total output of electrolytic copper, an average of less than 2 per cent was used by domestic industry during those years (see table 159).

There are two establishments for smelting copper

Table 159

PERU: CONSUMPTION OF PRIMARY REFINED COPPER BY DOMESTIC INDUSTRY, 1945-56

Year	Consumption (Kilogrammes)	Consumption as percentage of domestic production of refined copper
1945	77 830	—
1946	94 881	—
1947	170 004	48.6
1948	162 031	76.8
1949	43 015	0.2
1950	160 570	0.8
1951	271 697	1.2
1952	381 171	1.8
1953	589 762	2.5
1954	387 207	1.5
1955	434 495	1.6
1956	659 284	3.7

SOURCE: National Institute for Mining Research and Development (*Instituto Nacional de Investigaciones y Fomento Mineros*), *Anuario de la Industria Minera del Perú, 1956.*

ore: one in the department of Junín with a capacity of 1 200 tons per day and the other in the department of Ancash with a capacity of 100 tons of ore per day, which together represent a total capacity for treating 1 300 tons of ore a day. In addition, there is an electrolytic refinery capable of treating 75 tons of blister copper per day. In 1956, they operated at 93 and 66 per cent respectively of their maximum theoretical capacity.

In that year the number of workmen employed was 1 260 of whom 86 per cent were engaged in smelting and the rest in the refinery. Production amounted to 33 100 tons of blister coper, i.e. 0.08 per cent by weight of the ores and concentrates which were treated. A total of 46 per cent of the output was exported as impure copper and the rest was refined.

The electrolytic refinery yielded 17 900 tons of copper—95.4 per cent by weight of the anodes used—with a productivity of 42 kilogrammes of refined copper per man-hour. Among the by-products 1 045 tons of copper sulphate were obtained of which 37 per cent went to the domestic market.[145]

3. *Lead and zinc*

During the years 1945-56 the output of refined lead represented on the average 55 per cent of the total amount of lead mined; the corresponding figure for zinc was only 5 per cent.

Metallic lead produced for domestic consumption amounted to 2.7 per cent of the total output of refined lead; in the case of zinc, the domestic market absorbed about 4 per cent of the total output of refined metal (see table 160).

The production of metallic lead is carried on in two establishments in the departments of Ancash and Junín. Together they are capable of treating 380 tons of ore per day. Only one of them has a refinery, with a daily capacity of 160 tons. It uses the hydrofluosilicate electrolytic process. In 1956, the smelter utilized 91 per cent of its capacity and the refinery worked almost at full capacity. During that year 745 workers were engaged in lead metallurgy (625 in the roasting and smelting sections and the remainder in the refinery). Output amounted to 62 130 tons of impure lead —49.5 per cent by weight of the ores and concentrates treated—which yielded 59 770 tons of refined metal, 95 per cent by weight of the impure lead anodes.

Zinc metallurgy is carried on at a single establishment in Oroya, which consists of two plants, one electrolytic and the other electrothermal. The latter was installed only recently but has been temporarily out of action because of technical hitches. In 1956, 8 800 tons of refined zinc were produced by the electrolytic and 630 tons by the electrothermal process (42.7 per

[145] Sales of copper sulphate on the domestic market in previous years were: 1 123 tons in 1952; 1 705 in 1953; 273 in 1954 and 634 in 1955, all produced domestically. Considerable amounts were also imported.

Table 160

PERU: DOMESTIC CONSUMPTION OF PRIMARY METALLIC LEAD AND ZINC, 1945-56

Year	Consumption (Kilogrammes)				Consumption as percentage of domestic production of primary refined metallic lead and zinc	
	Lead			Zinc		
	Total	Refined	Antimonial		Lead	Zinc
1945	478 373	478 373	—	50 957	1.2	3.2
1946	886 627	784 522	102 105	59 087	2.4	6.3
1947	779 815	749 639	30 176	142 257	2.4	14.0
1948	813 924	737 260	76 664	146 746	2.4	21.2
1949	276 769	249 998	26 771	61 697	0.8	10.3
1950	749 043	749 043	—	234 311	2.4	18.6
1951	1 185 222	1 185 222	—	28 262	2.7	3.3
1952	2 056 081	2 056 081	—	343 516	4.2	6.6
1953	2 666 812	2 666 812	—	211 383	4.5	2.4
1954	1 569 019	1 569 019	—	433 882	2.7	2.8
1955	1 488 061	1 334 175	153 886	371 289	2.5	2.2
1956	1 453 290	1 087 481	365 809	527 369	2.4	5.0

SOURCE: National Institute for Mining Research and Development (*Instituto Nacional de Investigaciones y Fomento Mineros*), *Anuario de la Industria Minera del Perú, 1956.*

cent and 9.5 per cent respectively of the concentrates used).

One of the by-products of the electrolysis is zinc sulphate, the refinery's output of which during the years 1950-56, according to the National Institute for Mining Research and Development, was as follows:

	Kilogrammes
1950	244 159
1951	417 598
1952	678 085
1953	855 415
1954	339 591
1955	881 690
1956	845 389

In view of the high proportion of lead and zinc which is exported in ores and concentrates, it has been suggested that a new lead refinery and another zinc electrolytic plant should be built. The complete project, which would involve an investment of some 35 million dollars, comprises a lead smelter and refinery with a daily capacity of some 160 tons and a zinc refinery with a daily capacity of about 150 tons. The project appears to be a good one, but in view of the scale of investment a detailed study of its profitability should be made. One of the essential requisites would be an adequate supply of cheap electric power. Perhaps, therefore, Chimbote would be the most suitable spot, since the generating capacity required—some 30 000 kW—would call for a relatively small additional investment in civil engineering and in the powerhouse of the hydroelectric plant at Huallanca.

4. *Other non-ferrous metals*

Apart from those already dealt with, the most important non-ferrous metals produced in Peru in their metallic state are bismuth, antimony and cadmium. The first two are by-products of lead metallurgy and the last of lead and zinc metallurgy.

Bismuth is another of those metals which are found in the anodic sediments of the electrolytic lead cells. Part of the metal is recovered in the pure state and part as an alloy. The plant where it is extracted has a daily capacity of one ton.

Antimony is recovered as a metal 95.55 per cent pure (crude antimony) and in the form of an antimony and lead alloy; cadmium is recovered as a metal of 99.9 per cent purity. The establishments are small: that for antimony can deal with 6 tons of raw material and that for cadmium with 60 kilogrammes per day. All the production is exported and the annual figures during the period 1945-56 are shown in table 155.

XVII. METAL TRANSFORMING INDUSTRY

In 1945-55, the metal transforming industry developed faster than any other industrial branch (383 per cent), thereby ranking sixth among aggregate manufacturing industries as regards production value and fourth as regards value added (see table 37). In spite of its rapid growth it still lags behind all the others as regards satisfying domestic demand, since it covers 24 per cent only whereas most of the industrial branches cover more than 80 per cent.

The salient characteristics of the transforming in-

Table 161

PERU: STRUCTURE OF THE METAL TRANSFORMING INDUSTRY IN 1956

	Number of establishments (Units)	*Staff employed (Units)*		*Raw materials consumed (Thousands of soles)*			*Gross value of production (Thousands of soles)*	*Value added*	
		Employees	*Workmen*	*Total*	*Foreign*	*Domestic*		*Thousands of soles*	*Percentages*
Containers and metal caps	5	29	213	5 105	4 597	508	14 276	8 854	62
Metallic structures, steel tanks, tubing, door- and window-frames and wire products	23	104	575	22 340	22 282	58	48 115	25 036	52
Furniture made from steel tubes and plates[a]	22	111	706	17 975	12 504	5 471	31 277	13 021	42
Miscellaneous castings	27	172	721	9 547	7 849	1 699	31 394	20 108	64
Miscellaneous non-ferrous metal articles, except silverware and related items	13	20	344	11 234	9 758	1 476	22 706	11 046	48
Machines for agriculture, industry and mining	14	67	411	5 809	4 999	810	7 726	1 458	19
Electrical machines, appliances and accessories	26	169	510	8 555	6 644	1 911	26 070	17 064	65
Transport equipment	13	41	209	42 144	33 829	9 315	51 908	9 479	18
Repairs in general	247	633	2 615	45 763	41 539	4 224	115 475	68 179	59
Total	*390*	*1 346*	*6 304*	*168 472*	*144 001*	*25 472*	*348 947*	*174 247*	*50*

SOURCE: Ministry of Development and Public Works, Department of Industry and Electricity.

a The manufacture of furniture from steel sheet does not belong to the metal-transforming industry, according to the international classification, but it was impossible to isolate it from the manufacture of tubular furniture.

dustry at present are its division into a large number of tiny establishments, where repair operations predominate over those of manufacturing proper, and its use of a substantial proportion of imported raw materials owing to the fact that the domestic iron and steel industry is still in its infancy. Table 161 shows that there are 390 registered establishments, with an average of 19.6 employees and manual workers each; unregistered workshops, employing less than 5 workmen each, also exist and probably in far greater numbers. Fifty-eight per cent of the registered establishments do repairs only, and it is highly likely that this proportion exceeds 90 per cent in the case of those that are unregistered. Table 161 indicates that 86 per cent of raw material inputs come from abroad, although, according to the sections in this report that deal with

Table 162

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF SIMPLE METALLIC MANUFACTURES IN 1955 [a]

(Millions of soles)

	Item or product	*Production*	*Imports* [b]	*Apparent consumption*
352.	Containers of tinplate	43.7	11.3	55.0
	Metal caps	4.1	12.3	16.4
353.	Table and kitchen cutlery	—	5.6	5.6
	Other cutting implements (axes and machetes)	—	1.9	1.9
	Agricultural hand tools	—	10.6	10.6
	Artisan hand tools	0.3	26.7	27.0
	Drill rods	—	9.1	9.1
	Locks and padlocks	—	1.9	1.9
	Ironware and other hardware	4.1	7.9	12.0
354.	Sanitary articles of cast iron	0.3	9.0	9.3
	Taps and similar articles for sanitary installations	2.8	5.2	8.0
	Stoves, water-heaters, ovens, radiators and other non-electric heating appliances	7.2	9.8	17.0
355.	Structural units of steel tubing and light steel shapes (including door- and window-frames and lamp-posts)	18.5	0.2	18.7
	Structural units of tubing and light shapes, of aluminium (including door- and window-frames)	4.9	—	4.9
	Structural units of heavy shapes	10.2	21.8	32.0
	Steel furniture	6.0	16.1	22.1
	Silos, tanks, vats, etc.	1.6	10.0	11.6
	Gas cylinders	—	2.4	2.4
	Bedsteads	15.0	1.8	16.8
	Welded tubes and their fittings	18.3 [c]	49.6 [d]	67.9
356.	Aluminium cooking utensils and tableware	12.4	3.8	16.2
	Other domestic metal utensils (including those of cast iron and steel sheet)	3.2	15.2	18.4
357.	Lighting fixtures, such as fluorescent lighting shades, chandeliers, brackets, lamps, etc.	1.5	1.6	3.1
	Electric torches (flashlights)	—	3.5	3.5
538.	Iron and steel wire	—	25.0	25.0
	Coarse and fine wire netting of iron and steel	2.4	1.6	4.0
	Barbed wire	—	4.5	4.5
	Steel cables	—	7.7	7.7
	Nails, tacks, staples	3.5	8.7	12.2
	Electrodes of ordinary iron and steel	—	3.8	3.8
	Electrodes of special iron and steel	—	1.8	1.8
359.	Barrels, casks, drums, buckets, etc.	13.3	1.9	15.2
	Soft metal tubes for ointments and creams	3.5	0.4	3.9
	Nuts, screws, pulley-wheels, rivets, etc.	0.5	11.4	11.9
	Razors	—	1.5	1.5
	Needles, pins, hairpins, etc. (except hypodermic and gramophone needles)	—	3.0	3.0
	Safes and vault accessories	1.0	1.2	2.2
	Steel springs	4.8	3.3	8.1
	Other simple metal manufactures	28.2	303.2	331.4
	Total	212.2	618.2	830.4

SOURCE: Imports: Ministry of Finance and Trade, *Estadística del Comercio Exterior*. Production: Ministry of Development and Public Works, *Estadística industrial, 1955*.

a Only those items in which production or imports exceeded 1 million soles in 1955 have been included.

b The figures for each item are the averages for 1954 to 1956. Total imports are those for 1955.

c Under this item, 16.2 million soles were recorded in the official statistics as a basic industry and were transferred to the metal transforming industries to comply with the United Nations classification.

d Tubes imported at all ports, except Talara, have been considered as welded.

the iron and steel industry and the non-ferrous metals industry, Peru has sufficient resources to satisfy the greater part of its metal requirements.

Tables 162 to 165 show that the main development of the Peruvian transforming industry took place in simple metal manufactures, whose production reached 212 million soles in 1955. Except for motor vehicle repairs, which properly speaking do not form part of the manufacturing industry, production of machinery, electrical equipment and accessories and transport equipment was negligible, both in absolute value and in relation to demand. It is clear from the relevant section of chapter VIII that the industry has ample scope for expansion of which it has not yet taken advantage.

The manufacturing industry proper consists of approximately 65 factories, i.e. 17 per cent of the total number of establishments, which are responsible for 82 per cent of production. Table 166 gives a breakdown of the production of these factories, selected because their total sales in 1956 exceeded 1 million soles. Even in this select group there is a wide variety of activities, since they manufacture a total of approxi-

Table 163

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF MACHINERY AND EQUIPMENT (EXCEPT ELECTRICAL AND TRANSPORT EQUIPMENT) IN 1955 [a]

(Millions of soles)

	Item or product	*Production*	*imports* [b]	*Apparent consumption*
361.	Boilers, economizers and related equipment	0.2	18.9	19.1
	Steam machines and turbines	—	5.2	5.2
	Hydraulic turbines and wheels	0.1	6.4	6.5
	Diesel marine engines	—	26.3	26.3
	Other internal combustion engines, except when already installed in vehicles	—	65.3	65.3
362.	Agricultural tractors	—	64.5	64.5
	Machines for land preparation and cultivation	1.2	18.5	19.7
	Harvesting and threshing machines	—	3.8	3.8
	Machinery and equipment for processing agricultural commodities	—	39.2	39.2
363.	Concrete mixers	—	3.2	3.2
	Other machinery for construction	—	43.5	43.5
	Mining machinery	3.9	94.0	97.9
	Equipment for petroleum extraction	—	70.6	70.6
364.	Machine-tools for metal	0.7	16.3	17.0
365.	Dressing and spinning machines	—	20.9	20.9
	Flat looms	—	13.7	13.7
	Circular and rectilinear knitting machines	—	9.1	9.1
	Textile-finishing machines	—	17.4	17.4
	Wood-working machines	2.0	6.1	8.1
366.	Pumps	1.0	43.0	44.0
	Compressors (including pneumatic tools)	—	56.6	56.6
	Lifts and escalators for buildings	1.4	16.3	17.7
	Freight and other lifts	0.6	10.8	11.4
	Cranes and other equipment for lifting and handling weights	—	14.5	14.5
	Equipment for the transmission of mechanical energy	0.3	10.5	10.8
367.	Calculators	—	11.2	11.2
	Typewriters	—	23.0	23.0
	Accounting and statistical machines	—	9.5	9.5
	Cash registers	—	4.5	4.5
	Weighing-machines and scales	1.4	7.4	8.8
	Other machines for offices and shops	—	3.3	3.3
368.	Washers and dryers for domestic use, floor scrapers and polishers	—	12.9	12.9
	Industrial laundry equipment	—	16.6	16.6
	Industrial sewing-machines	—	6.8	6.8
	Domestic sewing-machines	—	61.0	61.0
	Industrial and domestic electric refrigerators	0.2	39.5	39.7
	Industrial and domestic non-electric refrigerators	—	6.3	6.3
369.	Valves, etc. (except for sanitary installations)	—	21.2	21.2
	Other non-electric machinery and equipment	10.9 [c]	103.2	114.1
	Total	*23.9*	*1 021.0*	*1 044.9*

SOURCE: Same as table 162.

a Except in the case of concrete mixers, only items in which production exceeded 1 million soles or in which imports exceeded 5 million have been included.

b The figures for each item are the averages for 1954 to 1956. Total imports are those for 1955.

c Including castings for subsequent machining.

Table 164

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF ELECTRICAL MACHINERY, INSTRUMENTS, APPLIANCES AND ACCESSORIES IN 1955 [a]

(Million of soles)

	Item or product	*Production*	*Imports* [b]	*Apparent consumption*
371.	Generators and generating assemblies	—	38.4	38.4
	Electric motors, over 50 h.p.	—	3.5	3.5
	Electric motors, 25 to 50 h.p.	—	1.3	1.3
	Electric motors, under 25 h.p.	0.1	8.7	8.8
	Transformers, over 100 kW	—	8.5	8.5
	Transformers, under 100 kW	0.5	10.1	10.6
	Electric control equipment and machinery	1.7	6.3	8.0
	Electric soldering machines	—	4.9	4.9
372.	Electric stoves and ovens	—	8.5	8.5
	Electric utensils with resistances	—	5.2	5.2
	Electric manual tools	—	3.3	3.3
	Liquidizers, mixers and other domestic utensils with small motors	—	9.5	9.5
373.	Electric wire and cables	4.2	37.8	42.0
374.	Electrical equipment for vehicles, aircraft and trains	—	9.0	9.0
375.	Electric lamps (bulbs and fluorescent tubing)	—	9.5	9.5
376.	Gramophones, radios, television sets and electrical detecting equipment	—	50.4	50.4
	Telephone and telegraph equipment	—	17.8	17.8
379.	Accumulators	8.8	11.7	20.5
	Dry batteries	—	7.5	7.5
	X-ray, diathermic and similar apparatus	—	11.3	11.3
	Other miscellaneous electrical products	17.7	77.5	95.2
	Total	33.0	340.7	373.7

SOURCES: Same as table 162.

a Except in the case of electric motors of 25 to 50 h.p., only items of which production exceeded 1 million soles or of which imports exceeded 5 million have been included.

b The figures for each item are the averages for 1954 to 1956. Total imports are those for 1955.

Table 165

PERU: PRODUCTION, IMPORTS AND APPARENT CONSUMPTION OF TRANSPORT EQUIPMENT [a]

(Millions of soles)

	Item or product	*Production*	*Imports* [b]	*Apparent consumption*
381.	Ship-building and repairing	3.0	3.7	6.7
382.	Locomotives and spares	—	34.5	34.5
	Railway carriages	—	1.3	1.3
	Freight vans and wagons for mines	—	6.3	6.3
	Rolling-stock parts	—	12.7	12.7
383.	Passenger cars and station-wagons	—	126.8	126.8
	Lorries	—	22.9	22.9
	Buses	—	6.8	6.8
	Delivery vans	—	53.2	53.2
	Jeeps and similar vehicles	—	1.9	1.9
	Chassis for lorries and buses	—	97.0	97.0
	Coachwork for lorries and buses	6.2	1.0	7.2
	Motorcycles	—	2.8	2.8
	Spare parts for motor-vehicles (except tractors)	—	118.0	118.0
	Spare parts for tractors	—	40.0	40.0
	Unspecified spare-parts	—	24.3	24.3
384.	Repair of motor vehicles	109.4	—	109.4
385.	Bicycles	—	13.0	13.0
386.	Aircraft	—	23.7	23.7
389.	Other transport equipment	11.7	15.2	26.9
	Total	130.3	605.1	735.4

SOURCES: Same as table 162.

a Except in the cases of railway carriages, jeeps and motorcycles, only items of which production exceeded 1 million soles or of which imports exceeded 5 million have been included.

b The figures for each item are the averages for 1954 to 1956. Total imports are those for 1955.

mately 300 different items, i.e. an average of five varieties per establishment. They are generally characterized by their advanced manufacturing procedures and their use of the most modern equipment that can be found on the market. Their main defect is insufficient utilization of installed capacity, since most of the factories in this group work on shift only.

Table 166

PERU: VALUE OF PRODUCTION OF THE METAL TRANSFORMING INDUSTRIES IN THE 65 ESTABLISHMENTS WHOSE TOTAL SALES IN 1956 EXCEEDED 1 MILLION SOLES

(Millions of soles at 1956 prices)

		Value
352.	Containers of tinplate, metal lids, etc.	80.03
353.	Non-ferrous metal ware	1.35
	Other hardware	1.54
354.	Stoves and water heaters	9.05
355.	Iron structures	18.01
	Structural units of light shapes	18.59
	Bedsteads	8.80
	Steel furniture	9.58
356.	Cooking utensils and other articles of cast iron, whether enamelled or not	11.35
	Aluminium cooking utensils	13.10
358.	Iron and steel wire netting	7.10
	Nails	5.66
	Other wire and solder	5.87
359.	Steel drums	11.64
	Welded tubes	7.09
	Metal tubes for ointments and creams	4.78
	Safes	2.39
	Steel leaf-springs	4.83
	Steel coil-springs	1.55
	Zip fasteners	2.98
	Lead shot	3.59
363.	Mining machinery and equipment	6.33
	Agricultural machinery	1.74
365.	Industrial machinery	8.10
366.	Lifts	1.39
371.	Electric motors	2.10
	Transformers	1.24
	Material for electrical installations	6.64
373.	Electric wire and cable	14.02
379.	Electric accumulators	8.88
382.	Wagons, etc. for mines	5.10
	Rolling-stock	2.03
383.	Coachwork	2.15
	Total	*284.77*

The following pages contain a description of the characteristics and problems of the 8 most important transforming industries in Peru, which together represent about 60 per cent of production in registered establishments, excluding vehicle repairs.

1. *Manufacture of tin containers and caps*

The rapid progress noted in the transforming industry in recent years has been mainly in this branch. Container manufacture has principally developed in response to increased demand in the fish-canning industry, which in 1940 had barely started production and by 1956 was turning out approximately 18 000 tons of canned fish. As regards tin caps production, its development was due to the unusual expansion of demand in the beverages industry which virtually tripled between 1945 and 1955.

The difference in the cost of transporting and storing as between finished goods and raw materials boosted production. Although the corresponding customs duties also differ, this neither protects nor encourages production since the customs authorities issue certificates for the containers leaving Peru with exports which can later be used in payment of duty on an equivalent amount of imported tinplate or containers.

In 1955, container production amounted to 43.7 million soles (approximately 68 million units) and imports to 11.3 million soles (approximately 1.1 million units). Imports consist of container tops and bottoms and bodies rolled out flat from which the finished article can be refashioned with the aid of fairly simple machinery. In view of the magnitude of domestic demand, there is no reason why such imports should not be totally replaced by domestic production, although it should be pointed out that, while there is a strong economic incentive for the complete nationalization of container production including its raw material, there is little stimulus for replacing the manufactured article since the industry in question is highly mechanized, requires skilled technicians and does not employ a large labour force.

Three methods are used for the manufacture of containers which differ in their degree of mechanization and their labour requirements. Approximately 80 per cent of Peruvian production is automatic and consists mainly of quarter-pound and half-pound fish-containers. The high degree of mechanization is evident from the fact that the labour force adds only 1 or 2 per cent to the value of the metal. Ten per cent of the containers are made by semi-automatic machinery and consist chiefly of the one-pound oval tins known as *portolas*. The value added by the labour force in this case is 4 to 6 per cent of the value of the metal. The rest of the industry turns out approximately 150 different container models, which are manufactured partly with the aid of a few machines and simple mechanical processes but mainly by hand. The containers range from five-gallon cans for petrol, paraffin and oil to a variety of boxes and other receptacles produced on a small scale. The cost ratio of labour to raw material in this case is 25 to 33 per cent. Although the manufacture of containers by hand might be classified more appropriately as a cottage industry, it is interesting to note that the largest factory uses all three procedures which, in the opinion of its technicians, are well suited from the economic point of view to the variety and volume of the markets to be supplied. Fully automatic mass production is to be found in one big establishment only, which is independent of the fish-canning companies. There are also four other plants with equipment that may be considered as semi-automatic. The remainder of the production is carried on in nine

The industry's over-all productivity is determined by that of automatic manufacture; during periods of continuous work, it may be compared with productivity in highly industrialized countries but it is reduced when adjustments are made to the machinery to change the containers size which involves stopping the assembly line for 15 days for each change.[146] The small market supplied by the large number of miscellaneous containers that are virtually hand-made does not warrant further mechanization for the time being. Yet production could be standardized and made less varied and thus attain a higher technological level.

It is estimated that on the whole the equipment is used at only a third of capacity. This is due partly to the predominance of automatic production and partly to the current recession in the fishing industry, but mainly to the seasonal nature of demand in the canning factories.

The manufacture of fuel drums is also very important. In 1955, 86 109 units were produced representing value of 11.4 million soles. The whole output comes from one factory which fully satisfies domestic demand. Production methods and equipment are similar to those in industrialized countries.

The crown cap industry produces 116 million units representing a value of 4.1 million soles. It works in conjunction with the container industry for the purpose of using up tin scrap. There are no economic impediments to the future replacement of crown cap imports, which amounted to 12.3 million soles in 1955.

2. *The manufacture of metal structures*

The manufacture of metal structures has been firmly established in Peru for many years. It supplies virtually the whole market for structures made from light tubes and shapes (23.6 million soles in 1955) and could satisfy the market for structures made from heavy shapes (32.0 million soles in 1955), since imports of the last item have been effected because of contractual features in building construction rather than because of the Peruvian industry's inability to replace them.

The market for heavy structures has consisted principally of bridges and industrial construction. So far, such structures—except for beams for wide spans or spaces—have been little used for buildings. Yet there is a tendency to replace reinforced concrete structures by those of steel which would increase demand in this branch at a more rapid rate than in the past.

The principal products of the light structures industry are public lighting standards, skeleton roofs, pylons and what is known in Peru as "metal carpentry", consisting, mainly of the manufacture of door- and window-frames. The latter is the most important branch and has developed more rapidly than the others in recent years owing to the replacement of wood by metal. There is no guarantee, however, that development will continue at the same brisk pace as in the past, since iron door- and window-frames do not stand up to the damp salty air of the principal market—Lima-Callao—without costly protection and up-keep.

There are more than 20 establishments which manufacture structures, of which at least 9 may be considered as large. Many combined this type of manufacture with other transforming activities. A general review of the larger plants shows that no technical problems exist, since the personnel is skilled in design and execution. Equipment raises no problems either, since it is simple and easily renewable. Idle capacity exists in the sense that the factories could increase production without expanding, but it is difficult and pointless to evaluate this aspect.

The construction of door- and window-frames and other structures from aluminium has been highly successful in Peru since the products are well finished, of excellent appearance and ideal for the weather in the Lima-Callao zone. Nevertheless, there is the problem of the excessively high cost of the raw material used which mainly consists of extruded section imported from abroad. Owing to the high cost of aluminium door- and window-frames[147] this industry cannot hope for a large expansion of its domestic market which will continue to be limited to luxury buildings and other constructions. But as the activity in question is well organized and has all the necessary technical facilities at its disposal, it may be possible for it to export its manufactures to neighbouring countries at least. The fact that its equipment is suitable for small-scale production would help it to do so, since a certain flexibility is thus imparted to its production which would enable the industry to compete easily with its counterpart in more highly developed countries, when, as frequently occurs in Latin America, architects ask for window- and door-frames of special sizes that cannot be manufactured economically by large factories abroad.

3. *Manufacture of welded tubes*

The production of electrically welded steel tubing by the resistance process began in Peru in 1954. The only existing factory produces tubing of 12.7 to 50.8 mm. (½" to 2") which meets 60 per cent of domestic demand. Output in 1955 was 2 340 tons of tubing, mostly galvanized, which constituted 21 per cent of the domestic market for welded tubing.[148] The industry has a capacity for producing about 9 000 tons of tubing a year; in other words, it could almost quad-

[146] A daily demand of 150 000 half-pound containers is required in order to keep one machine working for 8 hours a day.

[147] Aluminium window-frames already fitted are sold for approximately 80 soles per kilo, while the price for steel window-frames is 12.5. As an aluminium window-frame weighs about a third of a steel frame per square metre covered, its final cost is slightly more than twice that of steel.

[148] In the absence of more accurate data, the market for welded tubing has been estimated as the difference between the total market and imports of tubes over 50.8 mm. Such tubes are shipped into Talara and must be seamless, since they are destined for the petroleum industries.

ruple its production without more plant. Its equipment and procedures are exactly the same as those used in the more industrialized countries, and it has no technical or staff problems. Its raw material is steel strip shipped from abroad and already cut in the right sizes. Its cost is high compared with the value of the end-product but this may change when cheaper strip from Chimbote is available. So far, its products have been confined to those of the sizes cited and to galvanized and black types of piping, but a plan is on foot to make piping of smaller diameter as well as tubes needed by electrical installations. Labour is of little importance in such a mechanized type of plant; in any case its productivity may be considered as normal.

4. *Manufacture of bedsteads*

The manufacture of metal beadsteads is the most developed of the durable consumer goods industries and one which has done most to standardize its production. There are three factories in Peru exclusively concerned with this type of manufacture and another two which combine such activities with the manufacture of furniture. These five factories together produce about 85 per cent of the bedsteads; the rest of the production is distributed among a series of minor establishments. At the moment, nearly all the raw material is imported, but in the future much of it could come from Chimbote or from its satellite industries, since it consists mainly of tubes (some 54 per cent), bars and shapes (some 20 per cent), sheet (17 per cent), and wire (8 per cent). Even with imported raw materials, the industry can compete with foreign products except in the case of special lines or high-quality beds. It has no technical or staffing problems and it could probably at least double its production without increasing plant capacity since most of the units work only one shift.

5. *Manufacture of cooking utensils*

The production of cooking utensils is mainly concentrated on aluminium items the manufacture of which has grown very rapidly in recent years. In the first place, it commands a market both in and outside the Lima-Callao zone, although for most of the metal transforming industries the provinces represent only 20 per cent of the total market. This situation is attributable to the fact that aluminium utensils and tableware have been quite popular with the inhabitants of the sierra because they are easy to handle, durable and cheap.

There are seven factories of which one alone is responsible for more than 50 per cent of the output. Domestic manufacture meets 77 per cent of the demand for aluminium utensils. Those which are imported are mostly of thicker sheet. For stamping they require high-powered presses which the domestic industry does not possess.

Generally speaking, this activity is still quite artisan in character; there is little mass production and an abundant use of manpower. Another feature is the excessive diversification of production: factories with an output valued at a little over one million soles make more than 15 completely different articles. As this is an industry which requires expensive dies, it would be desirable to introduce a certain degree of specialization which would lead to the use of more automatic machinery of greater capacity. As a result, the quality would undoubtedly improve and prices would go down. Price reductions in turn would help to expand still further the excellent market for aluminium goods.

Enamelled iron utensils are turned out by two of the factories producing aluminium articles while another factory makes the necessary metal. Total production was valued at 3.2 million soles in 1955, i.e. about a quarter of the value of aluminium utensils and tableware. It consists mainly of saucepans, jugs, cups, ladles, washstand sets, plates and candlesticks.

The quality is good and at least superior to that of foreign articles which compete on the basis of cheap prices but which are made of flimsier metal and have a thinner coating of enamel.

6. *Manufacture of oil stoves and ovens*

With the exception of the container industries, the manufacture of oil stoves, ranges and ovens (paraffin) is the most important among those using mainly steel sheet. For reasons similar to those mentioned in dealing with aluminium cooking utensils, the market for them is expanding rapidly throughout Peru, except in places where oil supplies are unobtainable.

This industry is typical of those which develop with extraordinary rapidity in the Latin American countries, although their raw materials are imported. The principal reasons for this expansion are to be found in an extensive market covering the low-income sectors, a simple manufacturing process, and a marked difference in freight charges for the bulky finished product and the imported raw material, which serves as a natural safeguard for the industry.

Output is concentrated in three factories, of which one accounts for half of the total. Together they satisfy about 70 per cent of domestic demand. Imports are 50 per cent dearer than the domestic product and consist mainly of articles which are of better appearance, mainly because they have been stamped with powerful presses.

Unlike the consumer durables turned out by the other transforming industries, Peruvian stoves and ovens are mass produced, although by a simple and economic process. The length of ovens is in the region of 20 000 units so that the time lost in the preparation of machinery and the fitting of dies is very small per unit of production. This industry now has a technique perfectly suited to the volume of the market it

has to satisfy. The future expansion of the market will pave the way for further mechanization and particularly the use of more automatic and more powerful machinery, as well as of conveyor belts.

Although general measurements of productivity were impossible, a comparison of data from a Peruvian factory with average data from the Mexican stove industry reveals that the former could at least double its production per worker. Here, the same remark about the utilization of capacity may be made as in the case of other metal transforming industries: usually, only one shift is worked and, were it not for the difficulties of getting more skilled workers, technicians and supervisors, output might be doubled or trebled without substantial additions to the plant.

7. *Manufacture of steel furniture* [149]

At present steel furniture is manufactured by three establishments, one of which is large and specialized while the other two are small and make a wide variety of metal furniture to order. It is estimated that total production meets between 60 and 65 per cent of the domestic demand. Imports are mainly of office furniture which is different in finish and design from the domestic product and which attract customers able to pay for them. They also include theatre and cinema seats, dentists' chairs and other specialities.

The industry was launched in the middle of the last decade and has since been gradually perfecting its techniques and mechanizing its operations in order to reduce manpower. But it still has plenty of room to improve productivity through the more efficient organization of its processes and the use of more mechanized equipment. In the factories visited it was noted that the gradual increase in production had compelled entrepreneurs to arrange their equipment in the workshops in a manner which is not the best for ensuring the smooth flow of materials and products.

The main element in favour of domestic industry in the competition with foreign products is the high freight paid on furniture per unit of value because of its bulk. This is one of the reasons why the domestic industry can sell its products at prices 20 per cent lower than those of imported goods. It is to be hoped that they may become even more competitive in the future when steel sheet produced at Chimbote becomes available.

The products of the industry consist mainly of desks, tables, chairs, filing cabinets, special tables and furniture for mechanical accounting systems and equipment for checking inventories. Certain special furniture for use in hospitals and clinics and some types of theatre and cinema seats are also produced.

Unlike the situation in other countries, steel furniture may meet stiff competition from wooden furniture, even in the case of office equipment. Wood stands up better to the climate in Lima and Callao, the principal market, while Peru has plenty of *cedro* and mahogany for this purpose. Competition from this direction has so far, with a few exceptions, not been strong because the manufacture of wooden furniture is still in its infancy.

8. *Manufacture of copper wire*

This industry is confined to a single factory whose present capacity is 720 tons a year of copper wire of the insulated TW types, uncovered wire and cable, and insulated cable for high-tension and underground installations. With this capacity it covers approximately 76 per cent of the domestic consumption of insulated TW wire for 600 volts, and 47 per cent of the demand for uncovered wire.[150]

Although relatively small, it has all the latest techniques and operates at a satisfactory level of efficiency and productivity. However, the utilization of its equipment is still deficient because there is a bottleneck at the copper reheating stage and there is surplus capacity in the smelting and rolling processes as compared with the other stages. Among its raw materials, electrolytic copper, lead, tin and cotton are of domestic origin while plastics are imported.

149 According to the United Nations classification, steel furniture belongs to the furniture sector and not to the transforming industries. As, in Peru, it is produced in conjunction with other products of the mechanical industries, it was impossible to separate them in the statistics.

150 According to statistics for 1955, the industry appears to be meeting only 10 per cent of domestic demand; this is because it was not fully organized and because there had been certain exceptional copper imports.

XVIII. MISCELLANEOUS INDUSTRIES

This section deals with the manufacture of professional, musical and measuring instruments, etc., watch-repairing, the making of jewellery and related articles, and the production of a large number of goods which cannot properly be classified under the other industrial headings. For the purposes of this study, the only interesting branch of existing industry in this hybrid sector [151] is silver-work, which for centuries has been an important cottage activity and which, at least to some extent, has become an industry turning out easily exportable products.

The production of silver articles and related items is carried on in 38 establishments in which 961 workmen and 215 employees are engaged. Only one of them might be termed a factory in the sense that most

151 The larger categories for which separate statistics exist within this branch are ginned cotton and cotton-seed, which, strictly speaking, do not belong to industry but to agriculture.

of its operations are done by machine and the silversmith's art is practically confined to the construction of steel dies to stamp or emboss the silver. A further establishment might be described as semi-manufacturing while all the others are definitely of the artisan type.

The principal manufacturing operations are the rolling of the silver from ingots, lathe-turning, deep embossing and stamping of artistic designs. The most important products are cutlery, tableware and tea-sets, 90 per cent of which are exported directly and indirectly.

The main artisan operations are smelting, *repoussé* work and hand-chiselling. The most important products are objects of art of the Inca type for sale to tourists.

The value of production of such silver products and related items was 52 million soles in 1956 and the value added amounted to 24 million. Of the raw materials used, including all the silver, 83 per cent was of domestic origin.

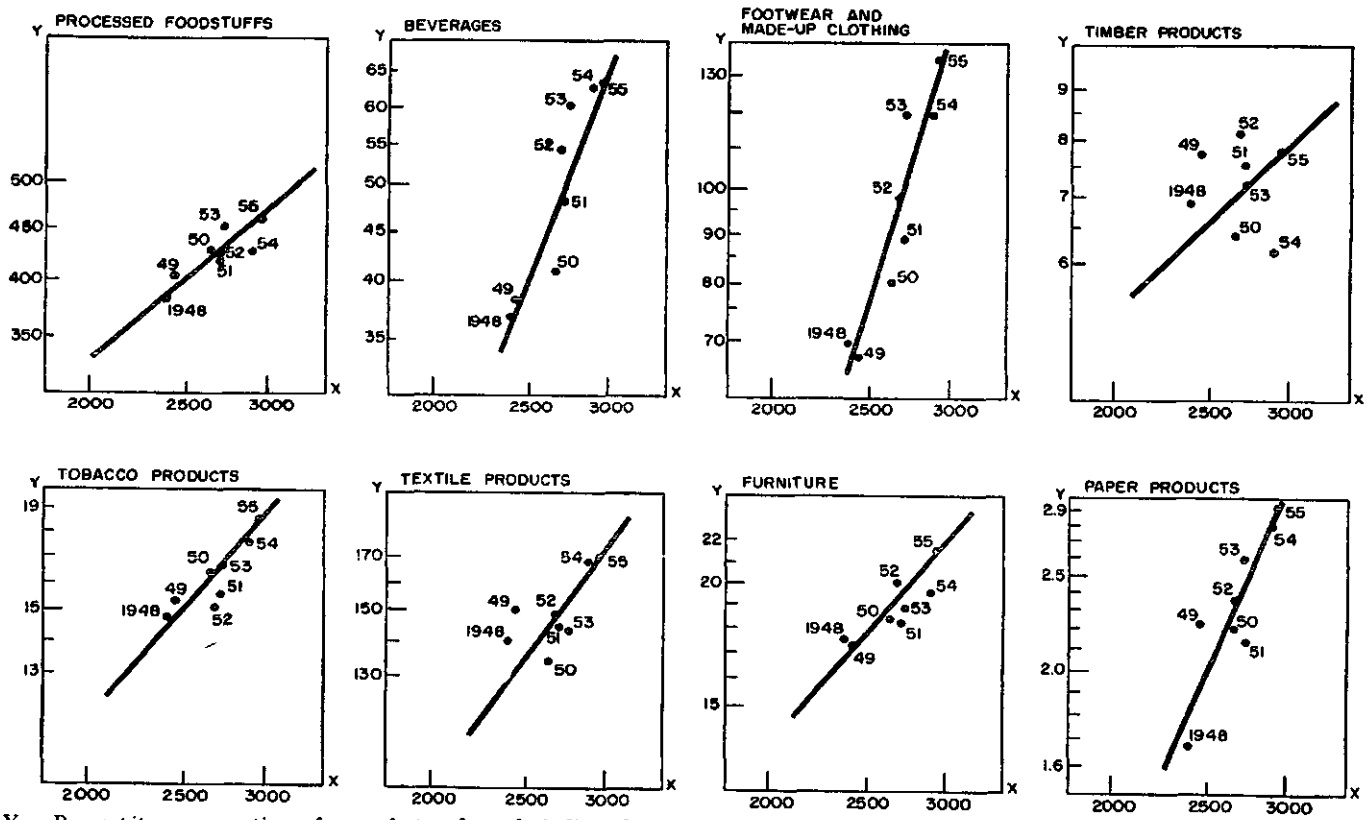
It is believed that this industry has excellent prospects of expanding its exports since its products are of a quality which makes them acceptable in any part of the world. In the opinion of the makers, the only difficulty in the way of such an expansion is the price they pay for silver. They maintain that, if it could be sold at 30 per cent less than the export price, they could easily triple their exports. For this to happen, better marketing techniques would have to be introduced and an intelligent publicity campaign launched.

Figure VII

PERU: RELATIONSHIPS BETWEEN THE INCREASE IN CONSUMPTION OF MANUFACTURED PRODUCTS AND THE INCREMENTS IN TOTAL *PER CAPITA* CONSUMPTION, 1948–55

(Values at 1955 constant prices)

LOGARITHMIC SCALE



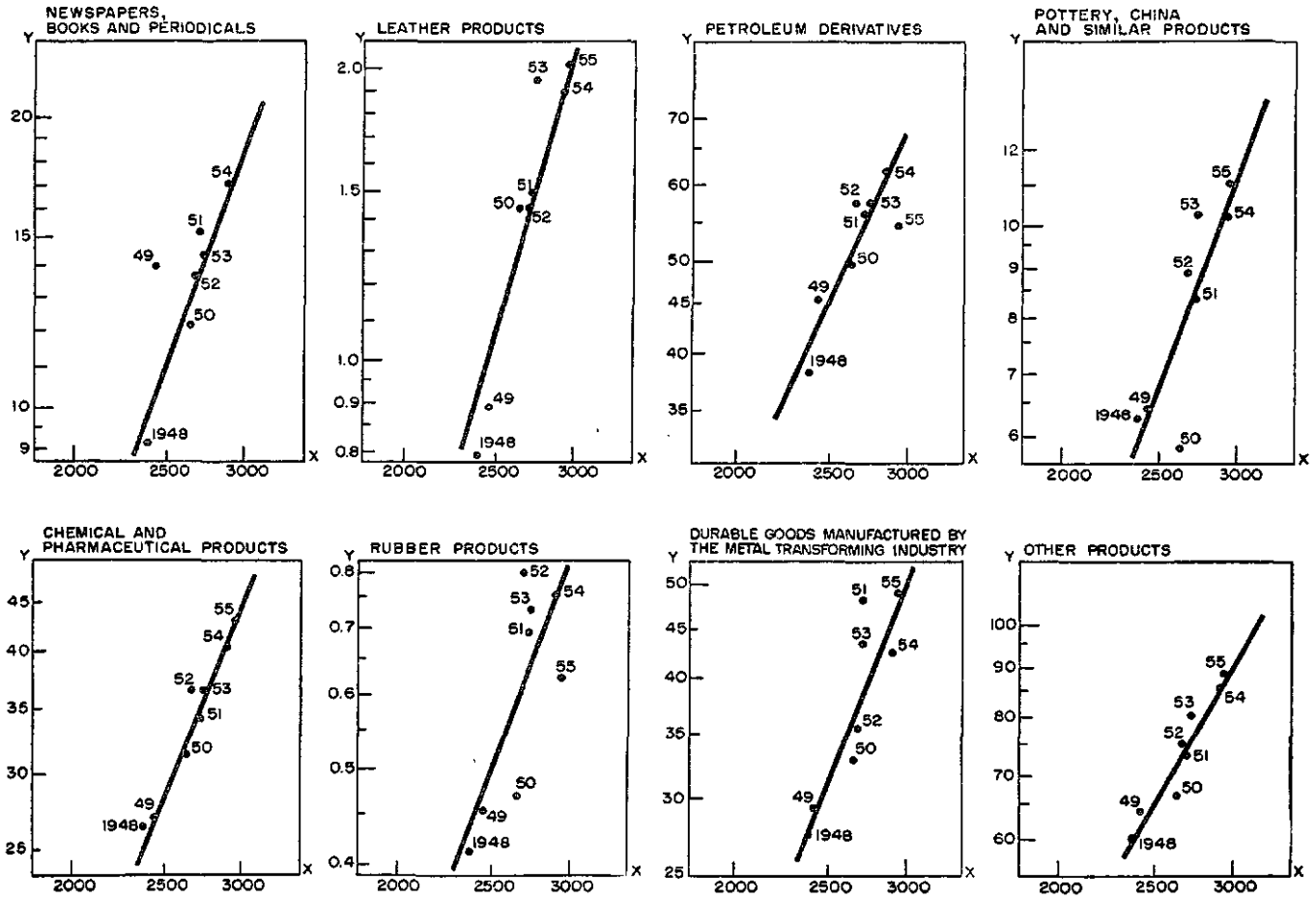
Y = *Per capita* consumption of manufactured goods indicated.
X = Total *per capita* consumption.

Figure VII (*continued*)

PERU: RELATIONSHIP BETWEEN THE INCREASE IN CONSUMPTION OF MANUFACTURED PRODUCTS AND THE INCREMENTS IN TOTAL *PER CAPITA* CONSUMPTION, 1948–55

(Values at 1955 constant prices)

LOGARITHMIC SCALE

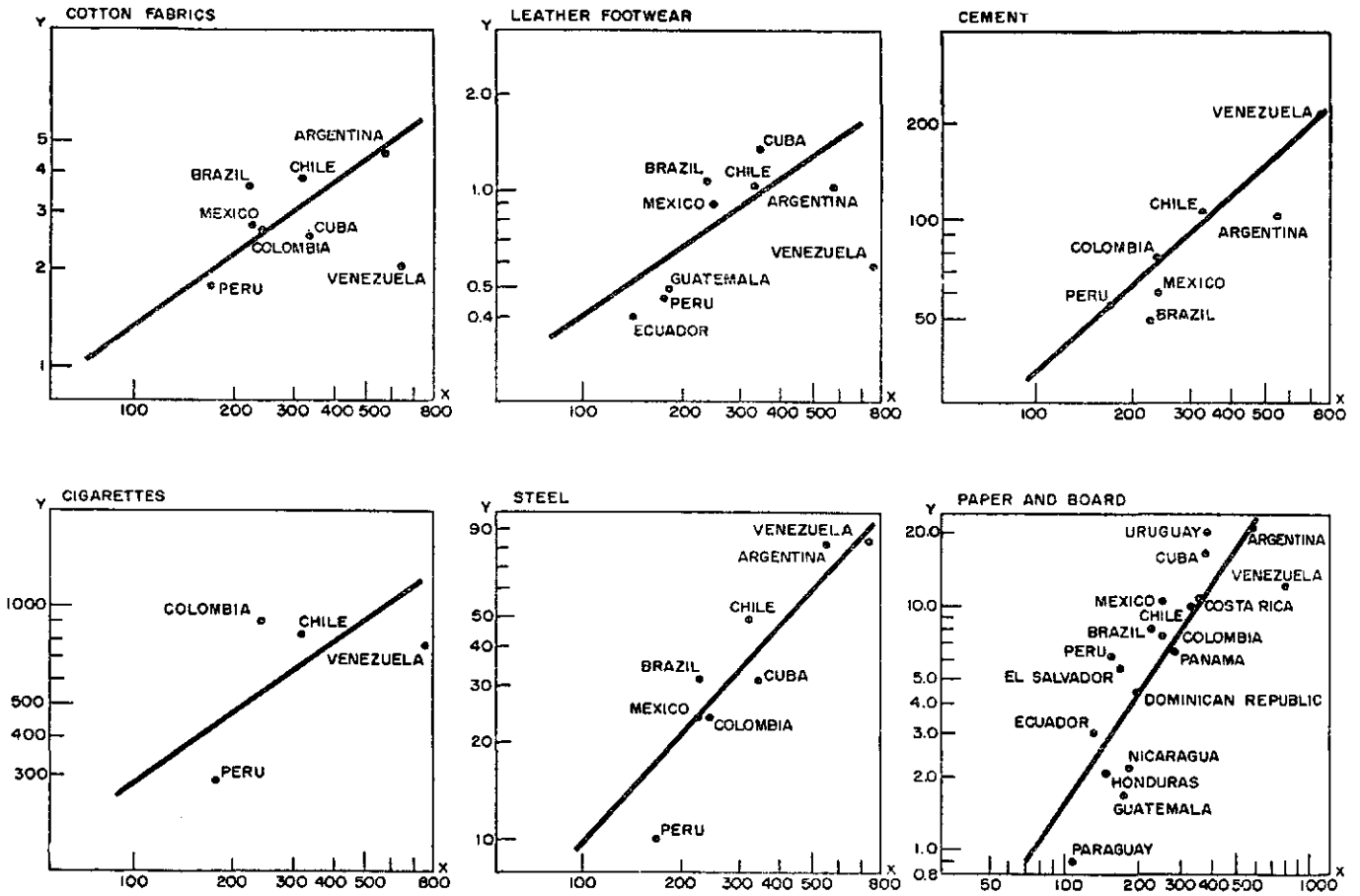


Y = *Per capita* consumption of manufactured goods indicated.
X = Total *per capita* consumption.

Figure VIII

PERU: LEVELS OF CONSUMPTION OF SELECTED MANUFACTURES AS COMPARED WITH THOSE IN OTHER LATIN AMERICAN COUNTRIES

LOGARITHMIC SCALE



Y = *Per capita* consumption in various units.
X = *Per capita* income in dollars.

Chapter VI

THE INSTITUTIONAL BACKGROUND TO INDUSTRIAL DEVELOPMENT

Obviously, the scope and character of industrial development depend to a large extent on its general environment. Thus, for example, State intervention, to whatever degree it is exercised, will inevitably produce its effect on industry, sometimes negatively (tax policies) and at other times positively (incentives, or protection against foreign competition). On occasion it will be deliberate, as for example when the Government formulates a clear-cut policy of industrial development; sometimes it will merely be the result of measures taken with other aims in view (for instance, the utilization of customs tariffs primarily for fiscal purposes). A comprehensive appraisal of the influence of the public sector on industrial development would therefore have to cover also tax and credit policies, the protection and development of industry, direct intervention in the promotion of given basic industries, etc. The degree of efficiency of the capital market, the extent of the participation of foreign capital and other similar factors also form an important part of the background to industrial development. Hence, in addition to the analysis of the main features of existing industry made in chapter V, consideration will now be given to this institutional environment. Most of the factors mentioned may be examined in the light of two basic problems: the methods required to finance industrial development and the protective and development measures taken by the State.

1. *Methods of financing industrial development*

Although the role of investment in the economy as a whole was already dealt with in detail in Part One, a short recapitulation will bring out more clearly the relative importance of industrial investment and methods of financing it. It has already been stated that at least throughout the last decade the Peruvian economy has shown a relatively high level of investment. Almost a fifth of the total product was used for this purpose. As was to be expected, most of the capital came from domestic saving. Investment from within the country represented about 80 per cent of the geographical total, but the foreign contribution was also considerable and in fact greater than in most other Latin American countries. Public investment too expanded relatively, mainly as a result of Government expenditure on basic services, and, from 1950 to 1954, it accounted for a yearly average of one-fifth of total investment; by 1955 it had risen to more than a quarter.

Although no data are available on the sectoral distribution of investment, there is evidence that in recent years the manufacturing sector as a whole has at least not absorbed a share of total investment greater than its contribution to the national product. The fact that contribution has been increasing at the same time does not detract from the validity of the above tentative conclusion because there was also a steady improvement in the product-capital ratio. Of course such an advantage cannot be counted upon indefinitely. The requirements of subsequent industrial growth will necessarily entail a relatively higher investment coefficient. Hence the importance of studying with some care the various financial sources available to industry with a view to reaching definite conclusions about measures likely to facilitate its future growth.

The investment funds available for expanding the productive capacity of the manufacturing industry have mainly come from the internal resources of the enterprises themselves, credits from commercial and development banks, and issues of securities on the capital market, apart from foreign and public investment.

The interesting data assembled by the *Banco Central*[1] provide certain general indications of the possible size and scope of the first three sources (see table 167). According to the relevant accounts, a large though variable number of industrial enterprises —2 851 in 1947 increasing to 4 093 in 1955—show a marked rise in total assets. Between 1947 and 1955 they increased almost sixfold from 1 519 million soles to 9 033 million, a total increment of 7 514 million.[2]

This extra amount had to be found by the industries concerned from the financial sources described.

As may be seen in table 167, about 40 per cent of the increase in assets may be attributed to increments deriving partly from the capital gains of existing enterprises and partly from the addition of funds from new ones. It is difficult to describe this source as internal or external. Although a large amount undoubtedly comes from the capital market, capital gains often

[1] See *Banco Central de Reserva del Perú, Renta Nacional del Perú*, annual publication.

[2] Since the data relate to the balance sheets of enterprises on 31 December of each year, it was considered preferable, for the purposes of these comparisons, to deduce the net profits of the corresponding financial year from total assets.

Table 167

PERU: METHODS OF FINANCING INCREASES IN THE ASSETS OF INDUSTRIAL ENTERPRISES, 1947-55

(Values in millions of soles)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Assets	1 664	2 233	2 900	3 465	4 105	5 420	6 620	7 983	9 425
Net profits	145	220	226	241	283	291	303	386	392
Capital	1 519	2 013	2 674	3 224	3 822	5 129	6 317	7 597	9 033
Capital	844	1 168	1 457	1 622	1 802	2 116	2 499	3 040	3 763
	675	845	1 217	1 602	2 020	3 013	3 818	4 557	5 270
Reserves	185	263	361	474	598	805	981	1 162	1 424
Resources	490	582	856	1 128	1 422	2 208	2 837	3 395	3 846
Temporary resources [a]	63	85	96	119	156	179	260	328	342
Other resources	427	497	760	1 009	1 266	2 029	2 577	3 067	3 504
(Bank credits)	272	311	417	493	694	840	889	997	1 154
Increases in assets		494	661	550	598	1 307	1 188	1 280	1 436
Increases in capital		324	289	165	180	314	383	541	723
Increases in reserves		78	98	113	124	207	176	181	262
Increase in temporary resources		22	11	23	37	23	81	68	14
Increase in other resources		70	263	249	257	763	548	490	437
Increases in bank credits		39	106	76	201	146	49	108	157

SOURCE: Basic figures from *Banco Central de Reservas del Perú, Renta Nacional del Perú*, annual publication.
a Including balances of undistributed profits and reserve and tax reserve funds.

take the form of an issue of securities to the same shareholders, which really amounts to ploughing back profits. While capital increments are large in absolute terms, relatively speaking, they are lower than increases in assets. Thus, the relationship between total capital and assets declined from more than 55 per cent in 1946 to 42 per cent in 1955, a fact which suggests that enterprises relied more on other financial resources. These include a marked increase in reserves due mainly to the investment of undistributed profits, a typically internal resource. The absolute value of such profits rise from 78 million soles in 1946 to 262 million in 1955, an increment representing almost a sixth of the increase in total assets. Other resources—also of internal origin—which could be used for the expansion of assets were certain temporary holdings, such as the balances of undistributed profits and sinking and tax reserve funds. Although not to the same extent as other financial resources, they increased quite considerably during the period under review, registering an increment of 279 million soles. Finally, the balance —equivalent to about 40 per cent of the total increase in assets—consists of funds from other external sources including credits from banks and suppliers.

Such are the general conclusions to be drawn from the available statistical data on the methods of financing the expansion in the productive capacity of industry. In view of the importance of these conclusions for future industrial development, certain specific points must now be examined in greater detail.

(a) *The capital market*

Most of the Peruvian industrial enterprises are constituted as limited liability companies, although they are relatively small establishments or enterprises whose capital has been subscribed by a very small number of individuals or bodies. This type of organization is not chosen voluntarily; it so happens that there is no legislation authorizing the constitution of other forms of limited company. Normally, therefore, social capital is not widely distributed but divided up among rather small financial groups or family concerns.

Although this legal framework is the norm for setting up industrial enterprises, there is no special body for regulating or controlling them. Nor is there any supervision of limited liability companies, except in the case of banks; the functions of the Department of Inland Revenue (*Superintendencia de Contribuciones*) are limited to purely fiscal aspects. Thus the only requirement for the formation of a limited liability company is that it must be registered with the Stock Exchange and pay the necessary stamp taxes. The declared capital is not checked nor is there any control over the distribution of dividends, etc. The Lima Stock Exchange, which is itself constituted in the form of a limited company, exercises no effective control over the financial operations of enterprises. In practice, it merely registers the new limited companies and notes their capital gains. It plays a very minor role as intermediary in security transactions. Actually, only a small fraction of security deals are carried out through the Stock Exchange. Direct contact between interested parties or negotiations through commercial banks are the usual channels. A review of balance-sheets and general information concerning a small number of limited companies [3] shows that, out of 24 industrial companies—including some of the largest in Peru—only 11 quoted their shares on the Stock Exchange while the other 13 made no quotation there of any kind.

[3] *Banco de Crédito del Perú*, Economic Survey Office, *Vademecum Inversionista*, 1956-57.

A few figures will provide a clearer picture. In 1955, the total movement of securities registered on the Stock Exchange was 22 million soles; in 1956, it fell to only 14.8 million soles. By contrast with such small figures, the new capital registered on the Stock Exchange in 1956 amounted to 776 million soles (of which about a quarter related to manufacturing industries) and, apart from these new entries, capital gains by companies already registered amounted to 247 million soles.

Another important relevant feature is the marked preference in Peru for issuing bearer security certificates. Of the 24 industrial limited companies already referred to, 10 issued, 3 registered security certificates and the other 11 gave shareholders the option of bearer or registered securities.

Both the preference for the limited company and for the issue of bearer securities appear largely attributable to tax considerations. Whether distributed or not, the total profits of a non-limited company are automatically liable to the surtax applicable to partners. On the other hand, the profits of a limited company only become part of the income liable to this surtax after they have been distributed in the form of dividends. Undistributed profits are thus free of this tax. Furthermore, dividends on bearer securities are liable to a special surtax of 14 per cent, which is deducted at source. Yet this does not mean that the tax paid is necessarily higher than that on dividends derived from registered securities. If they are added to other income for the purposes of the normal surtax, they may qualify for much higher taxes.

To sum up, the capital market seems at present to lack machinery advanced enough to allow more intense and varied activity. Even under such conditions it has become one of the main methods of financing industrial development, a fact which proves that both the resources and the interest have existed for an increased subscription of capital for the manufacturing industry and that they would probably have been still greater with a more favourable capital market system. In view of the present features of income distribution, little can be expected from large numbers of people with modest resources. But at least all possible ways of achieving a more flexible system of investments should be examined so as to bring about the changes in the pattern of productive capacity which are essential for future industrial development.

(b) *Reinvestment of profits*

As mentioned before, the reinvestment of profits also constituted an important means of increasing the assets of industrial enterprises. The figures given in table 168 contain certain additional data, although their interpretation is a somewhat complex matter.

As may be seen, the undistributed profits of the enterprises covered in the sample examined have been amassing rapidly from 29 million soles in 1947 to 205 million in 1955. The addition of this balance to the net profits of the financial year has yielded a total amount available for distribution. A large but decreasing proportion of it has been used for the distribution of profits and dividends and for tax reserves, as the total of undistributed or non-reinvested profits has increased both in absolute and relative terms. Throughout the whole period, total net profits represented some 2 487 million soles and the total amount distributed as profits and dividends and placed in reserve funds [4] reached 1 906 million soles. The proportion of net profits actually reinvested was slightly under 25 per cent.

In the final analysis, the scale on which profits are ploughed back depends on various important factors. They include the levels of gross profits, the general measures taken to encourage increases in productive capacity and tax incentives or barriers affecting the margin of undistributed profits. These aspects in themselves are so significant and complex that they would warrant detailed research which is beyond the scope of this study. Suffice it therefore to mention a few particular points.

In the first place, as regards the taxes payable by enterprises, no distinction is drawn between distributed and undistributed profits. They both remain equally subject to the pertinent scale of profit and excess

[4] Including funds reserved for the payment of taxes the amount of which was very similar to that distributed as dividends.

Table 168

PERU: DISTRIBUTION AND REINVESTMENT OF PROFITS IN INDUSTRIAL ENTERPRISES, 1947–55

(Values in millions of soles)

Year	*Net profit in the financial year*	*Balance of undistributed profits*	*Total for distribution*	*Profit-sharing, dividends and reserve funds*	*Profits not distributed or reinvested*
1947	145	28	173	132	41
1948	220	29	249	158	91
1949	226	33	259	163	96
1950	241	33	274	177	97
1951	283	54	337	215	122
1952	291	77	368	219	149
1953	303	143	446	264	182
1954	386	199	585	270	315
1955	392	205	597	308	289

SOURCE: Basic figures from *Banco Central de Reserva del Perú, Renta Nacional del Perú*, 1942-55.

profit taxes.[5] At a later stage, they are differentiated because being distributed they become part of individual incomes and are therefore liable to the progressive surtax.[6] The formation of limited companies rather than the reinvestment of profits is thus encouraged.

For the calculation of profits, depreciations are allowed only on the original purchasing price of assets. Consequently, there is no legal authorization for their periodic revaluation.[7] Allowances for depreciation as defined by law are thus clearly inadequate and enterprises must establish special supplementary reserves. These are thus liable to excess profits tax.

It is precisely this tax which has caused considerable concern in industry.[8] Recently there have been several developments which seem to indicate a definite trend towards the elimination of its adverse effects. For example, the General Industries Bill (*Proyecto de Ley General de Industrias*) now under discussion, suggests that the deductions and reserves for depreciation should relate to the "replacement value of the goods at the close of the financial year". Furthermore, special authorizations have been granted to domestic airlines to constitute their reserves for the replacement of aircraft and equipment on the basis of the prices obtaining at the time of replacement. Similarly, during the financial years 1955 and 1956, the textile industries were authorized to make a special deduction of 20 per cent of the original value of their installations and equipment.

(c) *Credit resources*

According to the figures quoted at the beginning of this chapter, additions to capital and reserves and the utilization of temporary resources are together responsible for about 60 per cent of the total increment in the assets of the industrial enterprises registered during 1947-55. The other 40 per cent (equivalent in absolute terms to a little over 3 000 million soles for the entire period) had to come from other sources outside the enterprises. Actually, their real total must have been much less because of the inevitable duplications involved in credits between enterprises, particularly those producing intermediate goods and those making finished goods. As a result, bank credits, which should constitute the main external source of this type of financing, represented a much smaller contribution (see table 169). On 31 December 1955, the total credit from banks granted for industrial activities amounted to 1 154 million soles, or about 10 per cent of total registered assets.[9] Their increment—from only 272 million soles on 31 December 1947—was somewhat smaller than the additions to assets but higher than the capital gains of the enterprises concerned.

The origin of these credits is significant. Most of them come from commercial banks. Those from the *Banco Industrial del Perú* represent less than 8 per cent of the total. In 1955, the aggregate value of credits granted by commercial and saving banks was 4 233 million soles of which 1 069 million, i.e. a little more than one quarter, went to manufacturing industry. Indeed, that sector had been gaining ground in this respect, for its share of such credits rose from slightly over 22 per cent in 1947 and 1948 to a maximum of 27.6 per cent in 1951.

Industry's share of credits granted by development banks was smaller. Total credit from this source

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[5] Under the present Peruvian tax system, the main taxes affecting industrial enterprises are as follows:

(a) Municipal initial licence tax (¼ per cent on capital up to a maximum of 1 000 soles);
(b) Registration tax upon formation of the company by public writ (1 per cent on capital);
(c) Stamp tax on security certificates issued by limited companies (6 per cent on the capital paid up);
(d) Annual licence fee (rate fixed in accordance with capital and varying between 20 and 5 000 soles annually);
(e) Profits tax according to the following scale:

Profits (soles)			*Tax (percentage)*
Under		10 000	7
10 001	to	30 000	10
30 001	to	50 000	12
50 001	to	70 000	15
70 001	to	100 000	17
Over		100 000	20

(f) Unemployment tax levied in addition to (e) (2 per cent of profit);
(g) Excess profits tax, in accordance with the following scale applicable to the difference between "normal profit" and "total profit":

Excess profits (soles)			*Tax (percentage)*
Under		50 000	10
50 001	to	100 000	12
100 001	to	1 000 000	15
Over		1 000 000	20

Excess profits may be defined optionally either as those exceeding 10 per cent of the enterprise's resources or as the average of the earnings obtained in the years 1938, 1939 and 1940 for enterprises founded prior to 1 July 1939. In practice, nearly all enterprises choose the first alternative.

For further details on the Peruvian tax system, see Rómulo A. Ferrero, *Comentarios acerca de los impuestos en el Perú*, a compilation of articles.

[6] Apart from the taxes payable by enterprises, profits are later subject to the progressive surtax levied on all individuals. With certain deductions, the scale in relation to taxable income is as follows:

Taxable income (soles)			*Tax (percentage)*
30 000	to	35 000	7
35 000	to	40 000	11
40 000	to	50 000	13
50 000	to	60 000	16
60 000	to	70 000	20
70 000	to	100 000	25
Over		100 000	30

[7] The authorized depreciation rates are as follows:

	Percentage
Buildings	2 to 5
Machinery	5 to 10
Furniture and fixtures	10 to 15
Motor-vehicles	20 to 30
Work animals	20 to 50

Within these limits official bodies decide upon the rate to be applied in each specific case. Usually they apply the maximum.

[8] Other adverse factors mentioned are the inefficient methods of collection and the multiplicity of rates applied in a series of indirect departmental, provincial and even communal taxes.

[9] Strictly speaking, the percentage is somewhat lower because it covers total bank credit in industry, while the figures relating to assets relate only to the sample on which the tabulations of the *Banco Central de Reserva* are based.

Table 169

PERU: BANK CREDITS GRANTED FOR INDUSTRIAL AS COMPARED WITH OTHER ACTIVITIES, 1945-55
(Millions of soles on 31 December of each year)

Year	Development banks			Commercial banks		Total investments	
	Industrial	Agricultural	Mining	Industry	Other activities	Industry	In other activities
1945	24	31	5				
1946	29	38	10				
1947	37	40	13	235	798	272	851
1948	42	46	13	269	918	311	977
1949	46	47	15	370	1 049	416	1 111
1950	48	86	22	445	1 310	493	1 418
1951	59	103	19	635	1 661	694	1 783
1952	61	147	34	779	2 157	840	2 338
1953	67	222	58	821	2 488	888	2 768
1954	83	564	74	914	2 631	997	3 269
1955	85	735	78	1 069	3 164	1 154	3 977

SOURCE: Peruvian statistical yearbooks, with basic figures taken from the Banks Department (*Superintendencia de Bancos*).

amounted to 898 million soles on 31 December 1955. The credit extended by the *Banco Industrial del Perú* amounted to only 85 million soles. In other words, the manufacturing industry obtained in 1955 a mere 9.5 per cent of total development loans, a relatively marked decrease over previous years. For example, in 1954 the proportion had been 40 per cent and, in 1949, 42.6 per cent.

The minor role played by development banks as regards industrial credit and the increasing predominance of commercial banks signifies not only a qualitative change in the sources of funds; it also has far-reaching consequences owing to the difference in repayment periods and interest. Generally speaking, commercial banks cannot undertake long-term financing operation and their loans are subject to higher interest rates than those normally charged by development banks. Of course, in practice, many commercial loans are used to finance medium- and long-term operations but then enterprises not only have to pay more interest but must also face the alternatives and uncertainties of renewing the credit at regular intervals.

Consequently, the future expansion of industrial output capacity may depend largely on the prospects of strengthening the resources which may be used as development credits, particularly those of the *Banco Industrial del Perú*. Undoubtedly, that Bank's capital resources, and hence its ability to advance more money to the manufacturing industry, have been very restricted and have not kept pace with industrial development. Some of its statutes are themselves designed to restrict its aid to small- and medium-scale enterprises. For example, there is a ceiling to the amount that can be lent to a single enterprise (at present 700 000 soles per loan). Only thus has it been able, with its relatively small capital, to advance loans to quite a few industries: 1 549 since its establishment and 219 in the year 1956 alone. In the case of bigger loans, the *Banco Industrial del Perú* has had to act merely as an intermediary. It adopted this role when 200 million soles—more than its paid-up capital—was advanced to the *Corporación Peruana del Santa* by the *Banco Central de Reserva del Perú* for the completion of the steel works at Chimbote and the hydro-electric station of Huallanca, both of which recently went into operation. The International Bank for Reconstruction and Development has also extended loans under similar conditions: 2.5 and 1.1 million dollars respectively to two cement works and 4 million dollars to a synthetic fertilizer factory.[10]

The shortage of funds held by the *Banco Industrial del Perú* was partially relieved in 1957 when an increase in its capital to 400 million soles was authorized. But this increase will take a long time to accrue because it is being financed by a special tax of 1 per cent on the value of specific imports. At present the tax yields only about 1.4 million soles per month.

(d) *Public investment and foreign capital*

Public investment in industry proper has been negligible. In 1955, it amounted to some 1 764 million soles, of which only 143 million went directly into industrial, mining and electric power development. As regards the last item, only the 68 million soles advanced to the *Corporación Peruana del Santa* and the 6 million allocated for the rebuilding of Cuzco may be described as direct industrial investment.

Similarly, the contribution of foreign capital to Peruvian manufacturing industry has been relatively small, although in absolute terms it is sizeable. Most of the manufacturing establishments were set up with domestic capital and only a relatively tiny fraction came from foreign firms. In 1955, of a total industrial capital estimated at about 4 200 million soles, foreign capital represented only 418 million, or less than 10 per cent. This proportion is somewhat lower than the total percentage of foreign capital invested in the Peruvian economy because most of it has gone into mining and petroleum. In those sectors an average of 15 per cent of the total capital invested is foreign.

[10] See *Industria Peruana, Revista de la Sociedad Nacional de Industrias*, No. 302.

Foreign investment in the manufacturing industry, while not impressive, has increased at a fairly rapid rate. From only 14.9 million dollars in 1951 it rose to 26.8 million dollars at the end of 1956. Annual investment in this sector fluctuated considerably between 1952 and 1956 (the respective figures for each respective year during this period were 0.9, 1.2, 3.3, 1.5 and 5.0 million dollars).

Besides receiving direct investments of foreign capital, Peruvian manufacturing enterprises have been able to sell bonds and shares on security markets abroad. Considerable success has recently been achieved with shares issued by one of the large electricity companies operating in Peru. International organizations, such as the Export-Import Bank, as well as certain private foreign banks, have also helped to finance the industrial expansion. These additional sources of funds might well be considerably amplified in the future. New institutions, such as the recently established International Finance Corporation, might also enter into the picture.

2. *State action to protect and develop industry*

As pointed out ealier, direct intervention by the Government, in the sense of the promotion of State or semi-State industries or the investment of public funds in certain enterprises, is rare in Peru. Nor have allocations to agencies supplying development credit to this sector been very generous. Yet the indirect influence of the State on industrial development has undoubtedly been substantial.

In the first place, public investment in basic social capital—transport, energy and similar services—have helped to consolidate all those external economies without which economic development of any intensity would be impossible. Indeed, in this respect, Peruvian industrialists have probably been better off than their Latin American neighbours who often have had to invest large sums in activities not directly related to the productive process.

There are many other ways in which the Government exercises indirect influence on the rate and character of industrial development. They will no doubt be systematized and co-ordinated following the promulgation of the General Industries Act (*Ley General de Industrias*) which will incorporate in a single instrument the relevant legislation already in force as well as new provisions.

The amount of protection afforded to domestic production in the face of competition from imports is of vital importance[11] and deserves closer attention.

[11] It seems superfluous to discuss here the economic factors which justify and sometimes necessitate the retention of certain protective measures to safeguard domestic industry against imports. They are set forth in *The economic development of Colombia*, op. cit., chapter III.

(a) *General data on the import control system*

Like other Latin American countries in the 'thirties and 'forties Peru was compelled to adopt certain import controls to protect its balance of payments and the value of its currency. Most of them were direct and took the form either of exchange restrictions or quantitative limitations on imports of certain items. Rarely was the customs tariff used for this purpose, perhaps because of its relative inflexibility as compared with the other measures. Tariff changes, besides involving lengthy administrative and legislative procedures often have repercussions on agreements with other countries. They are difficult to make unilaterally without provoking a reaction from the countries affected. Direct controls are also better suited to emergency or temporary situations. They may be applied or removed by the executive with great rapidity as the situation requires. Peru adopted such controls but when, in 1949, they were replaced by a less restrictive trade system, the role of the customs tariff, previously relegated to the background, became important again. However, since for many years protection had been provided by other forms of import control, the tariff did not fully conform to the trade pattern and Peru's needs including the need to develop the manufacturing industry.

(b) *Features of the Peruvian customs tariff*

The Peruvian tariff was designed essentially as a means of securing the maximum revenue. This aim contrasts with that of other countries in process of development where, besides the purpose of obtaining revenue, it is designed to promote the establishment of new economic activities and to protect those already existing, at any rate during their initial stages. As a result of this emphasis on the fiscal aspects, duties are concentrated on essential items that are imported in large quantities, which in Peru's case are raw materials and capital goods. The bulk of the duties fall on these items, which must be imported to ensure the smooth running of Peruvian industry. Duties on consumer goods, imports of which compete with domestic production, are already relatively low. And they have continued to decline owing to the actual structure of the tariff. The specific duty, the effect of which diminishes as prices rise (as in Peru), still predominates.

In 1949, the system which had formerly been based almost entirely on specific duties was changed substantially. In order to protect fiscal income during a period of rising prices, the specific duties were combined with *ad valorem* duties. A cursory examination of the total yield of import duties reveals that, in 1945, they represented a total equivalent to 8 per cent of imports and in 1949 only 4 per cent. As a result of the tariff reform, the yield went up to 11 per cent in 1951 and has remained around that level up to the present. Although it is higher than before, it is still relatively low.

(c) *Protection of the manufacturing industry*

It is not easy to estimate the extent of protection conferred by a customs tariff because of the many different factors—stage of industrial development reached by the country concerned, relative level of domestic production costs, etc.—which enter into the picture. For that reason, the present sub-section will dwell only on the most relevant conclusions arising from a comparison of the effects of the customs tariff in Peru with those in other Latin American countries.

This comparison, which covers several hundred industrial products, indicates that in general the level of the Peruvian tariff is much lower than in other Latin American countries in the process of development. In Venezuela, which has no great balance-of-payments difficulties, Colombia, which is undergoing an industrialization programme promoted and supported by the Government, and Chile, which has already achieved considerable industrial progress, tariffs on imported industrial products are considerably higher than in Peru. The differences vary from product to product. They are more marked in the case of light industries, duties on which in Peru are very different from those in other countries. They are less pronounced in the case of heavy industries, like machinery, where the Peruvian tariff is relatively higher without, however, reaching the level of the other countries mentioned.

In the group of consumer goods—including foodstuffs, beverages, tobacco, textiles, footwear and apparel—Peruvian tariffs on imports are slight. Imports may thus easily compete with domestic goods in this field. In the food industry, for example, duties in the other countries mentioned above are four or more times higher than those charged by Peru for such items as lard, sardines, evaporated milk, etc. A similar situation obtains in the beverages industry. For example, in Peru, the tax on beer amounts to 40 per cent,[12] in Venezuela and Chile it is about 135 per cent, and in Colombia almost 160 per cent. In the case of cigarettes—another domestic product—the Peruvian tariff is barely more than 20 per cent of the value; in Venezuela it is more than 100 per cent on American cigarettes and almost 900 per cent on those from other countries. The cotton textile industry —where Peru has the advantage of its own cotton crop—is protected to a certain extent by a duty on finished goods. However, the duty on cotton yarns, which may also be produced domestically and even exported, is very small. By contrast, Chile, which has no cotton plantations and has to import raw cotton and cotton yarns, taxes them fairly lightly, as they are considered as essential raw materials for domestic industry. The wool textile industry is one of the few in which sufficient protection is provided, probably as a means of tackling the problem of unemployment and to avoid the closing down of certain domestic establishments. There are also certain relatively new industries, such as those producing artificial fibres and paper and board, which seem to have secured an increase in tariffs to levels which allow their normal development.

In the field of intermediate products or raw materials used for industry, Peru's tariff policy does not appear to be clearly aimed at industrial development. Although the tariff level is low in absolute terms, a comparison with those of the other three countries mentioned above shows that they favour imports of such materials and tax them much less than consumer goods, in order to promote the development of domestic industry. This is not the case in Peru, where the tariff level for intermediate products is not actually lower than that for consumer goods. For example, the duty payable on certain chemicals in Peru is now greater than in Venezuela and Colombia. The case of some metal products and capital goods is somewhat similar. They are imported into Venezuela and Colombia at low tariffs while in Peru they pay the regular duties, although there is little likelihood that they will be produced domestically in the near future. Chile, which already has its own metallurgical industry, protects it by fairly high tariffs.

In short, it may be concluded that the Peruvian tariff system is designed mainly for fiscal purposes and that the size of the tariff is governed by its yield rather than by the stimulus it provides to industrial development. Moreover, even the yield in revenue has not responded fully to changing conditions and has remained at levels considerably lower than those in other Latin American countries. The size of the tariff does not appear to be related to the type of commodity in such a way as to favour industrial development. Thus, in some cases, imports of consumer goods which are or might be produced in the country are taxed lightly, discouraging the establishment and development of such industries. In others, heavy duties are levied on imports of raw materials necessary for domestic industry, although the materials are difficult to replace over the medium or short term. Again, relatively higher duties are levied on imports of machinery and basic metal products necessary for the installation and operation of industrial establishments without consideration for their somewhat remote prospects of domestic replacement. Heavier taxes are levied on the products of industries with more complex techniques than on those with more simple processes. In this way, the protection conferred by the tariff is weakened, a disadvantage which so far has not been offset by any increase in yield. Nor has the tariff been used to any marked degree as a means of redistributing income through heavier taxes on luxury goods.

12 To obtain these figures specific duties have first been expressed as a percentage of the unit price of imports during a recent period and *ad valorem* duties have then been added. The comparisons are based on the tariffs and yearbooks of the countries mentioned and do not necessarily include concessions granted in respect of certain products or industries after the publication of these tariffs. They should therefore be treated mainly as indicative of relative levels and sizes and not as the result of a detailed tariff study.

The above conditions reflect in the main the industrial situation during the last decade from the point of view of protection against imports. At the same time, although during this period there was no clear-cut policy of industrial development, many industries could obtain from the Government specific exemptions or concessions to enable them to face emergencies or to provide them with an adequate safeguard for starting operations.[13]

In any case, it is not easy to judge the net result of such measures. For example, while the experience of the decade 1945-55 indicates that the lack of sufficient protection may have retarded Peru's industrial development to a certain extent, it is nevertheless true that foreign competition has compelled existing industries to adopt relatively high standards of productivity. As a result, a fairly modern and efficient industrial foundation has been laid which compares well with that in certain other Latin American countries which, owing to excessive protection, have not shown a similar concern for these matters.

The prospects of future economic growth in Peru undoubtedly depend on a more intensive development of industry as a whole and fairly marked changes in its break-down by industrial branches. In that respect, the tariff may undoubtedly play an important role, particularly if it is brought into line with other measures of protection and encouragement within the framework of a more clearly-defined industrial policy.

[13] At the time of writing this report, a fairly extensive revision of the customs tariff in force is being carried out. Apparently both the need for revenue and the more deliberate aim of using the tariff as an instrument of economic development are being taken into account.

PART THREE

PROSPECTS OF INDUSTRIAL DEVELOPMENT

Chapter VII

OVER-ALL PROSPECTS

INTRODUCTION

At this point a brief review will be made of the contents of the previous section. In Part One a rough analysis of the present economic situation of Peru was attempted including the more important aspects of past development and certain working hypotheses concerning future trends. The intention was to provide a general frame of reference within which those aspects pertaining directly to the industrial sector could be examined in relationship with the other economic sectors. Part Two dealt with the characteristics of existing industry, its break-down by branches and types of products, the main problems now affecting it, the institutional framework within which it operates and some other aspects.

In the light of the foregoing analysis, it now seems desirable to tackle certain specific problems relating to Peru's industrial development prospects, in other words, to try to define the most outstanding features of future industrial development under given conditions. No attempt will be made to venture predictions the accuracy of which may later be assessed in the light of actual events. Any such attempt would be highly speculative and somewhat academic. The real aim is to explore some of the paths which industrial development might take as part of a general economic advance similar to that described in chapter III of Part One. Thus, a more detailed study will be made of the contribution which the industrial sector would have to make towards such over-all economic development. Both industry as a whole and its principal branches will be examined, together with the possible consequent changes in its structure. In short, a series of projections will be formulated which are complementary and consistent with certain general hypotheses. Naturally, the projections will have to be modified whenever there is a change in the underlying hypotheses.

This last qualification does not detract from the usefulness of the projections. Their practical purpose depends on the extent to which they may serve as a guide for a co-ordinated industrial policy. For example, they may suggest the scope and nature of the incentives needed to encourage industry as a whole or specific sectors of it. Of course, the intensity with which this industrial policy or its specific aspects are applied will have to be modified if there is a change in the basic factors which justify it or make it necessary.[1]

In chapter III a first approximation of over-all projections of the growth of industry as a whole was discussed. Care was taken to ensure that they were consistent with the development of other economic sectors as well as with import substitution and manpower absorption requirements. A brief resumé will now be given of the conclusions reached. The initial analysis was confined to the growth of industry as a whole. No reference was made to the probable changes in its composition or to the different expansion requirements of each of its main branches. These aspects will be dealt with in this section and the one which follows.

Just as the requirements for a general industrial advance are governed to a large extent by a series of non-industrial factors, so the degree of development necessary in certain of the main branches of industry does not always depend on strictly technical considerations or on the immediate advantages accruing to the manufacturing sector itself. In other words, it is not always advisable to establish development priorities among different manufacturing activities on the basis of criteria germane to industry itself but rather on the basis of requirements arising from other aspects of the economy as a whole. Thus, if this study is to supplement the estimate of the intensity of general industrial growth with a rough assessment of the increment in each of its main branches, it will have to take into account other factors, which have not so far been examined in sufficient detail. These include the pattern of demand for the different types of consumer goods, the effects of their production on needs for raw materials and intermediate products, and the import substitution possibilities that might arise in both cases.

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1 By way of example, one of the factors considered as basic in the projection of the growth of industry as a whole relates to import substitution needs. If the prospects of the capacity to import were to take a different turn from that assumed in the basic hypotheses, import substitution might have to be increased or decreased in order to maintain the same rate of growth in *per capita* income. Hence, the requirements of industrial growth arising from the first estimate would be modified.

1. *Basic hypotheses concerning the expansion needs of industry as a whole*

The first task is to sum up the most important deductions and hypotheses which were carefully discussed in Part One and which were used to estimate the rate of industrial growth for the period 1955-65. The conclusions reached would have to be compatible with a reasonable target for the increment in the gross *per capita* product and make allowance for the probable behaviour of other basic elements in the Peruvian economy.

As will be remembered, the hypothesis began with the basic assumption that the gross *per capita* product would increase during 1955-65 at an average rate of 2.9 per cent per year. In the light of the possible rate of growth of the population, this would amount to an increment in the total gross product of 5.5 per cent per year. It was assumed that the relatively favourable level (0.40) registered by the product-capital ratio in 1955 could be maintained and that in 1965 equilibrium would be attained in the net movement of foreign capital (which would mean a large gross inflow of such capital). In these circumstances, the increase in *per capita* consumption would be only 2.2 per cent per year, a rate lower than that of the increment in the gross product and that of average *per capita* consumption between 1945 and 1955.

In the same way, the elasticity of demand for imported goods would have to be reduced from the 1.57 of the previous decade to 1.2 for the decade 1955-65. In the light of these and other similar hypotheses, the conclusion was reached that the expansion needs of manufacturing industry depended on the three following basic factors:

(a) *Contribution of industry to the productive absorption of the labour increment*

After a close examination of the trends in the active population, it became apparent that the total labour force available in Peru would increase during the next decade by nearly one million persons. Their employment would undoubtedly constitute one of the acutest problems to be faced by the economy. In 1955, total employment in the manufacturing sector absorbed some 616 000 people. Of these, 121 000 were engaged in registered industry and 495 000 in non-registered and cottage industry. These figures represented 40.5 per cent of the non-agricultural active population, a proportion which would have to increase somewhat if industry is to contribute effectively to the task of absorbing part of the labour increment. According to a moderate hypothesis—that the proportion would amount only to 42 per cent in 1965—total employment in this sector would have to reach 850 000 of which registered industry would employ 216 000 and cottage and non-registered industry 634 000. Such, therefore, would be one of the factors determining the future requirements of industrial development.

(b) *Contribution of industry to import substitution*

A relatively detailed analysis was made of possible increments in exports and the possible participation of foreign capital, in view of the increased demand for imports consequent upon the country's growth. The conclusion was reached that the over-all hypothesis of development would produce so great a balance-of-payments disequilibrium that this target of income growth would finally prove unattainable unless at the same time import substitution was developed on a relatively large scale. Considering the import substitution possibilities of other economic sectors, it was concluded that the main responsibility in the substitution process would fall upon industry. For this purpose alone, this sector would have to expand its production 30 per cent beyond present levels. It would thus achieve an import substitution valued at some 3 400 million soles or, in actual fact, a total substitution of 4 400 million soles if allowance is made for the indirect effects of the initial substitution on needs for raw materials, intermediate products and capital goods.

(c) *Needs arising from the balanced growth of industry and of the other sectors of the national economy*

A very simplified outline of the Peruvian economy in 1955 and its projection for 1965 will reveal the relationships between the manufacturing sector and other economic activities, as well as the industrial expansion necessary to maintain a balanced development of the economy as a whole.

Consideration of these three factors led to the conclusion that—according to the basic hypotheses which have been described—the quantum of industrial production would almost have to double between 1955 and 1965. Thus, industry would play a positive role in the face of probable restrictions on the capacity to import, would contribute effectively to the task of absorbing manpower (without seriously impeding any increase in productivity that might take place at the same time) and would expand at a rate consistent with the simultaneous development of other productive sectors.

So far, this section has dealt with considerations which have already been developed in greater detail in Part One. A closer study must now be made of their effect not only on industry as a whole but also on its main branches. For this purpose the two outlines already used to sum up the arguments put forward will be used as a starting-point (tables 32 and 33), but this time certain changes of classification will have to be made to facilitate the final analysis.[2]

[2] These changes consist in transferring to the manufacturing industry certain activities which in the previous case were included in other economic sectors. The main object is to facilitate the analysis of foreign trade and the projection of exports particularly with regard to sugar production (formerly included in the agricultural sector) and metal and petroleum refineries (formerly considered as part of the extractive industries). In the new figures, manufacturing industry includes the production of electric energy, which in previous tables appeared within the services sector. Finally, there will be a change in

2. *Study and projection of the consumption of manufactured products*

The characteristics of the demand for manufactured consumer goods form a dynamic element of great importance for industrial development. One of the reasons which explains why the industrial rate of growth must be more rapid than that of the economy as a whole is precisely that the demand for manufactures normally displays high income-elasticity. As a result, a given increase in the level of *per capita* income is usually associated with a proportionately much greater rise in the consumption of manufactured goods. This fact is often under-estimated when the size of the Latin American internal market is assessed with a view to establishing specific industries. Conclusions are frequently based solely on existing size and no account is taken of the fact that these characteristics of demand may change the situation considerably in a few years.

This assertion is fully confirmed by Peru's experience between 1945 and 1955. A comparison of the trends then registered in total *per capita* income and the *per capita* consumption of manufactured goods gives an average elasticity of 1.6 for the demand for this type of goods.

According to the frame of reference for industrial development afforded by a comparison of tables 32 and 33 (with the corrections now introduced), aggregate demand for manufactured consumer goods is likely to expand from 11 651 million soles in 1955 to 20 224 million in 1965, although with an elasticity somewhat lower than that mentioned above, for the reasons indicated in Part One. Thus, the time has come to consider how this expansion may be distributed among the various industrial goods, and, subsequently, how far the greater requirements involved can be met with domestic production and how far with imports. Demand must first be broken down by major branches of industry, with a view to the extension or sub-division of the frame of reference, so that it may provide a means of checking projections of demand for specific goods. To begin with, Peru's own experience between 1948 and 1955 affords a valuable touchstone for the assessment of changes in the composition of demand for manufactured goods likely to result from higher income levels; that is, of the elasticity of demand for the whole group of consumer goods produced by each branch of industry. The relevant data are shown in figure VII, where annual statistics for consumption of manufactured goods are related under separate heads to total *per capita* consumption data for every year in the period 1948-55.[3]

Although these comparisons might suffice in themselves to constitute a reasonable basis for estimates of future consumption, by major branches of industry, it would be a mistake to disregard the possible influence of purely adventitious elements, and of others which might be conceived as operative in the conditions characterizing the particular period to which they relate, but not in those prevailing during the period covered by the projections. An attempt should therefore be made, even before the study of specific goods is embarked upon, to check the elasticities deduced from the experience referred to above against the evidence of other background data, which, besides enabling this problem to be viewed in broader perspective, may also contribute additional information on current levels of consumption of manufactured goods in Peru.

Figure VIII seeks to achieve this aim but is only partially successful because of the lack of statistical information or the difficulties of interpreting existing data. It portrays the present levels of *per capita* consumption of five manufactured products representing different branches of industrial activity (steel, cement, cotton fabrics, cigarettes and leather footwear). They are compared with those reached in other Latin American countries during recent years. As was to be expected, the Peruvian figures are much lower not only in the absolute sense but also (although to a lesser extent and with the exception of cement) if they are compared with the respective income levels. Thus, in Peru, the *per capita* consumption of certain types of manufactured goods is lower than in other Latin American countries, a fact which in principle is attributable to its lower level of income. However, at the same time, such consumption is lower than would be expected in the light of the average relationship between the consumption of manufactured goods and the *per capita* income levels registered in all the countries concerned. In other words, the deficiencies in consumption are not due to the present level of income. An increment in consumption is possible even if that level does not change appreciably. With this additional criterion in mind, considerable importance should be assigned to the probable behaviour of the demand for manufactured products in the future.

Another interesting aspect of the problem is revealed if the present consumption pattern in regard to manufactured goods in Peru is compared with that in other Latin American countries with a slightly higher level of *per capita* income. Generally speaking, the comparison is favourable to Peru in the case of "foodstuffs and beverages" and "textiles" but unfavourable in case of goods produced by the chemical and pharmaceutical, metal-transforming and printing industries,

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the evaluation of exports. They will now be assessed at producers' prices instead of f.o.b. as in Part One where it was important to make them strictly comparable with foreign trade figures.

3 All series are expressed in terms of constant 1955 prices. The pertinent relationships are presented logarithmically as a means of finding constant elasticities, a procedure which seems warranted, moreover, by the relative concentration of all values around the regression curve concerned. The use of this method means that the elasticity figure is given by the value of the angular coefficient of the regression curve in question. Finally, it should be noted that once comparisons are instituted between total consumption and consumption under each individual head, it would be more exact to speak of the total consumption-elasticity coefficient rather than of the income-elasticity of demand, and these elasticity coefficients are thus interpreted when they are utilized as a basic element in projections.

and other miscellaneous groups of small significance within the total.

It is impossible to assess in reasonably accurate terms the relative importance to be attached to each of the criteria mentioned—past elasticities registered in Peru, comparisons of absolute levels of consumption and income with other Latin American countries, and comparisons relating to the present pattern of consumption—for the purpose of estimating aggregate elasticities applicable to a projection of the demand for manufactured goods between 1955 and 1965. The main preference has been given to the first criterion, although inevitably such a procedure is to some extent arbitrary. The others have been used as supplementary criteria to correct the conclusions reached in those cases where they appear most relevant. At the same time, consideration was given to other factors implicit in the general review described in Part One; for example, a certain priority was granted to improvements in the present levels of supply of processed foodstuffs.

The coefficients finally selected as indicating the demand-elasticity of the various groups of manufactured products are shown in table 170. It also shows the break-down of *per capita* consumption in 1955, the levels which would be registered in 1965 on the basis of these coefficients and the increase in the total *per capita* consumption in 1955, the levels which would be registered in 1965 on the basis of these coefficients and the increase in the total *per capita* consumption hypothetically assumed in the initial aggregate projections, together with the total supplies needed as a result of the foreseeable increase in the population.

The next step is to determine what proportion of the demand for consumer goods will have to be met from domestic production in 1965. If, in a first hypothesis, it were assumed that imports would maintain in each case a proportion similar to that registered in 1955, it might be concluded that for this purpose alone import needs in 1965 would reach a total figure of about 2 614 million soles. This study has already discussed possible restriction in the capacity to import and made a rough assessment of import substitution requirements. On the basis of the aggregate projects already formulated, it was pointed out that an alternative consistent with the need to maintain payments in equilibrium would be to allocate a sum not higher than 1 880 million soles for imports of consumer manufactures. In other words, the expansion of domestic production would have to exceed the increase in demand in order to substitute potential import requirements valued at some 734 million soles. This additional expansion would assuredly not be distributed among the various industrial sectors on its present scale because in some branches import substitution has already reached levels close to complete self-sufficiency, while in others there are still prospects of much more considerable substitution.

To determine how each branch of industry needs to develop in order to meet requirements of consumer goods, detailed research must be carried out, by staple lines of production, and in some cases even at the level of individual industrial projects. This research is based on conditions in existing industry, as already dealt with in Part Two of the present study, and on industrial expansion possibilities which are discussed in detail in the next chapter. Its findings were utilized in the preparation of table 171, showing the proportion of domestic demand supplied in each case with domestic production and with imports in 1955, and

Table 170

PERU: PROJECTION OF DEMAND FOR MANUFACTURED CONSUMER GOODS, 1955-65
(Values at constant 1955 prices)

Branch of industry	*1955*		*Coefficient of elasticity of demand*	*1965*	
	Total consumption (Thousands of soles)	Per capita *consumption (Soles)*		Per capita *consumption*	*Total consumption (Thousand of soles)*
Foodstuffs	4 923 278	550.64	0.94	674.04	7 727 195
Beverages	559 068	62.53	1.70	90.14	1 033 365
Tobacco	168 102	18.80	1.00	23.31	267 226
Textiles	1 502 672	168.07	1.10	212.94	2 441 144
Footwear, other wearing apparel and made-up textile goods	1 185 653	132.61	2.23	214.03	2 453 648
Wood and cork	67 462	7.55	0.90	1.16	105 010
Furniture and fixtures	180 458	20.18	1.20	26.12	299 440
Paper and paper products	46 698	5.22	2.07	8.15	93 432
Printing, publishing and allied industries	169 130	18.92	1.86	28.23	323 629
Leather and leather products	12 631	1.41	2.00	2.17	24 877
Rubber products	5 333	0.60	2.60	1.05	12 037
Chemicals and chemical products	377 838	42.26	2.68	75.18	861 864
Products of petroleum and coal	1 042 627	116.61	1.54	162.32	1 860 835
Cement, glass, pottery, china and earthenware, etc.	98 377	11.00	1.49	15.16	173 794
Basic metal industries	—	—	—	—	—
Metal transforming industries	485 055	54.25	2.86	100.43	1 151 330
Miscellaneous industries	825 758	92.36	1.28	121.71	1 395 282

the hypothetical break-down assumed for 1965, in conformity with the aim of restricting total imports of manufactured consumer goods to the sum contemplated in the aggregate projections.

Although the detailed justification of these projections will be found in the appropriate sections of chapter VIII, the general criteria governing their formulation may be briefly outlined here. In the first place, by 1955 the share of domestic production in supplies of several categories of goods was already very high in comparison with that of imports, the latter having come to comprise a limited number of items which it was difficult to replace by domestic production. In these cases—which include such consumer goods as furniture, printed matter and petroleum and coal products—it was considered preferable to maintain the same break-down of supply by domestic production and imports as had been registered in 1955. Of course, this does not imply that such activities will stagnate at their present production levels but merely that their increase will be of the same intensity as the increase in domestic demand. As will be seen from the absolute figures, the latter is quite considerable.

In the second place, there are various categories of manufactures in which the domestic supply had also reached a very high proportion in 1955. They still include, however, a fairly large number of imported goods which are not too difficult to replace. Hence, the study has assumed an additional increment—although of moderate size—in the relative share of domestic production in the supply of cigarettes and certain processed foodstuffs. These cases involve a relative substitution in that domestic production is assumed to absorb a larger proportion of the demand increment in 1955. But, in absolute terms, the imports presumed for 1965 will be still greater than in 1955.

Certain textiles together with cereals form a third category. Their share of domestic production in the total 1955 supply is still high but lower than that registered in the previous groups (about 85 per cent). Here, a broader substitution may doubtless be achieved so that imports will be limited to a variety of special or high-quality items whose production within the country would most likely be relatively expensive. For that reason, it was assumed that 95 per cent of total needs in 1965 could be met from domestic production. Thus, not only would imports register a relative decline but also they would be lower in absolute terms than those of 1955.

Lastly, there remain other manufactured goods of which current supplies depend mainly on imports. However, in most of these cases, there are no production difficulties so great as to preclude the possibility of a substantial change in the situation during the course of the next ten years, as is explained in several sections of chapter VIII. Consequently, very high increments, which bear no relation to the current position or past development of industry, have been assumed for these items. They include timber, writing and printing paper, cordage, fruit containers and many

Table 171

PERU: PROJECTION OF DEMAND FOR CONSUMER GOODS AND HYPOTHESIS AS TO DEVELOPMENT OF DOMESTIC PRODUCTION

(Values in thousands of soles, at constant 1955 prices)

Branch of industry	*1955*	*1965*	*Percentage increase 1955–65*
20. *Foodstuffs*			
Demand	4 923 278	7 727 195	57
Production	4 619 458	7 133 195	54
Imports	303 820	594 000	96
Production as a percentage of demand	(94)	(92)	—
21. *Beverages*			
Demand	559 068	1 033 365	85
Production	535 049	1 022 365	91
Imports	24 019	11 000	— 54
Production as a percentage of demand	(96)	(99)	—
22. *Tobacco*			
Demand	168 102	267 226	59
Production	152 952	253 900	66
Imports	15 150	13 326	— 12
Production as a percentage of demand	(91)	(95)	—
23. *Textiles*			
Demand	1 502 672	2 441 144	62
Production	1 296 491	2 411 473	86
Imports	206 181	29 671	— 86
Production as a percentage of demand	(86)	(99)	—
24. *Footwear, other wearing apparel and made-up textile goods*			
Demand	1 185 653	2 453 640	107
Production	1 114 510	2 420 197	117
Imports	71 143	33 443	— 53
Production as a percentage of demand	(94)	(99)	—

Table 171 *(Continued)*

PERU: PROJECTION OF DEMAND FOR CONSUMER GOODS AND HYPOTHESIS AS TO DEVELOPMENT OF DOMESTIC PRODUCTION

(Values in thousands of soles, at constant 1955 prices)

Branch of industry	*1955*	*1965*	*Percentage increase 1955–65*
25. *Wood and cork*			
Demand	67 462	105 010	56
Production	22 123	78 095	253
Imports	45 339	26 915	– 41
Production as a percentage of demand	(33)	(74)	—
26. *Furniture and fixtures*			
Demand	180 458	299 440	66
Production	177 828	295 398	66
Imports	2 630	4 042	54
Production as a percentage of demand	(99)	(99)	—
27. *Paper and paper products*			
Demand	46 698	93 432	100
Production	13 593	65 662	383
Imports	33 105	27 770	– 16
Production as a percentage of demand	(29)	(70)	—
28. *Printing, publishing and allied industries*			
Demand	169 130	323 629	91
Production	162 555	311 040	91
Imports	6 575	12 589	91
Production as a percentage of demand	(96)	(96)	—
29. *Leather and leather products*			
Demand	12 631	24 877	97
Production	9 955	19 715	98
Imports	2 676	5 162	93
Production as a percentage of demand	(79)	(79)	—
30. *Rubber products*			
Demand	5 333	12 037	126
Production	1 592	7 400	365
Imports	3 741	4 637	24
Production as a percentage of demand	(30)	(61)	—
31. *Chemicals and chemical products*			
Demand	377 838	861 864	128
Production	226 924	579 300	155
Imports	150 914	282 564	87
Production as a percentage of demand	(60)	(67)	—
32. *Products of petroleum and coal*			
Demand	1 042 627	1 860 835	78
Production	917 019	1 632 324	78
Imports	125 608	228 511	78
Production as a percentage of demand	(88)	(88)	—
33. *Cement, glass, pottery, china and earthenware, etc.*			
Demand	98 377	173 794	77
Production	61 230	134 994	120
Imports	37 147	38 800	4
Production as a percentage of demand	(62)	(78)	—
34 to 38. *Metal transforming industries*			
Demand	485 055	1 151 330	137
Production	193 161	609 571	216
Imports	291 894	541 759	86
Production as a percentage of demand	(40)	(53)	—
39. *Miscellaneous industries*			
Demand	825 758	1 395 282	69
Production	793 721	1 369 471	73
Imports	32 037	25 811	– 20
Production as a percentage of demand	(96)	(98)	—
Total consumer goods			
Demand	11 650 140	20 224 100	74
Production	10 298 161	18 344 100	78
Imports	1 351 979	1 880 000	39
Production as a percentage of demand	(88)	(91)	—

durable consumer goods manufactured by the metal transforming industries.

With the exception of a few instances in which Peru would need to make a real drive to develop its industrial activities—cases in point are the manufacture of oils and slaughtering, where raw material shortages exist, or timber manufactures, where the obstacle encountered is the lack of communications—the import substitution effort would not represent too ambitious a goal for Peruvian industry at its present stage of development. Such limitations as might originate in the narrowness of the existing domestic market would be easily outweighed in the course of the next decade by the relatively high demand-elasticity generally registered for such manufactures and by the possibilities of a rise in *per capita* income levels.

In short, it may be asserted that as far as Peruvian industry is concerned, there would be no insuperable obstacles to attainment of the consumption growth target set up by the comparison of tables 32 and 33 (with the modifications to which allusion has been made), without imports exceeding the value imposed by the need to preserve equilibrium in the balance of payments.

3. *Projection of exports of manufactured goods and domestic production of capital goods*

On the basis of the foregoing projections relating to manufactured consumer goods, a hypothesis can be hazarded as to the extent to which industry as a whole and each of its main branches would have to develop in order to supply the direct demand of the population, with due regard to the fact that in the period under consideration the contribution of imports would be much less significant than of late. Before an approach is made to a somewhat more complex study of the raw materials and intermediate products that would be required for the necessary expansion of industrial output, it is worth while pausing briefly to consider the additional production requirements represented by two other categories of goods which combine with those just mentioned to constitute what are known as "final-demand goods"—namely, manufactures for export and certain domestically-produced capital goods.

Export development prospects for goods of every kind were discussed in considerable detail in chapter II, and it only remains to note here the projections for those products of manufacturing industry (including, at this stage, sugar, and articles obtained through the processing of metals and petroleum), which at that point were classified under the agricultural and mining sectors respectively. The opportunity will also be taken to adopt a different method of assessing the value of exports; manufacturers' instead of exporters' prices will now be taken into account.

As can be seen in table 172, it is assumed that exports of manufactured goods will expand substantially between 1955 and 1965, increasing from a little over 2 216 million soles in the first to nearly 4 900 million in the last of these years (at constant 1955 prices in both cases). With respect to the high level of these figures, it should once more be recalled that the explanation lies chiefly in the broad definition of the manufacturing sector resulting from the inclusion of sugar-processing and the refining of ores and petroleum. Exports of typically industrial products thus constitute less than 10 per cent of the total, and (in the projection for 1965) comprise mainly tinned fish and fish for export in other forms; a fairly significant quantity of textiles; and timber, leather goods and chemicals in smaller amounts.

Table 172

PERU: PROJECTION OF EXPORTS OF MANUFACTURED GOODS

(Value in thousands of soles, at 1955 factory prices)

Branch of industry	*1955*	*1965*	*Percentage increase 1955-65*
Foodstuffs	815 495	1 321 566	62
Beverages	92	—	−100
Textiles	3 193	103 680	225
Footwear, other wearing apparel and made-up textile goods	3 182	—	−100
Wood and cork	18 259	30 125	65
Paper and paper products	1 539	—	−100
Leather and leather products	5 521	5 184	− 6
Rubber products	261	—	−100
Chemicals and chemical products	20 311	17 280	− 15
Products of petroleum and coal	318 000	—	−100
Cement, glass, pottery, china and earthenware, etc.	2 248	—	−100
Basic metal industries	1 013 549	3 420 576	237
Metal transforming industries	335	—	−100
Miscellaneous industries	14 220	—	−100
Total	*2 216 205*	*4 898 411*	*121*

Exports of fish products are one of Peru's traditional foreign trade items, for which, although the market is at present adversely affected by severe competition, considerable prospects of expansion exist, provided that a policy designed to cut down costs is adopted. Appropriate suggestions are put forward in the next chapter but one of the present study, where a note will also be found on the export potentialities afforded to the textile industry by Peru's privileged position as a producer of long-fibre cotton and alpaca wool. As regards other exports such as timber, leather and chemicals, it will be seen that estimates of expansion possibilities are much more conservative. In some cases, the figures postulated are similar to those registered in 1955, while, in others of lesser importance, it is assumed that exports will cease altogether, as there are no adequate grounds for supposing that they will be maintained.

The list of export items intentionally excludes certain other articles, such as vitamins, inorganic salts, plate glass, aluminium structures and some of the products of the future metal transforming industry, the export-

Table 173

PERU: PROJECTION OF DEMAND FOR CAPITAL GOODS AND HYPOTHESIS AS TO DEVELOPMENT OF DOMESTIC PRODUCTION

(Values in thousands of soles, at constant 1955 prices)

Branch of industry	*1955*	*1965*	*Percentage increase 1955–65*
Wood and cork			
Demand	19 800	80 964	309
Production	15 980	73 234	358
Imports	3 820	7 730	102
Production as a percentage of demand	(81)	(90)	—
Furniture and fixtures			
Demand	44 338	67 641	53
Production	39 314	57 476	46
Imports	5 024	10 165	102
Production as a percentage of demand	(89)	(85)	—
Pulp and paper and paper products			
Demand	1 432	2 897	102
Production	—	—	—
Imports	1 432	2 897	102
Production as a percentage of demand	(0)	(0)	—
Printing, publishing and allied industries			
Demand	1 937	4 579	136
Production	1 937	4 579	136
Imports	—	—	—
Production as a percentage of demand	(100)	(100)	—
Leather and leather products			
Demand	159	376	136
Production	159	376	136
Imports	—	—	—
Production as a percentage of demand	(100)	(100)	—
Rubber products			
Demand	133 942	358 900	168
Production	100 706	288 800	187
Imports	33 236	70 100	111
Production as a percentage of demand	(75)	(80)	—
Chemicals and chemical products			
Demand	1 081	2 555	136
Production	1 081	2 555	136
Imports	—	—	—
Production as a percentage of demand	(100)	(100)	—
Cement, glass, pottery, china and earthenware, etc.			
Demand	337 090	733 375	118
Production	261 679	618 585	136
Imports	75 411	114 790	52
Production as a percentage of demand	(78)	(84)	—
Basic metal industries			
Demand	167 100	309 900	85
Production	3 742	198 300	5 199
Imports	163 358	111 600	— 32
Production as a percentage of demand	(2)	(64)	—
Metal transforming industries			
Demand	2 634 836	6 221 000	136
Production	462 048	1 571 045	240
Imports	2 172 788	4 649 955	114
Production as a percentage of demand	(18)	(25)	—
Miscellaneous industries			
Demand	81 665	165 813	102
Production	1 713	4 050	136
Imports	79 952	161 763	102
Production as a percentage of demand	(2)	(2)	—
Total			
Demand	3 423 380	7 948 000	132
Production	888 359	2 819 000	217
Imports	2 535 021	5 129 000	102
Production as a percentage of demand	(26)	(35)	—

ing of which would not be beyond the bounds of possibility. Peru has already more than once shown an interesting capacity to compete on foreign markets, and the country's varied resources might easily give rise to new opportunities which it is difficult to foresee. Furthermore, yet another factor might make a substantial difference to export prospects for manufactured goods. Were a Latin American common market to be successfully created, many existing obstacles would become less formidable, and far-reaching possibilities would be opened up for a regional trade in industrial products in which Peru might play a significantly active part, not only because it possesses the necessary raw materials, but because it occupies the central position in an economic area which might well embrace the whole of the Pacific coast, from Mexico to Chile.

To turn now to capital goods, it will be recalled that within the frame of reference provided by tables 32 and 33, total gross investment might increase from 6 140 million soles in 1955 to 12 979 million in 1965. This estimate was in turn deduced from the rate of growth postulated for the gross product and from the hypothesis that the product-capital ratio would remain constant. It was then provisionally assumed that the composition of gross investment would also remain unaltered as far as the proportion assigned to goods and services was concerned. However, a slight modification of these premises seems advisable in the light of a more detailed study of the investment question (taking into account the noteworthy possibilities for the development of domestic production of capital goods and the consequent detraction from the relative significance of imports, with which a greater volume of services is generally associated) and a provisional evaluation of changes in the distribution of investment. Hence, for the purpose of the following projections, the same figure is taken as a point of reference for the amount of aggregate gross investment, but this time it represents 7 948 million soles' worth of goods plus 5 031 million soles in the shape of complementary services.

The second aspect is related to the break-down of aggregate demand for capital goods by industries of origin. To this end, the main branches were examined in detail, the growth of demand for their most important products being correlated with the assumed expansion of certain economic activities such as transport, mining, construction, production of electric energy, etc. This analysis and its findings can be studied in the relevant sections of chapter VIII. One and the same rate of increase (78 per cent) was attributed to demand for the articles manufactured both by those industries whose importance as producers of capital goods is slight—printed matter, leather goods and chemicals products—and by the metal transforming industries, which rank foremost among all the industries manufacturing capital goods. The aggregate rate of growth of imports of capital goods projected in Part One was arbitrarily assigned to the items "Other industries" and "Pulp and paper", demand for which is satisfied almost entirely with imports. In relation solely to the industries of real importance for the production of capital goods, demand for rubber should expand considerably, in view of the exceptional increase that will probably take place in consumption of tyres for transport services; on the other hand, the same is not likely to be true of the products of the basic metal industries, since these are used mainly in construction, which it is assumed will follow a relatively slow upward trend. Lastly, a substantial increment will also probably be registered in demand for capital goods produced by the metal transforming industries, since they consist chiefly of machinery and equipment for the more dynamic industries, and of these the most important are the metal transforming industries themselves, which are expected to develop at a fairly rapid rate. The figures finally adopted for demand for capital goods deriving from each of the branches of industry concerned are given in summarized form in table 173, and in greater detail in other tables included in the various sections of chapter VIII.

Demand for the different types of capital goods in 1965 once estimated, the extent to which it could be satisfied with domestic production must be worked out. For the sake of simplicity, it may be assumed that in all the industries of little significance as producers of capital goods, the same or almost the same ratio as in 1955 would be maintained between production and demand. As regards the industries which are important in this respect—i.e., those manufacturing rubber, cement, glass, china and earthenware, etc., the basic metal and the metal transforming industries—a more detailed study of production possibilities is needed, such as that appearing in the relevant sections of chapter VIII, the findings of which are outlined in table 173. For industrial development projections in respect of goods of this type to be consistent with the targets fixed in tables 32 and 33 (duly corrected), it was necessary that imports should not exceed 5 129 million soles, to prevent balance-of-payments disequilibria. To sum up, it may be asserted that industry would have no difficulty in achieving the production required to keep imports of capital goods within the margin allowed by the frame of reference.

4. *Derived requirements of raw materials and intermediate goods*

Consideration having been given to the three components of final demand for domestic manufactures —exports, consumer goods (including import substitution requirements) and capital goods—the time has come to take into account the derived effects of such domestic production upon the supplies of raw materials and intermediate goods which would be needed for the production process itself. This last analysis, however,

Table 174: PERU: ESTIMATE OF INTER-INDUSTRIA

Break-down of production / Composition of inputs		Agricultural activities	Extractive industries	Foodstuffs	Beverages	Tobacco products	Textiles	Footwear and made-up textile goods	Wood manufactures	Furniture and fixtures	Paper a paper product
Agricultural activities	D	1 619 108	61 118	2 323 965	19 997	10 318	342 818	11 652	2 919	3 705	846
	P	1 617 703	39 016	1 893 563	15 690	5 727	447 416	5 998	2 557	2 950	160
	I	1 405	22 102	430 402	4 307	4 591	5 402	5 654	362	755	686
Extractive industries	D	192 245	1 259	3 135	15	—	401	209	—	63	346
	P	192 245	1 259	1 694	10	—	343	—	—	35	208
	I	—	—	1 441	5	—	58	209	—	28	138
Foodstuffs	D	9 705	—	758 270	39 246	—	5 393	95	1	—	3 822
	P	9 705	—	627 489	30 689	—	1 860	92	1	—	3 447
	I	—	—	130 781	8 557	—	3 533	3	—	—	378
Beverages	D	—	—	1 353	75 669	—	10	—	14	440	55
	P	—	—	1 033	45 862	—	10	—	14	440	59
	I	—	—	320	29 807	—	—	—	—	—	—
Tobacco products	D	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	—	—	—	—	—	—	—
Textiles	D	115 487	—	1 812	9	—	172 860	327 612	16	9 065	1 091
	P	95 920	—	1 229	1	—	164 066	276 114	10	5 385	460
	I	19 567	—	583	8	—	8 794	51 498	6	3 680	631
Footwear and made-up textile goods	D	—	—	139 139	43	—	41	910	—	358	—
	P	—	—	81 999	30	—	38	882	—	235	—
	I	—	—	57 140	13	—	3	28	—	123	—
Wood manufactures	D	—	1 264	2 767	1 211	—	232	1 666	117 243	49 243	11
	P	—	—	905	512	—	162	1 409	93 270	44 613	11
	I	—	1 264	1 862	699	—	70	257	23 973	4 630	—
Furniture and fixtures	D	—	190	71	5	—	34 887	2 579	186	870	—
	P	—	—	24	—	—	34 887	2 367	186	405	—
	I	—	190	47	5	—	—	212	—	465	—
Paper and paper products	D	—	3 115	65 223	4 684	5 678	3 180	5 274	75	397	61 23
	P	—	1 260	37 545	4 675	3 479	2 691	4 402	72	315	41 20
	I	—	1 855	27 678	9	2 199	489	872	3	82	20 03
Printing, publishing, etc.	D	—	—	28 895	11 633	4 224	2 255	13 399	—	—	2 12
	P	—	—	28 632	11 622	4 224	2 079	13 178	—	—	2 12
	I	—	—	263	11	—	176	221	—	—	—
Leather and leather products	D	—	—	—	—	—	12	254 972	6	1 341	—
	P	—	—	—	—	—	12	242 723	6	1 335	—
	I	—	—	—	—	—	—	12 249	—	6	—
Rubber products	D	—	9 840	42	180	—	1 603	16 468	10	259	1
	P	—	4 358	—	—	—	—	15 547	10	—	1
	I	—	5 482	42	180	—	1 603	921	—	259	
Chemicals	D	114 028	67 017	229 488	8 461	—	176 494	9 176	280	4 815	9 06
	P	—	21 304	199 094	3 913	—	105 017	4 830	213	2 185	4 98
	I	114 028	45 713	30 394	4 548	—	71 477	4 346	67	2 630	4 07
Petroleum and coal products	D	62 695	34 532	113 035	7 359	182	49 439	8 499	1 845	1 419	3 07
	P	62 695	32 761	113 024	7 359	182	49 296	8 446	1 845	1 400	3 06
	I	—	1 771	11	—	—	143	53	—	19	
Cement, glass, china and earthenware, etc.	D	—	19 782	22 127	31 185	—	28	793	226	2 594	65
	P	—	18 599	21 910	31 151	—	23	277	198	1 725	65
	I	—	1 183	217	34	—	5	516	28	869	—
Basic metal industries	D	—	11 022	19 731	3	—	312	37	80	6 892	14
	P	—	4 358	838	—	—	204	33	—	611	—
	I	—	6 664	18 893	3	—	108	4	80	6 281	14
Metal transforming industries	D	—	94 244	109 659	14 553	—	843	7 002	481	6 190	32
	P	—	1 260	97 826	6 830	—	192	3 921	428	2 989	30
	I	—	92 984	11 833	7 723	—	651	3 081	53	3 201	1
Miscellaneous industries	D	—	5 052	1 455	217	—	2 605	10 497	48	3 698	72
	P	—	1 260	628	213	—	683	6 725	6	77	70
	I	—	3 792	827	4	—	1 922	3 772	42	3 621	2
Services	D	85 632	117 000	416 217	32 651	3 951	61 486	50 725	14 385	16 236	20 12
	P	85 632	117 000	416 217	32 651	3 951	61 486	50 725	14 385	16 236	20 12
	I	—	—	—	—	—	—	—	—	—	—
Total inputs	D	2 198 900	425 435	4 236 384	247 121	24 353	964 899	721 565	137 815	107 585	103 65
	P	2 068 900	242 435	3 523 650	191 208	17 563	870 465	637 669	113 201	80 936	77 52
	I	135 000	183 000	712 734	55 913	6 790	94 434	83 896	24 614	26 649	26 13
Gross value of production, exports and imports		11 891 900	2 624 000	6 113 377	583 334	152 952	1 848 574	1 201 231	201 464	255 080	159 93
Gross production, consumption and investment	D	9 693 000	2 198 565	1 876 993	336 213	128 599	883 675	479 666	63 649	147 495	56 28
	P										
	I										

D: Demand; P: Production; I: Imports.

Printing, publishing, etc.	*Leather and leather products*	*Rubber products*	*Chemicals*	*Petroleum and coal products*	*Cement, glass, china and earthenware, etc.*	*Basic metal industries*	*Metal transforming industries*	*Miscellaneous industries*	*Services*	*Total intermediate transactions*	*Total final demand*	*Exports*	*Consumption*	*Investment*	*Total production and imports*
25	125 636	51 509	39 714	—	543	—	149	712 708	—	5 436 730	6 978 546	1 484 317	5 494 229	—	12 415 276
22	118 137	51 436	31 444	—	22	—	110	712 403	—	4 944 354	6 947 546	1 484 317	5 463 229	—	11 891 900
3	7 499	73	8 270	—	521	—	39	305	—	492 376	31 000	—	31 000	—	523 376
—	278	136	8 924	763 267	29 461	860 851	256	246	—	1 861 092	773 449	773 449	—	—	2 634 541
—	256	98	5 627	763 264	24 303	860 850	116	243	—	1 850 551	773 449	773 449	—	—	2 624 000
—	22	38	3 297	3	5 158	1	140	3	—	10 541	—	—	—	—	10 541
1	113	—	16 000	—	4	2	75	254	—	832 981	5 738 773	815 495	4 923 278	—	6 571 754
—	91	—	4 755	—	4	2	36	253	—	678 424	5 434 953	815 495	4 619 458	—	6 113 377
1	22	—	11 245	—	—	—	39	1	—	154 557	303 820	—	303 820	—	458 377
5	23	1	655	—	45	—	42	5	—	78 321	559 160	92	559 068	—	637 481
5	23	—	655	—	45	—	42	5	—	48 193	535 141	92	535 049	—	583 334
—	—	1	—	—	—	—	—	—	—	30 128	24 019	—	24 019	—	54 147
—	—	—	—	—	—	—	—	—	—	—	168 102	—	168 102	—	168 102
—	—	—	—	—	—	—	—	—	—	—	152 952	—	152 952	—	152 952
—	—	—	—	—	—	—	—	—	—	—	15 150	—	15 150	—	15 150
185	789	2 249	1 928	—	10	—	1 345	2 314	—	636 772	1 505 865	3 193	1 502 672	—	2 142 637
47	394	2 147	1 621	—	7	—	876	613	—	548 890	1 299 684	3 193	1 296 491	—	1 848 574
138	395	102	307	—	3	—	469	1 701	—	87 882	206 181	—	206 181	—	294 063
10	24	—	266	—	9	—	59	17	—	140 876	1 188 835	3 182	1 185 653	—	1 329 711
10	24	—	257	—	—	—	48	16	—	83 539	1 117 692	3 182	1 114 510	—	1 201 231
—	—	—	9	—	9	—	11	1	—	57 337	71 143	—	71 143	—	128 480
47	18	11	349	—	730	—	3 996	764	—	179 552	105 521	18 259	67 462	19 800	285 073
32	2	11	221	—	678	—	2 734	542	—	145 102	56 362	18 259	22 123	15 980	201 464
15	16	—	128	—	52	—	1 262	222	—	34 450	49 159	—	45 339	3 820	83 609
—	4	—	—	—	—	—	262	61	—	39 115	224 796	—	180 458	44 338	263 911
—	—	—	—	—	—	—	10	59	—	37 938	217 142	—	177 828	39 314	255 080
—	4	—	—	—	—	—	252	2	—	1 177	7 654	—	2 630	5 024	8 831
80 115	138	192	17 015	—	20 997	—	2 704	640	—	270 665	49 669	1 539	46 698	1 432	320 334
16 245	54	152	8 785	—	20 832	—	2 538	561	—	144 806	15 132	1 539	13 593	—	159 938
63 870	84	40	8 230	—	165	—	166	79	—	125 859	34 537	—	33 105	1 432	160 396
4 086	—	57	11 978	—	8 013	—	4 155	93	—	90 909	171 067	—	169 130	1 937	261 976
3 955	—	34	11 913	—	8 000	—	4 046	92	—	89 896	164 492	—	162 555	1 937	254 388
131	—	23	65	—	13	—	109	1	—	1 013	6 575	—	6 575	—	7 588
48	3 960	—	55	—	—	—	342	373	—	261 109	18 311	5 521	12 631	159	279 420
47	3 883	—	55	—	—	—	160	371	—	248 592	15 635	5 521	9 955	159	264 227
1	77	—	—	—	—	—	182	2	—	12 517	2 676	—	2 676	—	15 193
3	20	3 345	461	—	—	—	11 681	71	—	44 000	139 536	261	5 333	133 942	183 536
3	19	3 329	328	—	—	—	9 470	53	—	33 183	102 559	261	1 592	100 706	135 692
—	1	16	133	—	—	—	2 211	18	—	10 867	36 977	—	3 741	33 236	47 844
3 231	28 266	6 862	107 707	31 611	8 458	345	15 437	3 348	—	824 091	399 230	20 311	377 838	1 081	1 223 321
232	5 602	3	27 002	—	1 263	339	5 980	658	—	382 624	248 316	20 311	226 924	1 081	630 940
2 999	22 664	6 859	80 705	31 611	7 195	6	9 457	2 690	—	441 467	150 914	—	150 914	—	592 381
1 470	2 670	3 491	24 087	46 100	83 492	33 982	9 677	4 526	—	491 570	1 360 627	318 000	1 042 627	—	1 852 197
1 464	2 645	3 445	9 548	46 100	83 492	33 982	9 028	4 457	—	474 238	1 235 019	318 000	917 019	—	1 709 257
6	25	46	14 539	—	—	—	649	69	—	17 332	125 608	—	125 608	—	142 940
1	744	48	16 568	—	21 731	33	2 560	923	—	119 993	437 715	2 248	98 377	337 090	557 708
—	623	32	15 010	—	17 263	24	1 308	170	—	108 963	325 157	2 248	61 230	261 679	434 120
1	121	16	1 558	—	4 468	9	1 252	753	—	11 030	112 558	—	37 147	75 411	123 588
773	6	119	5 074	—	230	146 402	141 515	2 457	—	334 796	1 180 649	1 013 549	—	167 100	1 515 445
74	6	111	2 676	—	68	140 428	45 651	1 447	—	196 505	1 017 291	1 013 549	—	3 742	1 213 796
699	—	8	2 398	—	162	5 974	95 864	1 010	—	138 291	163 358	—	—	163 358	301 649
210	224	1 416	9 957	15	61	122	21 985	1 022	—	268 304	3 120 226	335	485 055	2 634 836	3 388 530
3	101	6	8 104	—	36	18	4 730	155	—	126 900	655 544	335	193 161	462 048	782 444
207	123	1 410	1 853	15	25	104	17 255	867	—	141 404	2 464 682	—	291 894	2 172 788	2 606 086
575	650	1 066	2 656	478	517	26 769	33 665	18 857	—	109 532	921 643	14 220	825 758	81 665	1 031 175
33	416	14	1 100	478	210	6 875	8 979	18 356	—	46 758	809 654	14 220	793 721	1 713	856 412
542	234	1 052	1 556	—	307	19 894	24 686	501	—	62 774	111 989	—	32 037	79 952	174 763
40 226	18 270	5 764	75 400	22 958	12 507	78 630	92 355	5 112	—	1 169 630	13 471 370	1 645 029	9 109 341	2 717 000	14 641 000
40 226	18 270	5 764	75 400	22 958	12 507	78 630	92 355	5 112	—	1 169 630	12 755 370	1 645 029	8 393 341	2 717 000	13 935 000
—	—	—	—	—	—	—	—	—	—	—	716 000	—	716 000	—	716 000
131 011	181 833	76 266	338 794	864 429	186 808	1 147 136	342 260	753 791	—	13 190 038					
62 398	150 546	66 582	204 501	832 800	168 730	1 121 148	188 217	745 566	—	11 359 036					
68 613	31 287	9 684	134 293	31 629	18 078	25 988	154 043	8 225	—	1 831 002					
254 388	264 227	135 692	630 940	1 709 257	434 120	1 213 796	782 444	856 412	13 925 000						45 238 126
												6 119 000			6 465 002
123 377	82 394	59 426	292 146	844 828	247 312	66 660	440 184	102 621	13 925 000			(—346 002)	26 253 710	6 140 380	32 048 088
													24 154 731	3 605 359	
													2 098 979	2 535 021	

PERU: TECHNICAL INPUT-OUTPUT COEFFICIENTS DERIVIN

Producer industry \ Consumer industry		Agricultural activities	Extractive industries	Food-stuffs	Beverages	Tobacco products	Textiles	Footwear and made-up textile goods	Wood manufactures
Agricultural activities	D	0.1361522	0.0232920	0.3801442	0.0342805	0.0674591	0.2449553	0.0097000	0.01448
	P	0.1360340	0.0148690	0.3097409	0.0268971	0.0374431	0.2420330	0.0049932	0.01269
	I	0.0001182	0.0084230	0.0704033	0.0073834	0.0300160	0.0029223	0.0047068	0.00179
Extractive industries	D	0.0161660	0.0004798	0.0005128	0.0000257	—	0.0002169	0.0001740	
	P	0.0161660	0.0004798	0.0002771	0.0000171	—	0.0001855	—	
	I	—	—	0.0002357	0.0000086	—	0.0000314	0.0001740	
Foodstuffs	D	0.0008161	—	0.1240346	0.0672788	—	0.0029174	0.0000791	0.00000
	P	0.0008161	—	0.1026420	0.0526097	—	0.0010062	0.0000766	0.00000
	I	—	—	0.0213926	0.0146691	—	0.0019112	0.0000025	
Beverages	D	—	—	0.0002213	0.1297181	—	0.0000054	—	0.00006
	P	—	—	0.0001690	0.0786205	—	0.0000054	—	0.00006
	I	—	—	0.0000523	0.0510976	—	—	—	
Tobacco products	D	—	—	—	—	—	—	—	
	P	—	—	—	—	—	—	—	
	I	—	—	—	—	—	—	—	
Textiles	D	0.0097114	—	0.0002964	0.0000154	—	0.0935099	0.2727302	0.00007
	P	0.0080660	—	0.0002010	0.0000617	—	0.0887527	0.2298592	0.00004
	I	0.0016454	—	0.0000954	0.0000137	—	0.0047572	0.0428710	0.00002
Footwear and made-up textile goods	D	—	—	0.0227597	0.0000737	—	0.0000222	0.0007576	
	P	—	—	0.1134130	0.0000514	—	0.0000206	0.0007343	
	I	—	—	0.0093467	0.0000223	—	0.0000016	0.0000233	
Wood manufactures	D	—	0.0004817	0.0004526	0.0020760	—	0.0001255	0.0013869	0.58195
	P	—	—	0.0001480	0.0008777	—	0.0000876	0.0011730	0.46296
	I	—	0.0004817	0.0003046	0.0011983	—	0.0000379	0.0002139	0.11899
Furniture and fixtures	D	—	0.0000724	0.0000116	0.0000086	—	0.0188724	0.0021470	0.00092
	P	—	—	0.0000039	—	—	0.0188724	0.0019705	0.00092
	I	—	0.0000724	0.0000077	0.0000086	—	—	0.0001765	
Paper and paper products	D	—	0.0011872	0.0106689	0.0080296	0.0371228	0.0017202	0.0043904	0.00037
	P	—	0.0004802	0.0061415	0.0080142	0.0227457	0.0014557	0.0036645	0.00035
	I	—	0.0007070	0.0045274	0.0000154	0.0143771	0.0002645	0.0007259	0.00001
Printing, publishing, etc.	D	—	—	0.0047265	0.0199423	0.0276166	0.0012199	0.0111544	
	P	—	—	0.0046835	0.0199234	0.0276166	0.0011247	0.0109704	
	I	—	—	0.0000430	0.0000189	—	0.0000952	0.0001840	
Leather, and leather products	D	—	—	—	—	—	0.0000065	0.2122589	0.00002
	P	—	—	—	—	—	0.0000065	0.2020619	0.00002
	I	—	—	—	—	—	—	0.0101970	
Rubber products	D	—	0.0037500	0.0000069	0.0003086	—	0.0008672	0.0137093	0.00004
	P	—	0.0016608	—	—	—	—	0.0129426	0.00004
	I	—	0.0020892	0.0000069	0.0003086	—	0.0008672	0.0007667	
Chemicals	D	0.0095887	0.0255400	0.0375387	0.0145046	—	0.0954757	0.0076388	0.00138
	P	—	0.0081189	0.0325670	0.0067080	—	0.0568097	0.0040209	0.00105
	I	0.0095887	0.0174211	0.0049717	0.0077966	—	0.0386660	0.0036179	0.00033
Petroleum and coal products	D	0.0052721	0.0131600	0.0184898	0.0126154	0.0011899	0.0267444	0.0070751	0.00915
	P	0.0052721	0.0124851	0.0184880	0.0126154	0.0011899	0.0266670	0.0070310	0.00915
	I	—	0.0006749	0.0000018	—	—	0.0000774	0.0000441	
Cement, glass, china and earthenware, etc.	D	—	0.0075389	0.0036198	0.0534599	—	0.0000151	0.0006602	0.00112
	P	—	0.0070880	0.0035839	0.0534017	—	0.0000124	0.0002306	0.00098
	I	—	0.0004509	0.0000355	0.0000582	—	0.0000027	0.0004296	0.00013
Basic metal industries	D	—	0.0042005	0.0032275	0.0000051	—	0.0001688	0.0000308	0.00039
	P	—	0.0016608	0.0001371	—	—	0.0001104	0.0000275	
	I	—	0.0025397	0.0030904	0.0000051	—	0.0000584	0.0000033	0.00039
Metal transforming industries	D	—	0.0359162	0.0179376	0.0249480	—	0.0004560	0.0058290	0.00238
	P	—	0.0004802	0.0160020	0.0117086	—	0.0001039	0.0032642	0.00212
	I	—	0.0354360	0.0019356	0.0132394	—	0.0003521	0.0025648	0.00026
Miscellaneous industries	D	—	0.0019253	0.0002380	0.0003720	—	0.0014092	0.0087385	0.00023
	P	—	0.0004802	0.0001027	0.0003651	—	0.0003695	0.0055984	0.00002
	I	—	0.0014451	0.0001353	0.0000069	—	0.0010397	0.0031401	0.00020
Services	D	0.0072009	0.0445884	0.0680830	0.0559732	0.0258316	0.0332614	0.0422275	0.07140
	P	0.0072009	0.0445884	0.0680830	0.0559732	0.0258316	0.0332614	0.0422275	0.07140
	I	—	—	—	—	—	—	—	
Total inputs	D	0.1849074	0.1621322	0.6929695	0.4236355	0.1592199	0.5219694	0.6006880	0.68406
	P	0.1735551	0.0923914	0.5763836	0.3255848	0.1148269	0.4708846	0.5308463	0.56189
	I	0.0113523	0.0697408	0.1165859	0.0958507	0.0443930	0.0510848	0.0698417	0.12217

D = Demand; P = Production; I = Imports.

ROM THE TABLE OF INTER-INDUSTRIAL TRANSACTIONS IN 1955

urniture and fixtures	*Paper and paper products*	*Printing, publishing, etc.*	*Leather and leather products*	*Rubber products*	*Chemicals*	*Petroleum and coal products*	*Cement, glass, china, and earthenware, etc.*	*Basic metal industries*	*Metal transforming industries*	*Miscellaneous industries*	*Services*
0145249	0.0052895	0.0000983	0.4754851	0.3796023	0.0629442	—	0.0012508	—	0.0001904	0.8322023	—
0115650	0.0010004	0.0000865	0.4471042	0.3790643	0.0498368	—	0.0000507	—	0.0001406	0.8318461	—
0029599	0.0042891	0.0000118	0.0283809	0.0005380	0.0131074	—	0.0012001	—	0.0000498	0.0003562	—
0002470	0.0021633	—	0.0010521	0.0010023	0.0141440	0.4465890	0.0678637	0.7092221	0.0003272	0.0002872	—
0001372	0.0013005	—	0.0009689	0.0007222	0.0089184	0.4465472	0.0559822	0.7092213	0.0001483	0.0002837	—
0001098	0.0008628	—	0.0000832	0.0002801	0.0052256	0.0000018	0.0118815	0.0000008	0.0001789	0.0000035	—
—	0.0238968	0.0000039	0.0004277	—	0.0253590	—	0.0000092	0.0000016	0.0000959	0.0002966	—
—	0.0215521	—	0.0003444	—	0.0075364	—	0.0000092	0.0000016	0.0000460	0.0002954	—
—	0.0023447	0.0000039	0.0000833	—	0.0178226	—	—	—	0.0000499	0.0000012	—
0017249	0.0003689	0.0000197	0.0000870	0.0000074	0.0010381	—	0.0001037	—	0.0000537	0.0000058	—
0017249	0.0003689	0.0000197	0.0000870	—	0.0010381	—	0.0001037	—	0.0000537	0.0000058	—
—	—	—	—	0.0000074	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
0355379	0.0068214	0.0007272	0.0029861	0.0165743	0.0030558	—	0.0000230	—	0.0017190	0.0027020	—
0211110	0.0028761	0.0001848	0.0014912	0.0158226	0.0025692	—	0.0000161	—	0.0011196	0.0007158	—
0144269	0.0039453	0.0005424	0.0014949	0.0007517	0.0004866	—	0.0000069	—	0.0005994	0.0019862	—
0014035	—	0.0000393	0.0000908	—	0.0004216	—	0.0000207	—	0.0000754	0.0000199	—
0009213	—	0.0000393	0.0000908	—	0.0004073	—	—	—	0.0000613	0.0000187	—
0004822	—	—	—	—	0.0000143	—	0.0000207	—	0.0000141	0.0000012	—
1930492	0.0000688	0.0001848	0.0000681	0.0000811	0.0005531	—	0.0016816	—	0.0051071	0.0008921	—
1748981	0.0000688	0.0001258	0.0000076	0.0000811	0.0003503	—	0.0015618	—	0.0034942	0.0006329	—
0181511	—	0.0000590	0.0000605	—	0.0002028	—	0.0001198	—	0.0016129	0.0002592	—
0034107	—	—	0.0000151	—	—	—	—	—	0.0003348	0.0000712	—
0015877	—	—	—	—	—	—	—	—	0.0000128	0.0000689	—
0018230	—	—	0.0000151	—	—	—	—	—	0.0003220	0.0000023	—
0015564	0.3828859	0.3149323	0.0005223	0.0014150	0.0269677	—	0.0483668	—	0.0034558	0.0007473	—
0012349	0.2575998	0.0638591	0.0002044	0.0011202	0.0139237	—	0.0479867	—	0.0032437	0.0006551	—
0003215	0.1252861	0.2510732	0.0003179	0.0002948	0.0130440	—	0.0003801	—	0.0002121	0.0000922	—
—	0.0132614	0.0160621	—	0.0004201	0.0189844	—	0.0184580	—	0.0053103	0.0001086	—
—	0.0132614	0.0155471	—	0.0002506	0.0188814	—	0.0184281	—	0.0051710	0.0001074	—
—	—	0.0005150	—	0.0001695	0.0001030	—	0.0000299	—	0.0001393	0.0000012	—
0052572	—	0.0001887	0.0149871	—	0.0000872	—	—	—	0.0004371	0.0004355	—
0052337	—	0.0001848	0.0146957	—	0.0000872	—	—	—	0.0002045	0.0004332	—
0000235	—	0.0000039	0.0002914	—	—	—	—	—	0.0002326	0.0000023	—
0010154	0.0001063	0.0000118	0.0000757	0.0246514	0.0007307	—	—	—	0.0149289	0.0000829	—
—	0.0001000	0.0000118	0.0000719	0.0245335	0.0005199	—	—	—	0.0121031	0.0000619	—
0010154	0.0000063	—	0.0000038	0.0001179	0.0002108	—	—	—	0.0028258	0.0000210	—
0188764	0.0566907	0.0127011	0.1069762	0.0505704	0.1707088	0.0184940	0.0194831	0.0002842	0.0197292	0.0039093	—
0085659	0.0311933	0.0009120	0.0212015	0.0000221	0.0427965	—	0.0029093	0.0002793	0.0076427	0.0007683	—
0103105	0.0254974	0.0117891	0.0857747	0.0505483	0.1279123	0.0184940	0.0165738	0.0000049	0.0120865	0.0031410	—
0055630	0.0191949	0.0057786	0.0101049	0.0257274	0.0381764	0.0269708	0.1923247	0.0279965	0.0123677	0.0058848	—
0054885	0.0191886	0.0057550	0.0100103	0.0253884	0.0151330	0.0269708	0.1923247	0.0279965	0.0115382	0.0052043	—
0000745	0.0000063	0.0000236	0.0000946	0.0003390	0.0230434	—	—	—	0.0008295	0.0000805	—
0101694	0.0040642	0.0000039	0.0028158	0.0003537	0.0262592	—	0.0500576	0.0000272	0.0032718	0.0010778	—
0067626	0.0040642	—	0.0023578	0.0002358	0.0237899	—	0.0397655	0.0000198	0.0016717	0.0001985	—
0034068	—	0.0000039	0.0004580	0.0001179	0.0024693	—	0.0102921	0.0000074	0.0016001	0.0008793	—
0270190	0.0008941	0.0030387	0.0000227	0.0008770	0.0080420	—	0.0005298	0.1206150	0.1808627	0.0028689	—
0023953	—	0.0002909	0.0000227	0.0008180	0.0042413	—	0.0001566	0.1156932	0.0583440	0.0016896	—
0246237	0.0008941	0.0027478	—	0.0000590	0.0038007	—	0.0003732	0.0049218	0.1225187	0.0011793	—
0242669	0.0020008	0.0008255	0.0008478	0.0104354	0.0157812	0.0000088	0.0001406	0.0001005	0.0280979	0.0011934	—
0117179	0.0018820	0.0000118	0.0003823	0.0000442	0.0128443	—	0.0000830	0.0000148	0.0060452	0.0001810	—
0125490	0.0001188	0.0008137	0.0004655	0.0103912	0.0029369	0.0000088	0.0000576	0.0000857	0.0220527	0.0010124	—
0144974	0.0045455	0.0022603	0.0024600	0.0078560	0.0042096	0.0002796	0.0011909	0.0220541	0.0430254	0.0220186	—
0003019	0.0044080	0.0001297	0.0015744	0.0001032	0.0017434	0.0002796	0.0004837	0.0056642	0.0114756	0.0214336	—
0141955	0.0001375	0.0021306	0.0008856	0.0077528	0.0024662	—	0.0007072	0.0163899	0.0315498	0.0005850	—
0636506	0.1258300	0.1581284	0.0691450	0.0424786	0.1195041	0.0134316	0.0288100	0.0647802	0.1180340	0.0059691	—
0636506	0.1258300	0.1581284	0.0691450	0.0424786	0.1195041	0.0134316	0.0288100	0.0647802	0.1180340	0.0059691	—
—	—	—	—	—	—	—	—	—	—	—	—
4217696	0.6480824	0.5150046	0.6881696	0.5620523	0.5369671	0.5057338	0.4303142	0.9450814	0.4374243	0.8801733	—
3172965	0.4846941	0.2452867	0.7697601	0.4906848	0.3241212	0.4872292	0.3886713	0.9236709	0.2405501	0.8705693	—
.044731	0.1633883	0.2697179	0.1184095	0.0713675	0.2128459	0.0185046	0.0416429	0.0214105	0.1968742	0.0096040	—

Table

PERU: PIVOTAL MATRIX OF DIRECT AND INDIRECT PRODUCTION

Producer industry \ Consumer industry	Tobacco products	Petroleum and coal products	Furniture and fixtures	Agricultural activities
Agricultural activities	−0.0374431	—	−0.0115650	0.8639660
Extractive industries	—	−0.4465472	−0.0026560	−0.0185855
Foodstuffs	—	—	—	−0.0008161
Beverages	—	—	−0.0017249	—
Tobacco	1.0000000	—	—	—
Manufacture of textiles	—	—	−0.0211110	−0.0080660
Footwear, other wearing apparel and made-up textile goods	—	—	−0.0009213	—
Wood and cork	—	—	−0.1748981	—
Furniture and fixtures	—	—	0.9984123	—
Paper and paper products	−0.0227457	—	−0.0012349	—
Printing, publishing and allied industries	−0.0276166	—	—	—
Leather and leather products	—	—	−0.0052337	—
Rubber products	—	—	—	—
Chemical, and chemical products	—	—	−0.0085659	—
Products of petroleum and coal	−0.0011899	0.9730292	−0.0056406	−0.0054182
Cement, glass, pottery, china and earthenware, etc.	—	—	−0.0067626	—
Basic metal industries	—	—	−0.0023953	—
Metal transforming industries	—	—	−0.0117179	—
Miscellaneous industries	—	−0.0002796	−0.0003035	−0.0000015
Services	−0.0258316	−0.0134316	−0.0637264	−0.0072737

Producer industry \ Consumer industry	Paper and paper products	Foodstuffs	Beverages	Textiles
Agricultural activities	−0.0013978	−0.3603965	−0.0526986	−0.2812969
Extractive industries	−0.0108388	−0.0164076	−0.0156701	−0.0180429
Foodstuffs	−0.0215533	0.8968765	−0.0590342	−0.0014287
Beverages	−0.0003693	−0.0001729	0.9213582	−0.0000422
Tobacco	—	—	—	—
Manufacture of textiles	−0.0028895	−0.0062264	−0.0006773	0.0985592
Footwear, other wearing apparel and made-up textile goods	—	−0.0134231	−0.0008438	−0.0000571
Wood and cork	−0.0000755	−0.0001757	−0.0009764	−0.0033947
Furniture and fixtures	—	−0.0000304	−0.0000019	−0.0189025
Paper and paper products	0.7421879	−0.0086027	−0.0149184	−0.0020357
Printing, publishing and allied industries	−0.0133409	−0.0050168	−0.0214393	−0.0011652
Leather and leather products	—	−0.0027529	−0.0001731	−0.0001187
Rubber products	−0.0001210	−0.0002071	−0.0000394	−0.0000317
Chemical, and chemical products	−0.0312938	−0.0330925	−0.0093932	−0.0572320
Products of petroleum and coal	−0.0207233	−0.0222406	−0.0259492	−0.0294032
Cement, glass, pottery, china and earthenware, etc.	−0.0043125	−0.0039000	−0.0560129	−0.0002959
Basic metal industries	−0.0000212	−0.0001873	−0.0000485	−0.0002105
Metal transforming industries	−0.0018876	−0.0160717	−0.0126963	−0.0003614
Miscellaneous industries	−0.0044212	−0.0002370	−0.0004840	−0.0004028
Services	−0.1267324	−0.0736835	−0.0649626	−0.0380796

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REQUIREMENTS PER UNIT OF FINAL DEMAND FOR DOMESTICALLY PRODUCED GOODS, 1955

Basic metal industries	*Rubber products*	*Leather and leather products*	*Footwear and made-up textile goods*	*Cement, glass, china earthenware, etc.*	*Extractive industries*
—	—0.4385491	—0.5175344	—0.1177663	—0.0000587	—0.0179576
—0.7220696	—0.0211959	—0.0152012	—0.0067650	—0.1443738	0.9910125
—0.0000016	—0.0003581	—0.0007667	—0.0002432	—0.0000092	—0.0000147
—	—	—0.0000870	—0.0000212	—0.0001037	—0.0000008
—	—	—	—	—	—
—	—0.0193615	—0.0056668	—0.2313668	—0.0000166	—0.0001719
—	—	—0.0000908	0.9992453	—	—
—	—0.0000811	—0.0000076	—0.0015209	—0.0015618	—0.0000116
—	—	—	—0.0019736	—	—
—	—0.0011202	—0.0002044	—0.0037237	—0.0479867	—0.0008363
—	—0.0002506	—	—0.0109737	—0.0184281	—0.0001364
—	—	0.9853043	—0.2050861	—	—
—	0.9754665	—0.0000737	—0.0132832	—	—0.0017026
—0.0002793	—0.0000224	—0.0212015	—0.0083862	—0.0029094	—0.0081409
—0.0287725	—0.0284959	—0.0130945	—0.0103331	—0.1976610	—0.0144860
—0.0000198	—0.0002358	—0.0023578	—0.0007307	0.9602345	—0.0073819
0.8843068	—0.0009250	—0.0000258	—0.0000540	—0.0001771	—0.0018810
—0.0000148	—0.0000442	—0.0003823	—0.0003663	—0.0000830	—0.0004809
—0.0056722	—0.0001165	—0.0015781	—0.0059263	—0.0005400	—0.0004987
—0.0651667	—0.0460806	—0.0730525	—0.0580887	—0.0314767	—0.0453192

Wood manufactures	*Printing, publishing, etc.*	*Chemicals*	*Metal transforming industries*	*Miscellaneous industries*	*Services*
—0.0149035	—0.0012735	—0.0628065	—0.0078509	—0.9666815	—
—0.0046843	—0.0038882	—0.0247404	—0.0544406	—0.0224439	—
—0.0000373	—0.0020721	—0.0090604	—0.0002638	—0.0012575	—
—0.0000775	—0.0000562	—0.0011407	—0.0000711	—0.0000093	—
—	—	—	—	—	—
—0.0002110	—0.0005042	—0.0035980	—0.0015769	—0.0093681	—
—0.0000014	—0.0000673	—0.0005302	—0.0000687	—0.0000365	—
0.5368747	—0.0002507	—0.0007618	—0.0065391	—0.0012652	—
—0.0009287	—0.0000099	—0.0000698	—0.0000488	—0.0002473	—
—0.0005569	—0.0860649	—0.0222174	—0.0052291	—0.0010023	—
—0.0000291	0.9832920	—0.0200261	—0.0055447	—0.0001806	—
—0.0000354	—0.0002015	—0.0002013	—0.0002241	—0.0004489	—
—0.0000589	—0.0000284	—0.0005847	—0.0125067	—0.0001064	—
—0.0011383	—0.0037309	0.9557019	—0.0087647	—0.0016422	—
—0.0097904	—0.0078178	—0.0221922	—0.0156884	—0.0113667	—
—0.0010716	—0.0004047	—0.0251511	—0.0023993	—0.0004275	—
—0.0000117	—0.0003369	—0.0048564	—0.0661356	—0.0019790	—
—0.0021401	—0.0002100	—0.0130633	0.9937844	—0.0002433	—
—0.0000384	—0.0005163	—0.0019077	—0.0119239	0.9785263	—
—0.0720296	—0.1694765	—0.1292796	—0.1287583	—0.0151445	1.0000000

Table

PERU: PRELIMINARY ESTIMATE OF REQUIREMENTS OF
(Values in thousands of

Break-down of production \ Composition of inputs		Agricultural activities	Extractive industries	Foodstuffs	Beverages	Tobacco products
Agricultural activities	D	2 336 616	150 278	3 621 694	38 193	17 128
	P	2 334 588	95 934	2 950 951	29 967	9 507
	I	2 028	54 344	670 743	8 226	7 621
Extractive industries	D	277 436	3 096	4 886	29	—
	P	277 436	3 096	2 640	19	—
	I	—	—	2 246	10	—
Foodstuffs	D	14 006	—	1 181 697	74 956	—
	P	14 006	—	977 886	58 613	—
	I	—	—	203 811	16 343	—
Beverages	D	—	—	2 108	144 522	—
	P	—	—	1 610	87 593	—
	I	—	—	498	56 929	—
Tobacco products	D	—	—	—	—	—
	P	—	—	—	—	—
	I	—	—	—	—	—
Textiles	D	166 665	—	2 824	17	—
	P	138 427	—	1 915	2	—
	I	28 238	—	909	15	—
Footwear and made-up textile goods	D	—	—	216 835	82	—
	P	—	—	127 787	57	—
	I	—	—	89 048	25	—
Wood manufactures	D	—	3 187	4 312	2 313	—
	P	—	—	1 410	978	—
	I	—	3 187	2 902	1 335	—
Furniture and fixtures	D	—	467	111	10	—
	P	—	—	37	—	—
	I	—	467	74	10	—
Paper and paper products	D	—	7 660	101 645	8 946	9 425
	P	—	3 098	58 511	8 929	5 775
	I	—	4 562	43 134	17	3 650
Printing, publishing, etc.	D	—	—	45 030	22 218	7 012
	P	—	—	44 620	22 197	7 012
	I	—	—	410	21	—
Leather and leather products	D	—	—	—	—	—
	P	—	—	—	—	—
	I	—	—	—	—	—
Rubber products	D	—	24 195	66	344	—
	P	—	10 715	—	—	—
	I	—	13 480	66	344	—
Chemicals	D	164 559	164 782	357 636	16 160	—
	P	—	52 383	310 270	7 474	—
	I	164 559	112 399	47 366	8 686	—
Petroleum and coal products	D	40 478	84 907	176 155	14 055	302
	P	90 478	80 553	176 138	14 055	302
	I	—	4 354	17	—	—
Cement, glass, china and earthenware, etc.	D	—	48 640	34 483	59 562	—
	P	—	45 731	34 144	59 497	—
	I	—	2 909	339	65	—
Basic metal industries	D	—	27 102	30 749	6	—
	P	—	10 716	1 306	—	—
	I	—	16 386	29 443	6	—
Metal transforming industries	D	—	231 729	170 894	27 796	—
	P	—	3 098	152 454	13 046	—
	I	—	228 631	18 440	14 750	—
Miscellaneous industries	D	—	12 421	2 267	414	—
	P	—	3 097	978	407	—
	I	—	9 324	1 289	7	—
Services	D	123 580	287 681	648 638	62 361	6 559
	P	123 580	287 681	648 638	62 341	6 559
	I	—	—	—	—	—
Total inputs	D	3 173 340	1 046 145	6 602 030	471 984	40 426
	P	2 978 515	596 102	5 491 295	365 195	29 155
	I	194 825	450 043	1 110 735	106 789	11 271
Gross value of production		17 161 788	6 451 924	9 527 157	1 114 123	253 900
Exports and imports						
Gross production, consumption and investment	D	13 988 448	5 405 779	2 925 127	642 139	213 474
	P					
	I					

D: Demand; P: Production; I: Imports.

RAW MATERIALS AND INTERMEDIATE PRODUCTS IN 1965

soles at 1955 prices)

Textiles	*Footwear and made up textile goods*	*Wood manufactures*	*Furniture and fixtures*	*Paper and paper products*	*Printing publishing, etc.*	*Leather and leather products*	*Rubber products*
877 929	24 746	7 366	6 200	1 870	48	262 702	143 910
867 456	12 738	6 452	4 937	354	42	247 022	143 706
10 473	12 008	914	1 263	1 516	6	15 680	204
777	444	—	106	765	—	581	380
665	—	—	59	460	—	535	274
112	444	—	47	305	—	46	106
10 456	202	3	—	8 446	2	236	—
3 606	195	3	—	7 618	—	190	—
6 850	7	—	—	828	2	46	—
19	—	35	736	130	10	48	3
19	—	35	736	130	10	48	—
—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—
335 143	695 777	40	15 170	2 411	355	1 650	6 283
318 093	586 406	25	9 011	1 017	90	824	5 998
17 050	109 371	15	6 159	1 394	265	826	285
80	1 933	—	599	—	19	50	—
74	1 873	—	393	—	19	50	—
6	60	—	206	—	—	—	—
450	3 538	296 061	82 404	24	90	38	31
314	2 992	235 525	74 656	24	61	4	31
136	546	60 536	7 748	—	29	34	—
67 639	5 477	469	1 456	—	—	8	—
67 639	5 027	469	678	—	—	—	—
—	450	—	778	—	—	8	—
6 165	11 201	189	664	135 334	153 900	289	536
5 217	9 349	182	527	91 050	31 206	113	425
948	1 852	7	137	44 284	122 694	176	111
4 372	28 457	—	—	4 687	7 849	—	159
4 031	27 987	—	—	4 687	7 598	—	95
341	470	—	—	—	251	—	64
23	541 505	15	2 244	—	92	8 281	—
23	515 491	15	2 234	—	90	8 120	—
—	26 014	—	10	—	2	161	—
3 108	34 975	25	433	38	6	42	9 346
—	33 019	25	—	36	6	40	9 301
3 108	1 956	—	433	2	—	2	45
342 188	19 488	707	8 058	20 038	6 207	59 104	19 172
203 608	10 258	538	3 657	11 025	446	11 714	8
138 580	9 230	169	4 401	9 013	5 761	47 390	19 164
95 853	18 050	4 659	2 375	6 785	2 824	5 583	9 754
95 575	17 937	4 659	2 343	6 783	2 812	5 531	9 625
278	113	—	32	2	12	52	129
54	1 684	571	4 341	1 437	2	1 556	134
44	588	500	2 887	1 437	—	1 303	89
10	1 096	71	1 454	—	2	253	45
605	79	202	11 533	316	1 485	13	332
396	70	—	1 022	—	142	13	310
209	9	202	10 511	316	1 343	—	22
1 634	14 871	1 215	10 358	707	403	468	3 956
372	8 328	1 081	5 002	665	6	211	17
1 262	6 543	134	5 356	42	397	257	3 939
5 050	22 292	121	6 188	1 606	1 105	1 359	2 978
1 324	14 281	15	129	1 557	64	870	39
3 726	8 011	106	6 059	49	1 041	489	2 939
119 210	107 729	36 326	27 170	44 476	77 274	38 203	16 104
119 210	107 729	36 326	27 170	44 476	77 274	38 203	16 104
—	—	—	—	—	—	—	—
1 870 755	1 532 448	348 004	180 035	229 070	251 671	380 211	213 078
1 687 666	1 354 268	285 850	135 441	171 319	119 866	314 791	186 022
183 089	178 180	62 154	44 594	57 751	131 805	65 420	27 056
3 584 034	2 551 150	508 734	426 857	353 457	488 680	552 493	379 107
1 713 279	1 018 702	160 730	246 822	124 387	237 009	172 282	166 029

Table 177

PERU: PRELIMINARY ESTIMATE OF REQUIREMENTS OF

(Values in thousands of

Break-down of production / Composition of inputs		Chemicals	Petroleum and coal products	Cement glass, china and earthenwear, etc.	Basic metal industries	Metal transforming industries
Agricultural activities	D	81 146	—	1 218	—	456
	P	64 248	—	49	—	337
	I	16 898	—	1 169	—	119
Extractive industries	D	18 234	1 147 743	66 070	3 032 228	784
	P	11 497	1 147 739	54 503	3 032 225	355
	I	6 737	4	11 567	3	429
Foodstuffs	D	32 691	—	9	7	230
	P	9 715	—	9	7	110
	I	22 976	—	—	—	120
Beverages	D	1 338	—	101	—	129
	P	1 338	—	101	—	129
	I	—	—	—	—	—
Tobacco products	D	—	—	—	—	—
	P	—	—	—	—	—
	I	—	—	—	—	—
Textiles	D	3 939	—	22	—	4 119
	P	3 312	—	16	—	2 683
	I	627	—	6	—	1 436
Footwear and made-up textile goods	D	544	—	20	—	181
	P	525	—	—	—	147
	I	19	—	20	—	34
Wood manufactures	D	713	—	1 637	—	12 238
	P	452	—	1 521	—	8 373
	I	261	—	116	—	3 865
Furniture and fixtures	D	—	—	—	—	802
	P	—	—	—	—	31
	I	—	—	—	—	771
Paper and paper products	D	34 766	—	47 088	—	8 281
	P	17 950	—	46 718	—	7 773
	I	16 816	—	370	—	508
Printing, publishing, etc.	D	24 475	—	17 970	—	12 726
	P	24 342	—	17 941	—	12 392
	I	133	—	29	—	334
Leather and leather products	D	112	—	—	—	1 047
	P	112	—	—	—	490
	I	—	—	—	—	557
Rubber products	D	942	—	—	—	35 775
	P	670	—	—	—	29 003
	I	272	—	—	—	6 772
Chemicals	D	220 071	47 534	18 968	1 215	47 278
	P	55 171	—	2 832	1 194	18 315
	I	164 900	47 534	16 136	21	28 963
Petroleum and coal products	D	49 216	69 322	187 241	119 696	29 637
	P	19 509	69 322	187 241	119 696	27 650
	I	29 707	—	—	—	1 987
Cement, glass, china and earthenware, etc.	D	33 852	—	48 734	116	7 840
	P	30 669	—	38 714	85	4 006
	I	3 183	—	10 020	31	3 834
Basic metal industries	D	10 368	—	516	515 682	433 412
	P	5 468	—	152	494 639	139 814
	I	4 900	—	364	21 043	293 598
Metal transforming industries	D	20 345	23	136	430	67 332
	P	16 559	—	80	63	14 486
	I	3 786	23	56	367	52 846
Miscellaneous industries	D	5 426	719	1 159	94 290	103 104
	P	2 247	719	471	24 216	27 500
	I	3 179	—	688	70 074	75 604
Services	D	154 061	34 524	28 048	276 963	282 851
	P	154 061	34 524	28 048	276 963	282 851
	I	—	—	—	—	—
Total inputs	D	692 239	1 299 865	418 937	4 040 627	1 048 222
	P	417 845	1 252 304	378 396	3 949 088	576 445
	I	274 394	47 561	40 541	91 539	471 777
Gross value of production		1 289 167	2 570 252	973 568	4 275 430	2 396 352
Exports and imports						
Gross production, consumption and investment	D	596 928	1 270 387	554 631	234 803	1 348 130
	P					
	I					

D: Demand; P: Production; I: Imports.

(Continued)

RAW MATERIALS AND INTERMEDIATE PRODUCTS IN 1965

soles at 1955 prices)

Miscellaneous industries	*Services*	*Total intermediate transactions*	*Total final demand*	*Exports*	*Consumption*	*Investment*	*Total production and imports*
1 234 343	—	8 805 843	9 174 685	2 224 685	6 950 000	—	17 980 528
1 233 815	—	8 002 103	9 159 685	2 224 685	6 935 000	—	17 161 788
528	—	803 740	15 000	—	15 000	—	818 740
426	—	4 553 985	1 920 000	1 920 000	—	—	6 473 985
421	—	4 531 924	1 920 000	1 920 000	—	—	6 451 924
5	—	22 061	—	—	—	—	22 061
440	—	1 323 381	9 048 761	1 321 566	7 727 195	—	10 372 142
438	—	1 072 396	8 454 761	1 321 566	7 133 195	—	9 527 157
2	—	250 985	594 000	—	594 000	—	844 985
9	—	149 188	1 033 365	—	1 033 365	—	1 182 553
9	—	91 758	1 022 365	—	1 033 365	—	1 114 123
—	—	57 430	11 000	—	11 000	—	68 430
—	—	—	267 226	—	267 226	—	267 226
—	—	—	253 900	—	253 900	—	253 900
—	—	—	13 326	—	13 326	—	13 326
4 008	—	1 238 423	2 544 824	103 680	2 441 144	—	3 783 247
1 062	—	1 068 881	2 515 153	103 680	2 411 473	—	3 584 034
2 946	—	169 542	29 671	—	29 671	—	199 213
30	—	173 621	2 453 640	—	2 453 640	—	2 627 261
28	—	130 953	2 420 197	—	2 420 197	—	2 551 150
2	—	42 668	33 443	—	33 443	—	76 111
1 323	—	455 111	216 099	30 125	105 010	80 964	671 210
939	—	327 280	181 454	30 125	78 095	73 234	508 734
384	—	127 831	34 645	—	26 915	7 730	162 476
106	—	76 545	367 081	—	299 440	67 641	443 626
102	—	73 983	352 874	—	295 398	57 476	426 857
4	—	2 562	14 207	—	4 042	10 165	16 769
1 108	—	527 197	96 329	—	93 432	2 897	623 526
972	—	287 795	65 662	—	65 662	—	353 457
136	—	239 402	30 667	—	27 770	2 897	270 069
161	—	175 116	328 208	—	323 629	4 579	503 324
159	—	173 061	315 619	—	311 040	4 579	488 680
2	—	2 055	12 589	—	12 589	—	14 644
646	—	553 965	30 437	5 184	24 877	376	584 402
643	—	527 218	25 275	5 184	19 715	376	552 493
3	—	26 747	5 162	—	5 162	—	31 909
123	—	109 418	370 937	—	12 037	358 900	480 355
92	—	82 907	296 200	—	7 400	288 800	379 107
31	—	26 511	74 737	—	4 637	70 100	101 248
5 798	—	1 518 963	881 699	17 280	861 864	2 555	2 400 662
1 139	—	690 032	599 135	17 280	579 300	2 555	1 289 167
4 659	—	828 931	282 564	—	282 564	—	1 111 495
7 839	—	974 731	1 860 835	—	1 860 835	—	2 835 566
7 719	—	937 928	1 632 324	—	1 632 324	—	2 570 252
120	—	36 803	228 511	—	228 511	—	265 314
1 599	—	244 605	907 169	—	173 794	733 375	1 151 774
295	—	219 989	753 579	—	134 994	618 585	973 568
1 304	—	24 616	153 590	—	38 800	114 790	178 206
4 255	—	1 036 655	3 730 476	3 420 576	—	309 900	4 767 131
2 506	—	656 554	3 618 876	3 420 576	—	198 300	4 275 430
1 749	—	380 101	111 600	—	—	111 600	491 701
1 770	—	554 067	7 372 330	—	1 151 330	6 221 000	7 926 397
268	—	215 736	2 180 616	—	609 571	1 571 045	2 396 352
1 502	—	338 331	5 191 714	—	541 759	4 649 955	5 530 045
32 658	—	293 157	1 561 095	—	1 395 282	165 813	1 854 252
31 790	—	109 704	1 373 521	—	1 369 471	4 050	1 483 225
868	—	183 453	187 574	—	25 811	161 763	371 027
8 854	—	2 380 612	22 148 228	2 621 228	14 496 000	5 031 000	24 528 840
8 854	—	2 380 612	20 648 228	2 621 228	12 996 000	5 031 000	23 028 840
—	—	—	1 500 000	—	1 500 000	—	1 500 000
1 305 496	—	25 144 583					
1 291 251	—	21 580 814					
14 245	—	3 563 769					
1 483 225	23 028 840						79 370 238
				11 664 324			12 087 769
177 729	23 028 840			(—423 445)	41 670 100	12 979 000	54 225 655
					38 275 100	7 850 000	
					3 395 000	5 129 000	

cannot be approached with any strict degree of accuracy through the utilization of simple criteria (coefficients of elasticity of demand, correlations with certain indices of economic activity, etc.), as is the case with some of the preceding categories of manufactures, but, in contrast, constitutes a problem typical of the kind that can be solved with the help of an input-output model.

With this end in view, table 174 was prepared provisionally to show the interrelationships existing in 1955 among the various branches of industrial activity, and those of each branch with the other sectors of the Peruvian economy, together with its contribution to availabilities of the several types of final goods. It is needless to point out the shortcomings and margins of error which are bound to occur in a table of this kind, prepared in reality in rather unpropitious circumstances as far as the availability of statistical data was concerned.[4] However, the figures given may be taken as valid for the purposes of the problem now to be approached.

The relationships between the purchases of raw materials effected by each sector of production and the total value of its output—that is, the technical input-output coefficients—reflect, in the last analysis, the costs structure of one branch of industry in one specific economic sector. Table 175 shows these figures for the Peruvian economy in 1955. The coefficients in question serve a twofold purpose. In the first place, they permit the deduction of a matrix of coefficients of direct and indirect requirements per unit of final demand, on the basis of which can be calculated the gross production requirements in all sectors that would correspond to any given composition of final demand. Secondly, once the gross value of production is known, they also enable an estimate to be formed of the supplies of raw materials and intermediate goods and services that each sector would require, on the sole condition that the coefficients utilized can be assumed to remain stable.

The whole set of coefficients of direct and indirect requirements is shown in table 176; the method of calculation adopted to compute them was that of the pivotal matrix.[5]

Application of this procedure to the final demand data given in tables 171, 172 and 173 led by calculation to a new input-output table reflecting industrial interrelationships in 1965, on the assumption that no change would take place in the proportions of raw materials used for each sector's production or in their break-down by domestic and foreign sources (see table 177). From the figures given in this table the conclusion was drawn that the value of total industrial production would have to expand from 16 797 to 32 727 million soles by 1965. The same table allows a rough estimate to be made of demand for raw materials and intermediate products in respect of each branch of industry, and the proportions that would correspond to domestically-produced goods and to those of foreign origin.

If the aggregate figure for imported raw materials is compared with that given in table 33 for purposes of reference, it will be seen that the former reached 3 564 million soles instead of the 3 140 million which it was estimated could be spent on importing intermediate goods without jeopardizing balance-of-payments equilibrium.

Once again, then, there emerges the need for import substitution, this time in relation to raw materials and intermediate products. Apparent substitution requirements amount to 424 million soles, but in practice domestic production would have to expand to a somewhat greater extent, since in most cases any increase in an industry's output is once more reflected in additional requirements of imported intermediate goods.

At this stage of the calculation, it becomes necessary to revert to more detailed study of industrial development possibilities—now in relation to the branches of industry producing raw materials—and to compare these possibilities with the frame of reference given in table 33, in order to ascertain in which industries production might be increased with a view to the substitution of rather more than 424 million soles' worth of imports of raw materials and intermediate products. Detailed consideration is given to the prospects for industrial expansion and import substitution in the various sections of chapter VIII; the following remarks are therefore confined to a rapid review of some of the main criteria underlying the analysis in question.

Attention was first concentrated on the chemicals industry, since with relatively few installations it could substitute domestically-produced goods for large quantities of raw materials to be used in activities of vital importance for Peru. Cases in point are synthetic fertilizers and insecticides for agriculture, and nitroglycerine for mining. If these are taken in conjunction with raw materials for other industries to a value of about 50 million soles, the chemical industry might achieve additional import substitution amounting to over 200 million soles' worth of raw materials. Next in importance as a possible field for the replacement of imported raw materials and intermediate goods by domestic production would come the basic metal industries, where substitution would cover mainly imported steel products, such as tinplate for the manufacture of containers and the shapes and rolled products used by the mechanical transforming industry. In this case the additional import substitution achieved might exceed 130 million soles. Third on the list would be the

[4] Special mention must be made of the lack of an industrial census. The preliminary estimate presented here is largely the outcome of the assistance rendered in this connexion by the Industry and Electricity Department of the Ministry of Development and Public Works, and is based almost entirely on that institution's annual tabulations of the data supplied by a very comprehensive sample of industrial enterprises.

[5] For further detailed discussion of other important questions relating to input-output calculations—in particular, the treatment of imports—see also "The Input-Output Model", *Economic Bulletin for Latin America*, Vol. I, No. 2 (Santiago, Chile, September 1956), pp. 16-28.

metal transforming industries, development of which might increase import substitution as regards spare parts for mining, tinplate containers for the foodstuffs and crown tops for the beverage industries, besides many other products destined for various industrial activities. New import substitution under this head might amount to a value of more than 120 million soles. Two other lines of production in which the substitution outlook is promising are the manufacture of pulp for the paper industry and that of various types of paper for the printing and publishing houses; in both these instances output could be considerably increased, and the resulting additional import substitution might in the aggregate represent about 50 million soles. Apart from these industries, in which significant substitution might be effected, others which would afford opportunities, although on a smaller scale, would be the beverage industry (in which imported malt for brewing would be completely replaced by domestic production), that of made-up textile goods (which could provide more sacks to replace imports for the food manufacturing industries) and the manufacture of cement, glass and china, etc., (where domestic production might be substituted for small additional quantities of imported raw materials for the various industries). An over-all picture of new substitutions in respect of raw materials and intermediate products is given in table 178, where plus signs indicate production increments and minus signs decreases in imports.

At this stage in the calculation of the input-output table, the opportunity was taken to introduce an important technological change in industrial inputs for agricultural activities. As can be seen in the section on the chemicals industries in chapter VIII, production of guano, which is the most important of the fertilizers in current use, will probably be limited to a more or less fixed amount (about 250 000 tons annually), while projected consumption of fertilizers should grow at quite a rapid rate. This would mean that the chemicals industry, besides substituting domestic production for imported chemical fertilizers, had to cover the whole of the guano deficit in 1965. When this substitution was incorporated into the input-output matrix, it was borne in mind that the price of synthetic fertilizers per unit of nitrogen is three times as high as that of guano. It was for this reason that, as table 178 shows, the sum of 308.7 million soles, which is three times larger than the amounts subtracted from agricultural inputs supplied by the extractive industries, was added to demand for chemical products to be used in agricultural activities.

When the additional import substitutions that might

Table 178

PERU: HYPOTHESIS OF IMPORT SUBSTITUTION OF RAW MATERIALS, BY SECTORS, IN 1965

(Values in millions of soles at 1955 prices)

Producer industry \ Consumer industry		Agricultural activities	Extractive industries	Foodstuffs	Beverages	Footwear and made-up textile goods	Furniture and fixtures	Paper and paper products	Printing, publishing, etc.	Leather and leather products	Chemicals	Cement, glass, china and earthenware, etc.	Basic metal industries	Metal transforming tries
Extractive industries	D	−102.9	—	—	—	—	—	—	—	—	—	—	—	—
	P	−102.9	—	—	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	—	—	—	—	—	—	—	—	—	—
Beverages	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	+31.0	—	—	—	—	—	—	—	—	—
	I	—	—	—	−31.0	—	—	—	—	—	—	—	—	—
Footwear, other wearing apparel and made-up textile goods	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	+ 9.7	—	—	—	—	—	—	—	—	—	—
	I	—	—	− 9.7	—	—	—	—	—	—	—	—	—	—
Paper and paper products	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	+29.1	+20.0	—	—	—	—	—
	I	—	—	—	—	—	—	−29.1	−20.0	—	—	—	—	—
Chemicals and chemical products	D	+308.7	—	—	—	—	—	—	—	—	—	—	—	—
	P	+473.2	+32.4	—	—	—	—	—	—	—	+50.0	—	—	—
	I	−164.5	−32.4	—	—	—	—	—	—	—	−50.0	—	—	—
Cement, glass, pottery, china and earthenware, etc.	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	+ 0.3	—	—	—	+0.4	—	—	—	—	+7.3	+ 1.0	—
	I	—	− 0.3	—	—	—	−0.4	—	—	—	—	−7.3	− 1.0	—
Basic metal industries	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	—	+29.5	—	—	—	—	—	—	—	—	+10.0	+98.2
	I	—	—	−29.5	—	—	—	—	—	—	—	—	−10.0	−98.2
Metal transforming industries	D	—	—	—	—	—	—	—	—	—	—	—	—	—
	P	—	+76.9	+16.0	+15.2	+3.0	+2.0	—	—	—	+ 3.5	—	—	+ 5.0
	I	—	−76.9	−16.0	−15.2	−3.0	−2.0	—	—	—	− 3.5	—	—	− 5.0

D: Demand; P: Production; I: Imports.

Table 179: PERU: PROJECTION OF INTER-INDUSTRIA

Break-down of production / Composition of inputs		Agricultural activities	Extractive industries	Foodstuffs	Beverages	Tobacco products	Textiles	Footwear and made-up textile goods	Wood manufactures	Furniture and fixtures	Paper and paper products
Agricultural activities	D	2 342 901	151 070	3 625 090	39 370	17 128	879 169	24 844	7 392	6 202	2 298
	P	2 340 867	96 439	2 953 717	30 890	9 507	868 681	12 789	6 475	4 938	435
	I	2 034	54 631	671 373	8 480	7 621	10 488	12 055	917	1 264	1 863
Extractive industries	D	175 283	3 112	4 890	30	—	778	446	—	105	940
	P	175 283	3 112	2 642	20	—	666	—	—	58	565
	I	—	—	2 248	10	—	112	446	—	47	375
Foodstuffs	D	14 043	—	1 182 806	77 269	—	10 471	203	3	—	10 385
	P	14 043	—	978 804	60 421	—	3 611	196	3	—	9 366
	I	—	—	204 002	16 848	—	6 860	7	—	—	1 019
Beverages	D	—	—	2 110	148 978	—	19	—	35	736	160
	P	—	—	1 612	121 292	—	19	—	35	736	160
	I	—	—	498	27 686	—	—	—	—	—	—
Tobacco products	D	—	—	—	—	—	—	—	—	—	—
	P	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	—	—	—	—	—	—	—
Textiles	D	167 113	—	2 826	18	—	335 618	698 520	40	15 174	2 964
	P	138 799	—	1 917	2	—	318 543	588 717	25	9 014	1 250
	I	28 314	—	909	16	—	17 075	109 803	15	6 160	1 714
Footwear and made-up textile goods	D	—	—	217 038	85	—	80	1 939	—	599	—
	P	—	—	137 588	59	—	74	1 880	—	393	—
	I	—	—	79 450	26	—	6	59	—	206	—
Wood manufactures	D	—	3 124	4 316	2 384	—	450	3 552	296 902	82 428	30
	P	—	—	1 411	1 008	—	314	3 004	236 195	74 678	30
	I	—	3 124	2 905	1 376	—	136	548	60 707	7 750	—
Furniture and fixtures	D	—	470	111	10	—	67 736	5 499	471	1 456	—
	P	—	—	37	—	—	67 736	5 047	471	678	—
	I	—	470	74	10	—	—	452	—	778	—
Paper and paper products	D	—	7 700	101 740	9 222	9 425	6 174	11 245	190	665	166 395
	P	—	3 115	58 566	9 204	5 775	5 225	9 386	182	527	141 000
	I	—	4 585	43 174	18	3 650	949	1 859	8	138	25 395
Printing, publishing, etc.	D	—	—	45 072	22 904	7 012	4 378	28 570	—	—	5 763
	P	—	—	44 662	22 882	7 012	4 037	28 099	—	—	5 763
	I	—	—	410	22	—	341	471	—	—	—
Leather and leather products	D	—	—	—	—	—	23	543 641	15	2 245	—
	P	—	—	—	—	—	23	517 524	15	2 235	—
	I	—	—	—	—	—	—	26 117	—	10	—
Rubber products	D	—	24 321	66	354	—	3 112	35 113	25	434	46
	P	—	10 771	—	—	—	—	33 150	25	—	43
	I	—	13 550	66	354	—	3 112	1 963	—	434	3
Chemicals	D	473 702	165 648	357 971	16 659	—	342 673	19 565	709	8 060	24 636
	P	473 200	85 008	310 561	7 704	—	203 896	10 299	539	3 657	13 556
	I	502	80 640	47 410	8 955	—	138 777	9 266	170	4 403	11 080
Petroleum and coal products	D	90 722	85 355	176 320	14 489	302	93 988	18 121	4 672	2 375	8 342
	P	90 722	80 977	176 303	14 489	302	95 711	18 008	4 672	2 343	8 339
	I	—	4 378	17	—	—	277	113	—	32	3
Cement, glass, china and earthenware, etc.	D	—	48 899	34 513	61 397	—	54	1 691	572	4 343	1 766
	P	—	46 274	34 174	61 330	—	45	591	501	3 288	1 766
	I	—	2 625	339	67	—	9	1 100	71	1 055	—
Basic metal industries	D	—	27 244	30 779	6	—	606	79	203	11 535	389
	P	—	10 772	30 779	—	—	396	70	—	1 024	—
	I	—	16 472	—	6	—	210	9	203	10 511	389
Metal transforming industries	D	—	232 949	171 052	28 650	—	1 637	14 929	1 218	10 362	869
	P	—	79 991	168 595	28 650	—	373	11 360	1 084	7 003	818
	I	—	152 958	2 457	—	—	1 264	3 569	134	3 359	51
Miscellaneous industries	D	—	12 487	2 270	427	—	5 058	22 380	122	6 190	1 975
	P	—	3 114	979	419	—	1 326	14 338	15	129	1 916
	I	—	9 373	1 291	8	—	3 732	8 042	107	6 061	59
Services	D	123 914	289 196	649 247	64 285	6 559	119 379	108 153	36 429	27 177	54 683
	P	123 914	289 196	649 247	64 285	6 559	119 379	108 153	36 429	27 177	54 683
	I	—	—	—	—	—	—	—	—	—	—
Total inputs	D	3 387 678	1 051 575	6 608 217	486 537	40 426	1 873 403	1 538 490	348 998	180 086	281 641
	P	3 356 828	708 769	5 551 594	422 655	29 155	1 690 055	1 362 611	286 666	137 878	239 690
	I	30 850	342 806	1 056 623	63 882	11 271	183 348	175 879	62 332	42 208	41 951
Gross value of production		17 207 957	6 485 909	9 536 095	1 148 472	253 900	3 589 100	2 561 208	510 182	426 977	434 574
Exports and imports											
Gross production, consumption and investment	D	13 820 279	5 434 334	2 927 878	661 935	213 474	1 715 697	1 022 718	161 184	246 891	152 933
	P										
	I										

D: Demand; P: Production; I: Imports.

TRANSACTIONS IN 1965 (*Values in thousands of soles at 1955 prices*)

Printing, publishing, etc.	*Leather and leather products*	*Rubber products*	*Chemicals*	*Petroleum and coal products*	*Cement, glass, china and etc. earthenware, etc.*	*Basic metal industries*	*Metal transforming industries*	*Miscellaneous industries*	*Services*	*Total intermediate transactions*	*Total final demand*	*Exports*	*Consumption*	*Investment*	*Total production and imports*
49	263 723	144 720	117 997	—	1 251	—	481	1 237 693	—	8 861 378	9 174 685	2 224 685	6 950 000	—	18 036 063
44	247 982	144 514	93 425	—	51	—	355	1 237 163	—	8 048 272	9 159 685	2 224 685	6 935 000	—	17 207 957
5	15 741	206	24 572	—	1 200	—	126	530	—	813 106	15 000	—	15 000	—	828 106
—	583	382	26 514	1 158 480	67 879	3 150 770	827	427	—	4 591 446	1 920 000	1 920 000	—	—	6 511 446
—	537	275	16 717	1 158 475	55 995	3 150 767	375	422	—	4 565 909	1 920 000	1 920 000	—	—	6 485 909
—	46	107	9 797	5	11 884	3	452	5	—	25 537	—	—	—	—	25 537
2	237	—	47 538	—	9	7	242	441	—	1 343 656	9 048 761	1 321 566	7 727 195	—	10 392 417
—	191	—	14 128	—	9	7	116	439	—	1 081 334	8 454 761	1 321 566	7 133 195	—	9 536 095
2	46	—	33 410	—	—	—	126	2	—	262 322	594 000	—	594 000	—	856 322
10	48	3	1 946	—	104	—	136	9	—	154 294	1 033 365	—	1 033 365	—	1 187 659
10	48	—	1 946	—	104	—	136	9	—	126 107	1 022 365	—	1 022 365	—	1 148 472
—	—	3	—	—	—	—	—	—	—	28 187	11 000	—	11 000	—	39 187
—	—	—	—	—	—	—	—	—	—	—	267 226	—	267 226	—	267 226
—	—	—	—	—	—	—	—	—	—	—	253 900	—	253 900	—	253 900
—	—	—	—	—	—	—	—	—	—	—	13 326	—	13 326	—	13 326
366	1 656	6 319	5 730	—	23	—	4 344	4 019	—	1 244 730	2 544 824	103 680	2 441 144	—	3 789 554
93	827	6 032	4 818	—	16	—	2 829	1 065	—	1 073 947	2 515 153	103 680	2 411 473	—	3 589 100
273	829	287	912	—	7	—	1 515	2 954	—	170 783	29 671	—	29 671	—	200 454
20	50	—	790	—	21	—	191	30	—	220 843	2 453 640	—	2 453 640	—	2 674 483
20	50	—	764	—	—	—	155	28	—	141 011	2 420 197	—	2 420 197	—	2 561 208
—	—	—	26	—	21	—	36	2	—	79 832	33 443	—	33 443	—	113 275
93	38	31	1 037	—	1 682	—	12 906	1 327	—	410 300	216 099	30 125	105 010	80 964	626 399
63	4	31	657	—	1 562	—	8 830	941	—	328 728	181 454	30 125	78 095	73 234	510 182
30	34	—	380	—	120	—	4 076	386	—	81 572	34 645	—	26 915	7 730	116 217
—	8	—	—	—	—	—	846	106	—	76 713	367 081	—	299 440	67 641	443 794
—	—	—	—	—	—	—	32	102	—	74 103	352 874	—	295 398	57 476	426 977
—	8	—	—	—	—	—	814	4	—	2 610	14 207	—	4 042	10 165	16 817
158 424	290	539	50 553	—	48 377	—	8 732	1 112	—	580 783	96 329	—	93 432	2 897	677 112
52 123	113	427	26 101	—	47 997	—	8 196	975	—	368 012	65 662	—	65 662	—	434 574
106 301	177	112	24 452	—	380	—	536	137	—	211 871	30 667	—	27 770	2 897	242 538
8 080	—	160	35 589	—	18 458	—	13 419	162	—	189 567	328 208	—	323 629	4 579	517 775
7 821	—	96	35 396	—	18 428	—	13 067	160	—	187 423	315 619	—	311 040	4 579	503 042
259	—	64	193	—	30	—	352	2	—	2 144	12 589	—	12 589	—	14 733
95	8 312	—	163	—	—	—	1 105	648	—	556 247	30 437	5 184	24 877	376	586 684
93	8 151	—	163	—	—	—	517	644	—	529 365	25 275	5 184	19 715	376	554 640
2	161	—	—	—	—	—	588	4	—	26 882	5 162	—	5 162	—	32 044
6	42	9 398	1 370	—	—	—	37 725	123	—	112 135	370 937	—	12 037	358 900	483 072
6	40	9 353	975	—	—	—	30 585	92	—	85 040	296 200	—	7 400	288 800	381 240
—	2	45	395	—	—	—	7 140	31	—	27 095	74 737	—	4 637	70 100	101 832
6 389	59 333	19 279	320 013	47 979	19 487	1 263	49 855	5 813	—	1 939 034	881 699	17 280	861 864	2 555	2 820 733
459	11 759	8	130 227	—	2 910	1 241	19 313	1 143	—	1 275 480	599 135	17 280	579 300	2 555	1 874 615
5 930	47 574	19 271	189 786	47 979	16 577	22	30 542	4 670	—	663 554	282 564	—	282 564	—	946 118
2 908	5 605	9 808	71 566	69 970	192 367	124 376	31 254	7 860	—	1 012 400	1 860 835	—	1 860 835	—	2 873 235
2 896	5 552	9 679	28 369	69 970	192 367	124 376	29 158	7 740	—	961 973	1 632 324	—	1 632 324	—	2 594 297
12	53	129	43 197	—	—	—	2 096	120	—	50 427	228 511	—	228 511	—	278 938
2	1 562	135	49 227	—	50 069	121	8 269	1 603	—	264 223	907 169	—	173 794	733 375	1 171 392
—	1 308	90	44 598	—	47 069	88	5 226	295	—	246 643	753 579	—	134 994	618 585	1 000 222
2	254	45	4 629	—	3 000	33	3 043	1 308	—	17 580	153 590	—	38 800	114 790	171 170
1 529	13	334	15 076	—	530	535 841	457 038	4 266	—	1 085 468	3 730 476	3 420 576	—	309 900	4 815 944
147	13	312	7 951	—	157	523 975	245 587	2 513	—	823 696	3 618 876	3 420 576	—	198 300	4 442 572
1 382	—	22	7 125	—	373	11 866	211 451	1 753	—	261 772	111 600	—	—	111 600	373 372
415	470	3 978	29 583	23	141	446	71 002	1 775	—	569 499	7 372 330	—	1 151 330	6 221 000	7 941 829
6	212	17	27 576	—	83	66	20 276	269	—	346 379	2 180 616	—	609 571	1 571 045	2 526 995
409	258	3 961	2 007	23	58	380	50 726	1 506	—	223 120	5 191 714	—	541 759	4 649 955	5 414 834
1 137	1 364	2 995	7 891	725	1 191	97 977	108 723	32 747	—	305 659	1 561 095	—	1 395 282	165 813	1 866 754
65	873	39	3 268	725	484	25 164	28 998	31 877	—	113 729	1 373 521	—	1 369 471	4 050	1 487 250
1 072	491	2 956	4 623	—	707	72 813	79 725	870	—	191 930	187 574	—	25 811	161 763	379 504
79 546	38 349	16 195	224 025	34 843	28 816	287 791	298 272	8 878	—	2 495 737	22 148 228	2 621 228	14 496 000	5 031 000	24 643 965
79 546	38 349	16 195	224 025	34 843	28 816	287 791	298 272	8 878	—	2 495 737	20 648 228	2 621 228	12 996 000	5 031 000	23 143 965
—	—	—	—	—	—	—	—	—	—	—	1 500 000		1 500 000	—	1 500 000
259 071	381 683	214 276	1 006 608	1 312 020	430 405	4 198 592	1 105 367	1 309 039	—	26 014 112					
143 392	316 009	187 068	661 104	1 264 013	396 048	4 113 475	712 023	1 294 755	—	22 873 788					
115 679	65 674	27 208	345 504	48 007	34 357	85 117	393 344	14 284	—	3 140 324					
503 042	554 640	381 240	1 874 615	2 594 297	1 000 222	4 442 572	2 526 995	1 487 250	23 143 965						80 663 212
												11 664 324			11 664 324
243 971	172 957	166 964	868 007	1 282 277	569 817	243 980	1 421 628	178 211	23 143 965				41 670 100	12 979 000	54 649 100
													38 275 100	7 850 000	
													3 395 000	5 129 000	

be achieved in respect of raw materials and intermediate products has been determined, the input-output table for 1965 was recalculated by means of the usual procedures.[6]

The final results of this calculation are given in table 179, which is no longer a mere mechanical projection of the 1955 input-output table, but an expression of the findings of the detailed survey of industrial development possibilities carried out in relation to all the most important industrial products. It was constructed on the basis of the frame of reference provided by tables 32 and 33, but further changes were introduced in the light of the study of existing industry and its development prospects, so that the final figures reached result from the interaction of the conditions imposed by a specific type of economic development and the possibilities of industry's successfully contributing its proper share to the development in question.

It seems appropriate here to retrace the process whereby the table showing the industrial development situation in 1965 was built up. The point of departure was the frame of reference afforded by tables 32 and 33, which showed, by means of global statistics, how industry as a whole would need to develop, a distinction being drawn between consumer goods, capital goods, exports and raw materials for industry and for other economic activities. The last-named table also fixed the limit beyond which imports could not go without jeopardizing balance-of-payment equilibrium. As these tables related to the Peruvian economy as a whole, it was necessary to adhere to the norms they established for industrial development to ensure that this latter would fit into an over-all pattern of balanced development. At the beginning of the present chapter the figures in the tables used for reference were brought into line with the classification adopted in the industrial study proper. Table 32, with the appropriate classification changes was expanded to form the 1955 input-output table, and the industrial sector, which had formerly been taken as a single item, was subdivided by branches of industry. Elasticities, correlations and other studies of demand carried out within industry itself were utilized to establish final demand values for each branch of industry in 1965, i.e., values of exports, consumption and demand for capital goods. Development possibilities for the manufacture of the most important products of each branch of industry were next analysed in greater detail, due allowance being made for the probable limitations of the capacity to import, in order to determine what contribution industry would have to make to the satisfaction of this final demand. Subsequently, the technical coefficients deduced from the 1955 input-output table and the corresponding coefficients of direct and indirect requirements were used to calculate the value of production and imports of raw materials and intermediate products necessary for the manufacture of the goods needed to meet final demand. The outcome of this process was table 177, which gives a preliminary estimate of requirements of raw materials and intermediate products in 1965, and which suggests that the volume of imports of raw materials would exceed the limits set by the frame of reference in table 33. The next step was to revert to the detailed study of industrial expansion possibilities in order to determine in which branches further import substitution could be effected, this time in respect of raw materials and intermediate products. Once these additional expansions of industry had been defined, they were incorporated into the calculation of a new input-output table for 1965, which was as far as possible consistent with the frame of reference, and at the same time represented industrial development possibilities as derived from a series of observations of industry itself and of the market for industrial goods.

The final figures reached by this procedure were of course somewhat different from those provisionally established in the over-all frame of reference provided by tables 32 and 33. A change in the number of sectors in which the various national activities are grouped would suffice in itself to account for different results in the projections, as in the present instance, where the highly simplified layout at first used was succeeded by another with a much more detailed break-down by sectors. In the particular case of this research, yet other additional factors came into play, such as the transfer of specific activities (refining of sugar and of metals) from one sector to another, changes in certain technical input-output coefficients (as for fertilizers), modification of the criterion used in valuing exports (producers' instead of exporters' prices) and the adoption of a somewhat different hypothesis on the composition of gross investment in goods and services.[7] It may be noted, however, that while the main features of the original over-all frame of reference are preserved, the variations introduced are relatively slight, and in no way affect the qualitative conclusions set forth above.

5. *The most important aspects of industrial growth between 1955 and 1965*

In accordance with previous calculations, the value at constant prices of industrial production would have

[6] In very general terms, the procedure consists in provisionally considering volumes represented by import substitution as if they formed part of final demand, and recalculating the implications of this new aggregation of final demands with respect to raw materials and intermediate products. As at the first trial, estimates of imports of raw materials may again exceed the limit fixed—although by a smaller margin—the previous import substitution must be increased and the operation repeated until the desired result is obtained by successive approximations.

[7] Strictly speaking, a specific piece of industrial programming ought to be approached with due regard to all those elements which emerge from a detailed study of industry, and the initial aggregate projections ought to be reverted to and the appropriate corrections introduced, so that the findings of the two phases of research would be perfectly consistent with each other. However, it was considered preferable to omit this kind of adjustment here, not only on account of the rather different aims of the study, but also in order to give a methodological account of the research which would follow the chronological order in which it was conducted and would thus facilitate is comprehension and discussion.

to increase by more than 100 per cent between 1955 and 1965 (from 16 797 million soles to 33 825 million). This would imply an average rate of annual growth of almost 7 per cent, a figure greater not only than the average growth between 1945 and 1955 but also than that which had been initially assumed in the trial aggregate projections formulated at the beginning of the study. Given different characteristics of demand and different substitution possibilities, this growth in industry as a whole would be accompanied by changes of relative intensity in its breakdown by branches and types of products. At the same time, the intensity and pattern of industrial development throughout this decade would considerably alter the relative position of domestic production and imports in the total manufactures needed by the home market. It should be remembered that they did not have a similar effect during the previous decade. While industry revealed a high rate of growth between 1945 and 1955, changes in its structure were very slight and in fact it lost ground to imports as a means of supplying the domestic market.

As will be remembered, the share of domestic industry in the total supply of manufactured goods amounted to 76.3 per cent in 1955, a figure which, according to the hypothesis just advanced, would rise to 79 per cent in 1965. The supply of domestic origin would increase during that period from 88 per cent to 91 per cent in the case of consumer goods, from 26 per cent to 35 per cent in that of capital goods, and from 72 per cent to 77 per cent in that of intermediate manufactures.

Table 180 indicates the changes which would take place in the pattern of industrial production. While in 1955 consumer goods represented 61.3 per cent of the total manufacturing output, in 1965 they would represent only 54.2 per cent. On the other hand, production of capital goods, although still at lower absolute levels, would increase its relative share from 5.3 to 8.3 per cent. The changes which would take place in the break-down of industrial production by individual branches would be even more significant. Traditional industries, like processed foodstuffs and beverages, would lose ground to fairly new and still undeveloped activities such as the manufacture of paper, chemical and pharmaceutical products and metallurgical goods. In this way, Peruvian industry would gradually approach the present pattern of industrial production in other countries where the manufacturing sector has reached a higher level of development. It must be stressed that these changes in the industrial pattern in no way signify stagnation at present production levels. On the contrary, all branches of industrial activity would have to contribute to the marked growth which is expected in industry as a whole. The actual amount of this expansion would be fairly considerable even in those cases where demand-elasticity is lower and further import substitution possibilities less.

Table 180

PERU: PROJECTION OF CHANGES IN COMPOSITION OF INDUSTRIAL PRODUCTION, 1955-65

(Percentages)

	1955	*1965*
A. *By types of product*		
Consumer goods	61.3	54.2
Intermediate goods	20.2	23.0
Capital goods	5.3	8.3
Production for export	13.2	14.5
Total	*100.0*	*100.0*
B. *By branches of industry*		
Foodstuffs	36.4	28.2
Beverages	3.5	3.4
Tobacco	0.9	0.8
Textiles	11.0	10.6
Footwear, other wearing apparel and made-up textile goods	7.2	7.6
Wood and cork	1.2	1.5
Furniture and fixtures	1.5	1.3
Paper and paper products	1.0	1.3
Printing, publishing and allied industries	1.5	1.5
Leather and leather products	1.6	1.6
Rubber products	0.8	1.1
Chemicals and chemical products	3.7	5.5
Products of petroleum and coal	10.2	7.6
Cement, glass, pottery, china and earthenware, etc.	2.6	3.0
Basic metal industries	7.2	13.1
Metal transforming industries	4.6	7.5
Miscellaneous industries	5.1	4.4
Total	*100.0*	*100.0*

6. *The probable growth of the artisan industry*

So far, the growth of each one of the industrial branches has been considered without any distinction between artisan production and that of industry proper. Such a distinction is necessary to determine the importance to be assigned to the role of the manufacturing sector in development. While this sector can be guided and encouraged by means of a suitable economic policy, artisan producers must seize the reduced opportunities left to them by industry proper.

In calculating this break-down, the starting-point was the difference between the two sectors for 1955 (see table 35). In addition, the hypothesis described in chapter III was accepted. There, with respect to the growth of the labour force and the possibilities of its absorption, it was assumed that the number of persons employed in artisan activities would rise between 1955 and 1956 at the same rate as the increase in total population, i.e. 28 per cent.

In order to estimate total artisan production in 1965, on the basis of the growth of the labour force, it was assumed that during the decade productivity would rise slightly (7 per cent), thus bringing the increase in total output to 37 per cent. Even though the labour employed is manual, an improvement in the techniques of production may always be expected because both tools and raw materials are bound to get better as the years go by.

The aggregate growth of artisan activities was broken

down among the various industrial branches on the assumption that there was a certain relationship between the increase registered in a given branch and the expansion of the whole artisan sector.[8] The rates of growth thus obtained were then modified in the light of a set of factors which are expected to influence the future development of artisan activities. They include the following considerations: (*a*) artisan production of footwear may show a relatively marked increase because, for a certain type of article (women's shoes, for example), it may compete successfully with industry proper because its lack of mechanization enables it to adapt itself better to stylistic changes; (*b*) the artisan output of other leather articles would be greater than that established in an initial hypothesis because this kind of work is mainly artistic; as it therefore requires a large supply of labour and little or no mechanization, very small workshops can easily compete with the larger factories; (*c*) the artisan output of non-metallic minerals is also expected to attain a relatively high rate of growth because the manufacture of ordinary bricks and many types of ceramics is relatively simple and fairly exacting as regards proximity to consumption centres and raw material sources; (*d*) lower rates of growth may be assigned to artisan metal-transforming activities (except motor-vehicle repairs) because they require a considerable degree of mechanization, and to the artisan production of chemicals because such products as soap can be produced more economically on a large scale and the public has more confidence in perfumes, medicines and the like which have been produced industrially.[9]

In view of these considerations and the fact that the total increment in artisan production will not exceed 37 per cent, table 181 was prepared. It shows the hypothetical break-down of the production increment between the industrial and the artisan sector during the period 1955-65.

8 On the basis of this assumption, the artisan production in a given branch would therefore have to rise at a slower rate than the total output of that branch since total artisan activity in all branches increases by 37 per cent in 10 years while the total increment in industry and artisan work together is 100 per cent. The rates of increase used in this initial approximation were obtained by raising each of the growth ratios of the branch to an exponent (0.455), calculated by dividing the logarithm of the ten-year growth ratio for industry as a whole (including artisan production), which amounts to 2.00, by the logarithm of the ten-year growth ratio for total artisan activities (1.37).

9 In the chemical branch it was assumed that artisan activities would be completely absorbed by industry.

Table 181

PERU: HYPOTHETICAL BREAK-DOWN OF PRODUCTION INCREMENT (1955–65) BETWEEN ARTISAN ACTIVITIES AND INDUSTRY PROPER

(Values in million of soles at 1955 prices)

Industrial branch	*Total*			*Artisan activities*			*Industry proper*		
	Production in 1955	*Ten-year rate of growth (Percentage)*	*Production in 1965*	*Production in 1955*	*Ten-year rate of growth (Percentage)*	*Production in 1965*	*Production in 1955*	*Ten-year rate of growth (Percentage)*	*Production in 1965*
Food	6 113	56	9 536	3 165	34	4 240	2 948	80	5 296
Beverages	583	97	1 149	88	28	113	496	109	1 036
Tobacco	153	66	254	—	—	—	153	66	254
Textiles	1 849	94	3 589	594	34	796	1 254	122	2 793
Footwear and made-up textiles	1 201	113	2 561	902	77	1 596	299	222	965
Wood manufactures	201	154	510	61	52	93	140	198	417
Furniture and fixtures	255	67	426	204	25	254	51	238	172
Paper and paper products	160	172	435	—	—	—	160	172	435
Printing and publishing	254	98	503	104	31	136	150	145	367
Leather	264	110	555	99	117	215	165	106	340
Rubber	136	181	381	33	43	47	103	225	334
Chemicals	631	198	1 875	186	—	—	445	322	1 875
Petroleum and coal products	1 709	52	2 594	—	—	—	1 709	52	2 594
Cement, glass, ceramics, etc.	434	130	1 000	126	86	235	308	149	765
Basic metals	1 214	266	4 443	—	—	—	1 214	266	4 443
Metal transforming	782	223	2 527	383	11	424	399	427	2 103
Miscellaneous	856	74	1 487	—	—	—	856	74	1 487
Total	16 795	100	33 825	5 945	37	8 149	10 850	137	25 676

SOURCES: 1955 data (see table 35).

Chapter VIII

INDUSTRIAL DEVELOPMENT POSSIBILITIES

I. FOOD MANUFACTURING INDUSTRIES

As indicated in the outline in Part One and as shown specifically in tables 174 and 179 of the preceding chapter, a rise of 58 per cent in the demand for manufactured foodstuffs was assumed for the period 1955-65. At the same time, an increase in production of 56 per cent was postulated for the manufacturing and artisan sectors combined and of 80 per cent for the manufacturing sector alone. As can be seen from table 182, this development would not lead to an improvement in the product-demand ratio for the food industry as a whole, but rather to a slight deterioration, because increases in certain items or products would be offset by greater decreases in others.

The remainder of this chapter examines to what extent each of the main food items may contribute towards the attainment of the development targets mentioned above.

1. *Slaughtering of livestock and preparation of meat*

The 56 per cent increase attributed to meat consumption in Peru mainly reflects the difficult circumstances in which meat supply has developed in the past ten years, for, as can be seen from chapter V, section I, the livestock population is extremely small. A more accurate estimate of potential demand might be obtained if it is assumed that in ten years *per capita* consumption throughout the country will reach the level now existing in the Lima-Callao zone—some 35 kilogrammes of meat instead of 13 as at present. The attainment of such an objective would require an industrial development of 240 per cent in 10 years, with production rising to some 400 000 tons of meat annually. This hypothesis, however, is quite untenable in the light of Peru's livestock resources. The 56 per cent rate attributed to consumption appears fairly optimistic when compared with the 47 per cent increase in production in the past ten years and the 44 per cent increase in consumption itself.

During the period covered by this report, meat production will probably be restricted because the cattle population in the supply areas has grown only slightly. Over a longer period, however, the deficiencies may be made good for there are no fundamental problems hindering the development of stock-raising in the tropical and semi-tropical zone of the mountainous ridge in eastern Peru. Some economic form of transport should therefore be considered. Since meat has a definite value per unit of weight, aircraft might even be used for this purpose.

If, by dint of strenuous efforts, slaughterhouses were constructed in the areas where the cattle are now reared, it might perhaps be possible to ensure that future production kept pace with demand. This has in fact been assumed here. Production would then have to increase by 56 per cent, reaching a figure of 183 000 tons of meat annually and imports rise at approximately the same rate, i.e. up to 10 000 tons by 1965.

For projection purposes, it may be assumed that the expansion of meat production would call for new processing plants in at least three cattle-raising centres—Arequipa, Cajamarca and Puno. Assuming that the initial daily capacity of each of these plants were 125 beef cattle, 4 000 sheep and 50 pigs, and that they were all equipped with chilling and freezing units both at the slaughtering centres and at the main consumer markets, the investment required would be some 100 million soles. Since there is still room for improvement in productivity, only 260 additional workers (43 per cent more than at present) would probably have to be taken on.

Although the projections do not specify figures for the possible development of poultry production, it may be said that, like pig-rearing, it is fairly backward in Peru and that both these sectors might expand very fast, given a policy of assistance and encouragement. There are some problems as regards the feeding of poultry and pigs but they could probably be solved by boosting the manufacture of concentrated feeds. It would be a matter of discovering feeds based more on ingredients abundant in Peru (such as fish meal, molasses and pastes made from cottonseed, sunflower seed and peanuts) and less on those which are scarce (such as wheat, alfalfa, milk and meat). Prospects for the development of poultry-meat production are at present good, at least in the Lima-Callao area. The shortage of poultry-feed might be mitigated if the most modern methods of breeding and rearing were disseminated to ensure large egg and meat yields from each kilogramme of feed. Peru might find it hard to import hybrid chicks because it is so far away from the world supply centres. Foreign producers might therefore be encour-

Table 182

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE FOOD MANUFACTURING INDUSTRIES

(Value in millions of soles at 1955 prices; decenial rates of increase in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	833.0	815.5	1 758.3	—	3 406.8	1 343.7	61	1 321.6	62	3 487.2	98	—	—	6 152.5	81
	P	678.4	815.5	1 454.5	—	2 948.4	1 081.3	59	1 321.6	62	2 893.2	99	—	—	5 296.1	80
	I	154.0	—	303.8	—	458.4	262.4	70	—	—	594.0	96	—	—	856.4	87
	P/D	(81)	(100)	(83)	—	(87)	(80)	—	(100)	—	(83)	—	—	—	(86)	—
Slaughtering of livestock and processing of meat	D	—	—	339.5	—	339.5	—	—	—	—	529.0	56	—	—	529.0	56
	P	—	—	286.5	—	286.5	—	—	—	—	446.0	56	—	—	446.0	56
	I	—	—	53.0	—	53.0	—	—	—	—	83.0	56	—	—	83.0	56
	P/D	—	—	(84)	—	(84)	—	—	—	—	(84)	—	—	—	(84)	—
Dairy products	D	46.6	—	167.0	—	213.6	84.7	81	—	—	262.0	57	—	—	346.7	62
	P	—	—	120.0	—	120.0	—	—	—	—	184.0	53	—	—	184.0	53
	I	46.6	—	47.0	—	93.6	84.7	81	—	—	78.0	66	—	—	162.7	74
	P/D	(0)	—	(72)	—	(56)	(100)	—	—	—	(70)	—	—	—	(53)	—
Fruit and vegetable preserving	D	—	—	20.0	—	20.0	—	—	—	—	50.0	150	—	—	50.0	150
	P	—	—	—	—	—	—	—	—	—	26.0	—	—	—	26.0	—
	I	—	—	20.0	—	20.0	—	—	—	—	24.0	20	—	—	24.0	20
	P/D	—	—	(0)	—	(0)	—	—	—	—	(52)	—	—	—	(52)	—
Fish freezing	D	—	25.0	—	—	25.0	—	—	28.5	14	—	—	—	—	28.5	14
	P	—	25.0	—	—	25.0	—	—	28.5	14	—	—	—	—	28.5	14
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	—	(100)	—	—	(100)	—	—	(100)	—	—	—	—	—	(100)	—
Fish canning	D	—	138.0	20.0	—	158.0	—	—	250.0	81	56.0	180	—	—	306.0	94
	P	—	138.0	19.0	—	157.0	—	—	250.0	81	53.0	179	—	—	303.0	93
	I	—	—	1.0	—	1.0	—	—	—	—	3.0	200	—	—	3.0	200
	P/D	—	(100)	(95)	—	(99)	—	—	(100)	—	(95)	—	—	—	(99)	—
Fish meal	D	3.0	34.0	—	—	37.0	7.8	160	134.1	294	—	—	—	—	141.9	284
	P	3.0	34.0	—	—	37.0	7.8	160	134.1	294	—	—	—	—	141.9	284
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	—	—	(100)	(100)	—	(100)	—	—	—	—	—	(100)	—
Fish oils	D	1.0	12.0	—	—	13.0	—	—100	—	—	49.0	308	—	—	49.0	308
	P	1.0	12.0	—	—	13.0	—	—100	—	—	49.0	308	—	—	49.0	308
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	—	—	(100)	—	—	—	—	(100)	—	—	—	(100)	—

Grain mill products	D	464.4	—	247.0	—	711.4	739.0	59	—	—	391.3	59	—	—	1 130.3	59
	P	264.4	—	234.0	—	698.4	739.0	59	—	—	391.3	67	—	—	1 130.3	62
	I	—	—	13.0	—	13.0	—	—	—	—	—	−100	—	—	—	−100
	P/D	(100)	—	(88)	—	(98)	(100)	—	—	—	(100)	—	—	—	(100)	—
Flour or bakery products	D	—	—	207.0	—	207.0	—	—	—	—	329.2	59	—	—	329.2	59
	P	—	—	207.0	—	207.0	—	—	—	—	329.2	59	—	—	329.2	59
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	—	—	(100)	—	(100)	—	—	—	—	(100)	—	—	—	(100)	—
Sugar.	D	143.0	606.5	90.0	—	839.5	225.3	58	909.0	50	128.7	43	—	—	1 263.0	50
	P	143.0	606.5	90.0	—	839.5	225.3	58	909.0	50	128.7	43	—	—	1 263.0	50
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	(100)	—	(100)	(100)	—	(100)	—	(100)	—	—	—	(100)	—
Cocoa, chocolate and sugar confectionery	D	—	—	96.0	—	96.0	—	—	—	—	134.0	40	—	—	134.0	40
	P	—	—	83.0	—	83.0	—	—	—	—	119.0	43	—	—	119.0	43
	I	—	—	13.0	—	13.0	—	—	—	—	15.0	15	—	—	15.0	15
	P/D	—	—	(86)	—	(86)	—	—	—	—	(89)	—	—	—	(89)	—
Oils and fats of agricultural origin.	D	—	—	364.8	—	364.8	—	—	—	—	935.0	156	—	—	935.0	156
	P	—	—	285.0	—	285.0	—	—	—	—	730.0	156	—	—	730.0	156
	I	—	—	79.8	—	79.8	—	—	—	—	205.0	156	—	—	205.0	156
	P/D	—	—	(78)	—	(78)	—	—	—	—	(78)	—	—	—	(78)	—
Animal feeds	D	67.0	—	—	—	67.0	109.2	63	—	—	—	—	—	—	109.2	63
	P	67.0	—	—	—	67.0	109.2	63	—	—	—	—	—	—	109.2	63
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	(100)	—	—	—	—	—	—	—	(100)	—
Other manufactured foodstuffs . .	D	108.0	—	207.0	—	315.0	177.7	64	—	—	623.0	202	—	—	800.7	154
	P	—	—	130.0	—	130.0	—	—	—	—	437.0	236	—	—	437.0	237
	I	108.0	—	77.0	—	185.0	177.7	64	—	—	186.0	142	—	—	363.7	97
	P/D	(0)	—	(63)	—	(41)	(0)	—	—	—	(70)	—	—	—	(55)	—
Artisan production	D	—	—	3 165.0	—	3 165.0	—	—	—	—	4 240.0	34	—	—	4 240.0	34
	P	—	—	3 165.0	—	3 165.0	—	—	—	—	4 240.0	34	—	—	4 240.0	34
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	—	—	(100)	—	(100)	—	—	—	—	(100)	—	—	—	(100)	—
Total.	D	833.0	815.5	4 923.3	—	6 571.8	1 343.7	61	1 321.6	62	7 727.2	57	—	—	10 392.5	58
	P	678.4	815.5	4 619.5	—	6 113.4	1 081.3	59	1 321.6	62	7 133.2	54	—	—	9 536.1	56
	I	154.6	—	303.8	—	458.4	262.4	70	—	—	594.0	96	—	—	856.4	87
	P/D	(81)	(100)	(94)	—	(93)	(81)	—	(100)	—	(92)	—	—	—	(83)	—

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955*; Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports.

aged to establish branches in Peru for rearing hybrids and also for distributing them to neighbouring countries.

The growth of sausage and canned meat production might likewise be stimulated by a more favourable beef price policy. As has already been said with reference to the industry in its present form, the worst quality beef in Peru—which could be used for sausages and canned meats—carries practically the same price as the highest-grade meat.

2. *Dairy products*

The development projections for dairy products have been centred mainly on the production of evaporated, condensed and powdered milk as being a more strictly industrial operation which is more dynamic than other milk-processing activities. Although the industry has grown considerably in the past (205 per cent between 1945 and 1955), its future development is limited by the difficulty of increasing the output of fresh milk. For projection purposes, it will be assumed that industrialization will have to expand at the same rate as the milk supply. As regards the increase in milk production between 1956 and 1965, the agricultural economists who collaborated with the mission established a maximum hypothesis of 260 million litres, an intermediate one of 200 million and a minimum one of 150 million. If the intermediate hypothesis is adopted as the more likely, production will rise by 53 per cent between 1955 and 1965. In the projections this increment has been applied entirely to milk for consumption as it appears to be relatively cheaper to import powdered milk for industrial use. Assuming that consumption grows with an elasticity of 0.98 or by 57 per cent during the period under consideration and that the demand for powdered milk for industry grows at the same rate as the demand for manufactured foods, imports would have increased by 74 per cent by 1965 and the share of domestic production in supply would have fallen from 56 per cent in 1955 to 53 per cent in 1965 (see table 182). According to this hypothesis, the production of condensed, evaporated or powdered milk would increase by 5 900 tons over the 1955 figure of 11 126. This increase in production could be achieved without building new factories, for those already in existence are operating at only 42 per cent of their capacity. If present productivity—which is very good—is maintained, the expansion would involve about 160 extra workers, excluding those employed in the manufacture of containers.

Other important products made from milk are butter and cheese; consumption of these foods increased by 100 per cent and 45 per cent respectively, during the period 1945-55. Assuming these rates and the present production-consumption ratio remain unchanged during the coming ten years, consumption would rise to 8 700 tons of butter and 13 900 tons of cheeses, of which 4 800 and 12 800 tons, respectively, would be of domestic manufacture. This development would entail an increase of some 50 per cent in the capacity of the butter-making plant and the modernization of much of the cheese-making equipment. The total investment necessary is estimated at some 20 million soles, and the increase in the labour force at some 320 persons.

As in the case of meat, the demand for dairy products assumed for the ten-year period 1955-65 is based on a past consumption which was severely limited, mainly by lack of raw materials. The only foreseeable advantage the production of milk will have over that of meat is that, over the short-term, it should be easier to increase the former in the coastal area. Here, unlike beef cattle, dairy herds can be kept on land used for other agricultural purposes (such as the cultivation of cotton and sugar-cane) or, at any rate, they can participate in the rotation system necessary to renew the nutrients in the soil and break up the biological cycle of pests.

In the more distant future, substantial increases in milk production are much less likely than in meat output because all the problems involved in dairy cattle-rearing in tropical zones—which seem best suited for long-term expansion in this branch—have not yet been solved.

3. *Fruit and vegetable preserving*

As stated in chapter V, section I, this industry has been unable to progress with the same intensity in Peru as in other countries owing to the scarcity of raw materials, especially of such fruit and vegetables as tomatoes, peas and peaches, which are essential for large-scale development. The Technical Assistance Administration expert who studied this sector nevertheless asserts that there are excellent opportunities for expansion at least in two places: firstly, the valley of the Cañete, which has the advantage of being near to the coast as well as to large markets and a possible source of domestic tinplate; and, secondly, the Cuzco region, which, apart from having abundant raw materials of first-class quality for the development of this industry, must in any case preserve its fruit and vegetables in order to be able to send them economically to the most important market, the Lima-Callao zone. The idea that canned products from Cuzco could not compete with fresh fruit and vegetables in the area surrounding the capital has no foundation. They have a separate market of their own and serve as a substitute for fresh produce which, in any case, is scarce.

In the model hypothesis of Peruvian development it has been assumed that the production of preserved fruit and vegetables will have to expand rapidly, although import substitution would not exceed 52 per cent because the growing popularity of canned goods in Peru, as in other Latin American countries, is expected to boost demand (150 per cent in 10 years).

Production would therefore amount to about 4 000

tons annually. Some 200 extra workers would have to be employed but the number of factories would not have to be greatly increased.

4. *Fish freezing*

The industrial development projections allow for a relatively slight increase (14 per cent in 10 years) in the freezing of fish for export. It is believed that this industry will in future find it increasingly difficult to compete on what is at present its main market—the United States. Indeed, both United States and Japanese fishermen are offering a much cheaper product. Furthermore, Peruvian producers fear that imports into the United States will become subject to an *ad valorem* tax to protect local fishing interests. Nor is there an appreciable margin for reducing the most important cost elements, such as fishing itself, freezing, and transport in refrigerated ships.

The small increase postulated could be achieved with existing equipment and manpower.

5. *Fish canning*

The canning of fish for export is one of the most promising of Peruvian industries; supplies are abundant and excellent in quality besides being easily marketable abroad. Nevertheless, as stated in Part Two, because of its high costs, this industry has found it very hard to compete with other similar products—mainly Japanese. Unlike the producers of frozen fish, who have no margin for cost reduction, canners could cut both their general operating outlay and that for the two most important inputs, the fish itself and the containers, which together represent 68 per cent of their total expenditure. The cost of the fish could be considerably reduced if large cold-storage plants were built in the main fishing ports. It could then be stored when abundant or sold to manufacturers at fair prices when in short supply. Both manufacturers and fishermen would benefit since fish prices would remain fairly constant throughout the year while factories could operate continuously, thus increasing their annual capacity and reducing their general costs per unit of product. Imported tinplate is mainly responsible for the high cost of containers. As can be seen from section XV of this chapter, the Chimbote mill could set aside a large part of its capacity for the manufacture of tinplate by the immersion process. The resulting product would be quite satisfactory and cheaper than that bought abroad. If Peru succeeded in reducing costs under these three heads—the fish itself, factory operation and containers—it could increase its sales on international markets and expand this industry as a natural consequence of its abundant fish resources.

For these reasons, Peru should make a real effort to maintain the growth of its fish-preserving industry, although perhaps not at the same rate as in the past. For projection purposes, it has been assumed that in the 1955-65 decade the industry might increase its production for export by 81 per cent instead of by 114 per cent as in the past. In that case, in 1965 Peru would be producing for export 2 320 000 cases (each of 48 half-pound tins) instead of the 1 280 000 it was producing in 1955.

Opportunities abound for producing more canned fish for the domestic market since there will undoubtedly be a meat shortage and since fish consumption is at present very low. Assuming that Peruvians consume five times as much meat protein as fish protein and that each person eats 27 kilogrammes of meat per year, a *per capita* annual figure of 15 kilogrammes is obtained as the minimum desirable [1] for the consumption of all types of fish. This is roughly twice the present figure (7.26). Supposing—conservatively—that, if the consumption of canned fish is doubled then total fish consumption will also double, the present deficit would amount to some 270 000 cases annually. If this figure is added to that of consumption in 1955—226 000 cases—and the resulting total projected for 1965 in accordance with likely population growth, domestic consumption would amount to 635 000 cases—an increase of 180 per cent over 1955. The increment in output for consumption (179 per cent) has been given as slightly less than that in demand to allow for imports of fish preserves which differ from those produced in Peru.

Projected production for export added to that for domestic market would be 2 950 000 cases annually by 1965, a total increase of 1 440 000 cases. If the factories can work regularly with the help of cold storage facilities, the production increment could be achieved with the existing packing plants. It is estimated that cold storage installations and further additions to capacity necessary for the fishing industry generally—including those involving products dealt with later—together with the additional shipping required, would entail an investment of 350 million soles and the employment of an additional 2 150 workers.

6. *Fish meal and fish oils*

Although the fish meal industry has been one of the most dynamic in Peru in recent years, its growth has had to be limited in the model development projections because the expansion of its productive capacity has been prohibited pending confirmation as to whether it interferes with the production of island guano by reducing the population of *anchovetas*—the fish on which the guano—producing seabirds feed. In 1955, the industry utilized about 27 per cent of its total capacity, which was estimated at 75 000 tons of fish meal annually. There is thus quite a wide margin for the increase of production up to the limit mentioned.

In projecting the output of fish meal as raw material for domestic consumption, the figure of 160 per

1 Assuming a relationship of 1:4 between the protein content of meat and that of fish.

cent has been taken as the ten-year rate, whereas that assumed for animal feeds in general was 63 per cent. Due allowance was made for the fact that larger amounts of this raw material are used in animal feeds and that deodorized fish meal is employed more extensively in the manufacture of bread and other foods for human consumption. This latter fact is of national importance for, if fish meal were used for such foods up to the limits normal in other countries, wheat imports would be at once reduced. Were domestic consumption to grow at the rate postulated, it would slightly exceed 2 000 tons by 1965. The surplus capacity—some 73 000 tons—could be used for export production.

The production of fish oil should increase at the same rate as that of fish meal, the former being a by-product of the latter. It has been assigned a somewhat higher rate in order to allow for the output of certain factories which do not at present recover oil but will be doing so by 1965. Given an oil-meal relationship of 33 per cent, the industry would in 1965 be producing about 25 000 tons of oil—an implied increase of 308 per cent over the 6 081 tons produced in 1955. It is assumed that the entire output would be used for domestic consumption for it is a well-known fact that by 1965 Peru will be finding it very hard to obtain enough fats.

7. *Grain mill and bakery products*

With only a few imports of wheat flour—the principal grain mill product—domestic production accounted for 98 per cent of total demand. If it is assumed that demand will have to increase with an elasticity of 1.00 (or by 59 per cent over the whole decade) and that domestic output will succeed in meeting all requirements, production between 1955 and 1965 will have to rise by 65 per cent. In other words, 200 000 tons will have to be produced in addition to the 324 000 tons milled in 1955. Present capacity being 500 000 tons a year, output would have to be raised by a mere 25 000 tons. This would entail an investment of 7 million soles (at 1955 prices) and an additional labour input of 230 workers.

The same rate of increase has been attributed to the demand for flour and bakery products as to that for grain mill products. It also coincides with the rate prevailing for those items during the past decade. If production—parallel with demand—expanded by 59 per cent in the ten-year period, some 4 500 tons would be added to the existing capacity of 7 745 tons. A maximum investment of 50 million soles and an additional labour input of 2 120 workers would be required. This large manpower figure is based on the assumption that small-scale mills will continue to predominate and that general productivity will not rise. The reduced quantities of alimentary pastes and biscuits now imported could be easily replaced by domestic production.

8. *Sugar*

In Part One the domestic consumption of sugar in 1965 was estimated at 278 000 tons, a figure based on a coefficient of elasticity of 0.5. Assuming a cultivated area of 89 400 hectares and a yield of 11 200 kilogrammes per hectare, in 1965 Peru should be able to produce approximately 1 million tons, 722 000 of which would be available for export. On the basis of these figures, the percentage increases in productive capacity necessary during the period 1955-65 have been worked out as follows: 50 per cent in production for export, 43 per cent in production for domestic consumption and 58 per cent in the production of sugar as a raw material for use in other industries, 50 per cent being the average for the expansion of the industry as a whole (see table 182). As the coefficient of utilization in 1955 was 81 per cent, the industry would have to increase its capacity by 163 000 tons annually in order to reach the level of production mentioned. An investment of 100 million soles[2] and an additional labour input of 6 770 workers would be required.

9. *Cocoa, chocolate and sugar confectionery*

Although Peru is a producer of cocoa and sugar, the next decade is unlikely to see much import substitution in this branch of industry because domestic production, based largely on artisan activities, will be unable, at least over the short term, to compete with higher-quality foreign products. An increase of 40 per cent in demand has been postulated. This corresponds to an elasticity of 0.73 per cent with respect to total consumption. It is expected that production will expand by 43 per cent, making possible a moderate advance in import substitution. On this assumption, the industry would have to produce 3 600 tons of cocoa and chocolate in addition to the 8 422 tons it produced in 1955. This expansion would not require substantial investment since existing plant capacity is more than sufficient. But some 350 more workers might perhaps have to be taken on.

10. *Tea and coffee processing*

Although the general outline made no special reference to the projections for tea and coffee processing plants (which were included under the heading "other products"), some idea of their possible future development is given in the following paragraphs.

Assuming the same ten-year rate of increase in tea consumption as in 1946-56 (83 per cent), demand in 1965 would be some 1 680 tons. This should be met entirely from domestic production. Processing plants would have to expand by 30 per cent of their present capacity; 10 million soles would have to be invested; and 200 additional workers engaged.

[2] Mainly for the electrification of mills and the modernization of the evaporation and centrifugation sections.

Domestic consumption of coffee increased by 86 per cent during the period 1946-56. If this rate were maintained, consumption would reach the figure of 10 000 tons in 1965. By then, production will probably fluctuate between 18 500 and 12 300 tons. Thus, even if the least favourable hypothesis is chosen, i.e. if production falls below the 1956 level, Peru would still be a net coffee exporter. It is assumed that an investment of only 10 million soles will be required to buy new equipment for some plant. The number of staff employed might well remain unchanged.

11. *Oils and fats of agricultural origin*

As can be seen from the section on edible oils and fats in chapter V, the *per capita* consumption of fats should be doubled if the people are to receive a normal intake. As the assumed rate of population increase for the period 1955-65 is 28 per cent, the production of edible oils and fats will have to increase by 156 per cent during the same period ($128 \times 2 - 100$) to ensure that consumption reaches normal levels. As Peru will find it hard to get enough oils and fats, at least over the short term, it has been assumed that oils and fats of agricultural origin will continue to be imported in the same proportion as in 1955, i.e. that domestic production must still cover 78 per cent of consumption. In this case, production will have to expand by 156 per cent (from 26 000 tons in 1955 to some 66 500 in 1965). Peru will therefore have to make a tremendous effort to obtain more oils and fats. The main problem will be the supply of raw materials for this industry. The output of cottonseed is at present very inadequate. It is expected to increase by only 44 per cent in the ten-year period whereas fat production should actually rise by 156 per cent. An alternative raw material will therefore have to be found on which to base the bulk of this industry. These figures show that both the Government and development bodies can play a vital role by encouraging planters to expand cultivation of sunflowers, coconuts and other oil-bearing species. The present capacity for the production of edible oils and vegetable fats is 34 000 tons in 300 days. In order to reach the proposed target of 66 500 tons in 1965, 40 000 additional tons will be required, assuming 90 per cent utilization of the equipment. An investment of 500 million soles and 2 000 extra workers would be needed. Despite this unprecedented growth, imports would increase from 29 000 to 74 000 tons annually.

12. *Animal feeds*

As has already been stated in connexion with meat and dairy products, raw materials for the production of concentrated animal feeds are in very short supply. Nevertheless, this industry may still have room for development since potential sources of such raw materials have not been fully exploited and hence more progress could have been made. The projections are based on the conservative assumption that production will increase slightly above the demand for meat and dairy products, i.e. at a rate of 63 per cent during the period

Table 183

PERU: EXPANSION OF CAPACITY, ADDITIONAL INVESTMENT AND EXTRA MANPOWER REQUIRED IN THE FOOD MANUFACTURING INDUSTRIES IN 1965

(Tons annually, numbers of workers, and millions of soles at 1955 prices)

Item or product	*Production in 1965*	*Capacity in 1955*	*Expansion required up to 1965*	*Additional workers in 1965*	*Additional investment up to 1965*
Slaughtering of livestock and processing of meat	183 000	120 000	63 000	260	100
Evaporation of milk	17 000	26 500	—	160	—
Butter and cheese	17 600	16 000	1 600 [a]	320	20 [a]
Fruit and vegetable preserving	4 000	more than 4 000	—	200	—
Fish freezing [b]	12 700	„ „ 12 700	—	—	—
Fish canning [c]	2 950	„ „ 2 950	[d]	2 150	350 [d]
Fish meal	75 000	75 000	—	— [e]	— [e]
Grain mill products	525 000	500 000	25 000	230	7
Flour or bakery products	12 245	4 500	7 745	2 120	50
Sugar	1 000 000	837 000	163 000	6 770	100
Cocoa, chocolate, confectionery	12 022	more than 12 022	—	350	—
Tea processing	1 680	1 290	390	200	10
Coffee processing	18 500	more than 18 500	—	—	10 [f]
Oils and fats of agricultural origin	66 500	34 000 [g]	40 000 [g]	2 050	380
Animals feeds	100 000	62 000	38 000	200	25
Other food products [h]	272	130	142	3 570	40 [i]
Total	—	—	—	*18 580*	*1 092*

SOURCE: Direct investigation.

a The expansion of capacity refers only to butter-making plants; investments include the modernization of equipment for the manufacture of cheese.
b Production and capacity expressed in terms of landed fresh fish.
c Production and capacity expressed in thousands of boxes each of 48 half-pound tins.
d The expansion required is in freezing and not canning and it is to the former that the additional investment figure refers.
e Manpower and additional investment included under the item fish canning.
f For the modernization of certain plants only.
g Maximum capacities the coefficient of utilization of which may be taken as 90 per cent.
h Values in millions of soles.
i Calculated at the rate of 165 000 soles worth of annual production per worker.

1955-65. Productive capacity would therefore have to rise from its present figure of 62 000 tons to 100 000 tons annually. An additional investment of 25 million soles and 190 more workers would be required.

Table 183 summarizes the physical expansion needs of the entire food industry and compares them with existing capacity. It shows, briefly, that an over-all increase in production of 60 per cent would require a considerably smaller increase in capacity because the present utilization of equipment is very low. It may therefore be said that the industry as a whole will boost its productivity more by converting artisan establishments into factories proper than by instituting additional and more advanced lines of production.

Table 182 summarizes the projections in constant 1955 values; all are expressed in a form which allows them to be related to the macro-economic projections for the industrial branch as a whole. These appear against the heading "Total" at the foot of the table and exactly correspond to those given in the input-output tables for 1955 and 1965.

II. BEVERAGE INDUSTRIES

1. *Distilling, rectifying and blending of spirits*

To judge by its past history, the beverages industry will not have to face a rapidly-growing demand in future, primarily because most Peruvians have come to prefer lighter and cheaper drinks such as beer. If they are to revert to their old habits, a strenous effort would have to be made to improve quality. But, as the general public seems to show no interest in stimulating the industry, it has been assumed that demand will grow merely at the same rate as the average for 1945-55. At the same time, the hypothesis has been advanced that there will be a moderate rise in import substitution represented by an increase from 90 to 93 per cent in the contribution of domestic output towards the satisfaction of demand. Production would therefore expanded by 34 per cent in the course of the period in question, i.e., approximately from 1 161 000 to 1 550 000 litres. Although the pertinent data are lacking, the industry is assumed to have a surplus productive capacity, so that no substantial increase would be required in either capital or labour inputs.

2. *Wine industries*

It would be worth while to carry out a technical study on the possibilities of developing specialized branches of wine production so that each type of grape would be cultivated where the climate was best suited to it. It might well prove that Peru could manufacture wines of the type produced in the Douro river valley in Portugal. These might perhaps be exported in exchange for table wines shipped to Peru from other Latin American countries where the conditions would be more appropriate for their production. Such a plan might arrest the marked deterioration in both the volume and quality of Peruvian output during the last few years. In the projections, a very slow rate of growth has been assumed for demand although, in actual fact, it exceeds that recorded in the past. Imports are taken to remain stationary. An increment of 7 per cent in production would thus be achieved during the period covered by the projections. No additional investment or manpower would be required.

3. *Breweries and malt manufacture*

Brewing has been one of Peru's most dynamic industries in the past. It expanded by 188 per cent between 1945 and 1955. However, towards 1955, its rate of growth began to slow down, possibly because beer had lost its initial popularity at least in so far as the important Lima-Callao market was concerned. A slower rate of growth—of only 99 per cent—has therefore been assumed for the future. Nevertheless, it is 20 per cent more than the figure which would be obtained if the elasticity that characterizes the growth of beer consumption in Mexico were applied to Peruvian statistics. Under these circumstances, beer production, which was 98 million litres in 1955, would reach 195 millions by 1965. Although utilization of installed capacity is only about 85 per cent on an average, this is because consumption—and hence production—vary considerably according to the season. It has therefore been supposed that the increase in production would be based on completely new capacity. It should be borne in mind that, unlike the marketing of carbonated beverages, the increased sale of beer is largely dependent on transport facilities within a whole area. A new brewery must have an extensive market with good communications. If existing transport routes were improved or new ones instituted, beer consumption might increase in areas where little is now drunk. Hence, expansion might be more rapid than that actually projected.

In order to assess the development possibilities open to maltsters, it has simply been assumed that malt and beer demand would follow parallel courses and that malt production would expand until complete import substitution had been achieved. If this assumption is correct, the rate of growth would be 500 per cent during the period in question, i.e., installed capacity would be raised to 14 750 tons annually from a mere 2 500 tons in 1955.

The additional capital and labour inputs required for the assumed expansions in brewing and malt manufacture would be about 180 million soles and 1 660 workers respectively.

4. *Soft drinks and carbonated waters*

The carbonated beverages industry has been assumed

Table 184

PERU: DEMAND PROJECTIONS AND DEVELOPMENT HYPOTHESES FOR THE BEVERAGES INDUSTRY

(Values in millions of soles at 1955 prices; ten-yearly rates of growth, expressed as percentages)

Item		Data for 1955					Hypothesis for 1965							
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investments		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing	D	78.3	0.1	471.1	—	549.5	154.3	97	—	—100	920.4	95	—	—	1 074.7	96
	P	48.2	0.1	447.1	—	495.4	126.1	161	—	—100	909.4	103	—	—	1 035.5	109
	I	30.1	—	24.0	—	54.1	28.2	— 6	—	—	11.0	— 54	—	—	39.2	— 28
	P/D	(62)	(100)	(95)	—	(90)	(82)	—	—	—	(99)	—	—	—	(96)	—
Distilling, rectifying and blending of spirits	D															
	P	20.2	—	74.0	—	94.2	27.1	34	—	—	96.0	30	—	—	123.1	31
	P	20.2	—	65.0	—	85.2	27.1	34	—	—	87.0	34	—	—	114.1	34
	I	—	—	9.0	—	9.0	—	—	—	—	9.0	—	—	—	9.0	—
	P/D	(100)	—	(88)	—	(90)	(100)	—	—	—	(91)	—	—	—	(93)	—
Wine industry	D	2.0	0.1	12.0	—	14.1	2.0	—	—	—100	13.0	8	—	—	15.0	6
	P	2.0	0.1	10.0	—	12.1	2.0	—	—	—100	11.0	10	—	—	13.0	7
	I	—	—	2.0	—	2.0	—	—	—	—	2.0	—	—	—	2.0	—
	P/D	(100)	(100)	(83)	—	(86)	(100)	—	—	—	(85)	—	—	—	(87)	—
Brewing	D	—	—	288.0	—	288.0	—	—	—	—	573.4	99	—	—	573.4	99
	P	—	—	288.0	—	288.0	—	—	—	—	573.4	99	—	—	573.4	99
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	—	—	(100)	—	(100)	—	—	—	—	(100)	—	—	—	(100)	—
Malt manufacture	D	30.1	—	—	—	30.1	60.0	99	—	—	—	—	—	—	60.0	99
	P	10.0	—	—	—	10.0	60.0	500	—	—	—	—	—	—	60.0	500
	I	20.1	—	—	—	20.1	—	—100	—	—	—	—	—	—	—	—100
	P/D	(33)	—	—	—	(33)	(100)	—	—	—	—	—	—	—	(100)	—
Soft drinks and carbonated waters	D	26.0	—	84.1	—	110.1	65.2	151	—	—	238.0	183	—	—	303.2	175
	P	16.0	—	84.1	—	100.1	37.0	131	—	—	238.0	183	—	—	275.0	175
	I	10.0	—	—	—	10.0	28.2	182	—	—	—	—	—	—	28.2	182
	P/D	(62)	—	(100)	—	(91)	(57)		—	—	(100)	—	—	—	(91)	—
Other products of the beverages industry	D	—	—	13.0	—	13.0	—	—	—	—	—	—100	—	—	—	—100
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	—	—	13.0	—	13.0	—	—	—	—	—	100	—	—	—	—100
	P/D	—	—	(0)	—	(0)	—	—	—	—	—	—	—	—	—	—
Artisan activities	D	—	—	88.0	—	88.0	—	—	—	—	113.0	28	—	—	113.0	28
	P	—	—	88.0	—	88.0	—	—	—	—	113.0	28	—	—	113.0	28
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	—	—	(100)	—	(100)	—	—	—	—	(100)	—	—	—	(100)	—
Total	D	78.3	0.1	559.1	—	637.5	154.3	97	—	—100	1 033.4	85	—	—	1 187.7	86
	P	48.2	0.1	535.1	—	583.4	126.1	162	—	—100	1 022.4	91	—	—	1 148.5	97
	I	30.1	—	24.0	—	54.1	28.2	— 6	—	—	11.0	— 54	—	—	39.2	— 27
	P/D	(62)	(100)	(96)	—	(92)	(82)	—	—	—	(99)	—	—	—	(97)	—

SOURCE: Ministry of Development and Public Work (*Ministerio de Fomento y Obras Públicas*), *Estadistica Industrial 1955*; Ministry of Finance and Trade (*Ministerio de Hacienda y Comercio*), *Estadistica de Comercio Exterior 1955*.

Symbols: D: Demand; P: Production; I: Imports; P/D: Ratio of production to demand, expressed as a percentage.

Table 185

PERU: ADDITIONAL CAPACITY, INVESTMENT AND LABOUR REQUIRED BY THE BEVERAGES INDUSTRY IN 1965
(Annual litres, millions of soles at 1955 prices and number of workers)

Item	*Production in 1965*	*Capacity in 1955*	*Additional capacity required up to 1965*	*Additional labour force required up to 1965*	*Additional investment required up to 1965*
Distilling, rectifying and blending of spirits	1 550 000	more than 1 550 000	—	—	—
Wine industry	12 000	more than 12 000	—	—	—
Brewing	195 000 000	98 000 000	97 000 000	1 660 [a]	180 [a]
Malt manufacture [b]	14 750	2 500	12 250	[c]	[c]
Soft drinks and carbonated waters	155 000 000	100 000	55 000	2 330	100
Total	—	—	—	3 990	280

SOURCES: Direct research.
a Including the expansion in malt manufacture.
b Annual tons.
c Included in the expansion of brewing.

to be more dynamic than brewing because it can get a better foothold in new markets notwithstanding their being isolated from the main population centres as a result of poor means of transport. Indeed, this branch of manufacturing can be completely decentralized even though its markets are relatively unimportant. The equipment required is small and inexpensive while the principal raw materials—essences and carbonic gas—cost very little to transport per unit of product, however bad the communications. The rate of growth assumed for consumption—183 per cent—would raise production of mineral and carbonated waters from 55 million litres in 1955 to 155 million in 1965. It has also been assumed that a small proportion of the raw materials needed by the industry and produced locally would be replaced by imports, since essences brought in by the big companies, which are gradually monopolizing the market, are tending to oust domestic products.

As the industry utilizes only a relatively small proportion of its installed capacity—an annual average of 90 per cent for one shift per day—the plant expansion would be proportionately far less than that of production. On the basis of the adjustment required to bring capacity up to the right level for the anticipated volume of production, it is estimated that investment would not exceed 100 million soles. The labour force would have to be augmented by about 2 330 workers.

Table 184 groups together the hypotheses of development in demand and production so as to bring them into line with the macro-economic projections prepared with the aid of input-product tables for 1955 and 1965. Table 185 recapitulates the expansion requirements in regard to productive capacity, investment and labour.

III. TOBACCO MANUFACTURES [3]

It has been assumed that demand for tobacco manufactures will grow at the same annual rate as in 1950-56, i.e. 59 per cent in all between 1955 and 1965. If this industry is to develop in the future, it will have to tackle the problem of how to compete in quality with foreign manufactures which have gradually been gaining ground in the last few years. It can probably do so, provided it uses higher-grade leaf, even at the cost of increased imports, and modernizes its plant so that the margin left by the resulting cost reductions would cover the extra outlay on tobacco. In these conditions, the share of demand that could be satisfied by local output would probably expand from 91 per cent (its level in 1955) to 95 per cent in 1965. In other words, production would have to increase by about 66 per cent during that period (an addition of 2 540 tons to the 3 841 tons manufactured annually in 1955). The feasibility of this rate of development is borne out by the experience of other Latin American countries. Mexico, for example, manages to product cigarettes that compete successfully with foreign brands, although in some cases a large amount of imported tobacco is used and even the trademark of foreign firms adopted. This type of industry benefits the country mainly by employing considerable numbers of local workers.

Although only about 42 per cent of existing equipment is utilized and the industry has sufficient capacity for the increment envisaged in 1965, it is estimated that 50 per cent of the machinery would have to be replaced at a cost of some 30 million soles, if production is to become economic.

In spite of its relatively modest dimensions, the industry would have to be completely reorganized in order to reach the target set. The introduction of faster machines might facilitate substantial manpower reductions, even though production were to increase

[3] Since the projections do not contain a break-down of the industry's output by product or destination, it has not been thought necessary to present the data in tabular form as in other sections. The figures referring to the projections, expressed in terms of value, may be found in chapter VII, in the input-product model for 1965 (table 179).

as anticipated. Nevertheless, it has been conservatively assumed that productivity would fall short of the ideal level and that the factories would therefore have to employ the same number of workers as in 1955.

IV. MANUFACTURE OF TEXTILES

1. *Soft-fibre flat yarns and fabrics*

The growth of demand for soft-fibre textiles in the past can be measured by adding imports of made-up goods to consumption of cotton, wool and artificial fibre textiles in two years as far apart as 1956 and 1946 (see chapter V, tables 86 and 99). The ten-year rate of growth which emerges from this comparison (59 per cent) might be suitable for projecting aggregate textile consumption up to 1965 since it would be tantamount to adopting an elasticity coefficient of 1.00, which is slightly higher than that used for similar projections in other countries. However, in the case of Peru, there is reason to believe that the consumption of textiles has been depressed in the past because they have been too dear. For this reason, and also because the present study assumes that radical changes making for a reduction in costs and prices are going to take place in the textile industry, it has been supposed that internal consumption of textiles, either directly or through the made-up goods industry, will expand at the decennial rate of 70 per cent. The same figure would be obtained if the estimate were based on an elasticity coefficient of 1.14.

Given this aggregate rate of growth, the next problem is how to estimate the increase in consumption of each kind of fibre. Future trends will undoubtedly be quite different from those in the past and some fibres will thus be largely replaced by others. The use of cotton has hitherto increased at the relatively low ten-year rate of 37 per cent chiefly because of heavy competition from artificial fibres. This trend is expected to improve considerably, however, since the modernization and reorganization of the mills will put better and cheaper products at the consumer's disposal. The position of cotton will also be influenced by modern ways of treating fabrics during the finishing process. For example, by making them creaseless and unshrinkable, they will help cotton to compete more successfully with artificial fibres. For these reasons, it has been assumed that internal demand for cotton yarns and fabrics will expand at the rate of 44 per cent in ten years.

Wool is in a similar position to cotton in that its consumption was slow to increase in the past owing to its relatively high fabric prices and its inability to compete with synthetic products. There are two factors which may accelerate the growth of consumption. Firstly—and this holds good for cotton too—wool costs and prices may possibly be lowered if machinery is completely modernized and the industry reorganized from the stage of raw material supplies to that of fabric distribution. The other factor is the growing tendency to mix wool with synthetic fibres, thereby reducing the price of knitted goods and giving them characteristics which they would not have if made of pure wool. In this respect, artificial fibres, instead of competing with wool, help to boost its sales. A decennial rate of growth of 82 per cent has therefore been supposed for woollen yarns and fabrics instead of 56 per cent as before.

The consumption of artificial-fibre products themselves will not increase at the same exceptional rate as in the past (506 per cent). That rate was attributable, on the one hand, to the conditions prevailing during the introductory period when artificial fabrics replaced all those that could be easily ousted and, on the other, to the coincidence of that period with the

Table 186

PERU: PROBABLE GROWTH OF TEXTILE DEMAND AND ITS DISTRIBUTION AMONG MANUFACTURERS OF DIFFERENT FIBRES [a]

(Annual tons)

Type of fibre	*Internal demand in 1955*	*Decennial rate of growth of internal demand (Percentage)*	*Increment of internal demand*	*Increment of exports*	*Total demand in 1965*	*Decennial rate of growth of internal demand (Percentage)*
Textiles [a]	(19 320)	86	(13 747)	(2 250)	(35 317)	83
Cotton	14 381	44	6 340	2 160	22 881	59
Wool	2 148	82	1 760	90	3 998	86
Cut fibre	1 487	317	4 733	—	6 220	317
Filament	1 304	70	914	—	2 218	70
Net foreign trade balance: made-up goods [b]	278	— 33	— 92	—	186	— 33
Total	19 598	70	13 655	2 250	35 503	81

SOURCES: Data for 1955: chapter V, tables 86 and 89.

a Excluding hard-fibre fabrics and knitted goods.

b Made-up goods have been included in this estimate so as to give a more complete picture of internal demand.

Table 187

PERU: PROJECTION OF DEMAND AND HYPOTHESIS OF THE DEVELOPMENT OF THE TEXTILE INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products (Value)	Exports (Value)	Consumption (Value)	Investment (Value)	Total (Value)	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	502.0	3.2	1 043.2	—	1 548.4	1 088.3	117	103.7	3 141	1 801.6	73	—	—	2 993.6	93
	P	414.1	3.2	837.0	—	1 254.3	917.5	121	103.7	3 141	1 771.9	111	—	—	2 793.1	122
	I	87.9	—	106.2	—	294.1	170.8	94	—	—	29.7	— 86	—	—	200.5	— 32
	P/D	(82)	(100)	(80)	—	(81)	(84)	—	(100)	—	(98)	—	—	—	(93)	—
Flat cotton yarns and fabrics	D	310.5	1.0	280.7	—	592.2	462.4	49	88.7	8 770	387.6	38	—	—	938.7	59
	P	275.8	1.0	215.2	—	492.0	418.0	52	88.7	8 770	369.3	72	—	—	876.0	76
	I	34.7	—	65.5	—	100.2	44.4	28	—	—	18.3	— 72	—	—	62.7	— 37
	P/D	(89)	(100)	(77)	—	(83)	(90)	—	(100)	—	(95)	—	—	—	(92)	—
Flat wollen yarns and fabrics	D	117.6	2.2	260.8	—	380.6	257.5	119	15.0	582	434.3	67	—	—	706.8	86
	P	97.5	2.2	219.4	—	319.1	219.4	125	15.0	582	424.3	94	—	—	658.7	106
	I	20.1	—	41.4	—	61.5	38.1	90	—	—	10.0	— 76	—	—	48.1	— 22
	P/D	(83)	(100)	(84)	—	(84)	(85)	—	(100)	—	(98)	—	—	—	(93)	—
Flat cut-fibre yarns and fabrics [a]	D	26.0	—	135.0	—	161.0	156.8	503	—	—	515.3	280	—	—	672.1	317
	P	14.5	—	84.7	—	99.2	126.6	773	—	—	515.3	508	—	—	641.9	546
	I	11.5	—	50.3	—	61.8	30.2	163	—	—	—	—100	—	—	30.2	— 51
	P/D	(56)	—	(62)	—	(62)	(81)	—	—	—	(100)	—	—	—	(96)	—
Flat fabrics woven from artificial filament	D	18.3	—	174.6	—	192.9	112.9	517	—	—	215.0	23	—	—	327.9	70
	P	12.5	—	149.5	—	162.0	90.0	620	—	—	215.0	44	—	—	305.0	88
	I	5.8	—	25.1	—	30.9	22.9	295	—	—	—	—100	—	—	22.9	— 26
	P/D	(68)	—	(86)	—	(84)	(80)	—	—	—	(100)	—	—	—	(93)	—
Flat hard-fibre yarns and fabrics	D	14.0	—	4.3	—	18.3	50.6	262	—	—	6.8	59	—	—	57.4	212
	P	5.0	—	2.0	—	7.0	26.4	428	—	—	6.8	240	—	—	33.2	374
	I	9.0	—	2.3	—	11.3	24.2	169	—	—	—	—100	—	—	24.2	114
	P/D	(36)	—	(47)	—	(38)	(52)	—	—	—	(100)	—	—	—	(58)	—
Knitted goods	D	1.1	—	170.4	—	171.5	23.5	2 036	—	—	213.0	25	—	—	236.5	38
	P	0.3	—	157.7	—	158.0	23.5	7 733	—	—	213.0	35	—	—	236.5	50
	I	0.8	—	12.7	—	13.5	—	—100	—	—	—	—100	—	—	—	—100
	P/D	(27)	—	(93)	—	(92)	(100)	—	—	—	(100)	—	—	—	(100)	—
Cordage	D	14.5	—	17.4	—	31.9	24.6	70	—	—	29.6	70	—	—	54.2	70
	P	8.5	—	8.5	—	17.0	13.6	60	—	—	28.2	232	—	—	41.8	146
	I	6.0	—	8.9	—	14.9	11.0	83	—	—	1.4	— 84	—	—	12.4	— 17
	P/D	(59)	—	(49)	—	(53)	(55)	—	—	—	(95)	—	—	—	(77)	—
Artisan activities	D	134.8	—	459.5	—	594.3	156.4	16	—	—	639.6	39	—	—	796.0	34
	P	134.8	—	459.5	—	594.3	156.4	16	—	—	639.6	39	—	—	796.0	34
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	—	(100)	(100)	—	—	—	(100)	—	—	—	(100)	—
Total	D	636.8	3.2	1 502.7	—	2 142.7	1 244.7	95	103.7	3 141	2 441.2	62	—	—	3 789.5	77
	P	548.9	3.2	1 296.5	—	1 848.6	1 073.9	96	103.7	3 141	2 411.5	86	—	—	3 589.0	94
	I	87.9	—	206.2	—	294.1	170.8	94	—	—	29.7	— 86	—	—	200.5	— 32
	P/D	(86)	(100)	(86)	—	(86)	(86)	—	(100)	—	(99)	—	—	—	(95)	—

Sources: Data for 1955: Ministry of Development and Public Works (*Ministerio de Fomento y Obras Públicas*), *Estadística industrial 1955* and Ministry of Finance and Trade (*Ministerio de Hacienda y Comercio*), *Estadística de comercio exterior 1955*.

Symbols: D: Demand; P: Production; I: Imports; P/D: Relation of production to demand as a percentage.

a Production and import figures for 1965 have been estimated at approximately average prices for 1955 in order to give the domestic textile industry a larger share in the manufacture of fabrics of higher value per unit of weight.

stage at which natural fibres had not yet built up any defence by resorting to blends with artificial fibres or the use of processes designed to improve the characteristics and quality of the fabrics. It has therefore been assumed that aggregate artificial fibre consumption would have a lower rate of growth (200 per cent), although it would far exceed that of other fibres. Among such fibres as a whole, it was decided to allot a very rapid rate of growth (317 per cent) to cut fibre consumption and a fairly slow one (70 per cent) to filament consumption. The disparity is due to the marked trend in favour of cut fibres, since fabrics of acetate or other types of rayon are becoming more popular, and are in increasing demand for mixing with natural fibres. Conversely, the use of filament is becoming more and more restricted to certain types of fabric, and is rapidly ceding to that of cut fibres or cotton for the other kinds.

The volume of exports which is thought to be attainable in 1965 should be considered side by side with internal textile demand. As pointed out in chapter V, Peru should profit from the advantages which its textile industry enjoys over those of other countries in having at its disposal long-fibre cotton and alpaca wool, and try to export manufactures based on these two raw materials. It is estimated that by 1965 Peru could export over 2 000 tons annually of fine yarns, sewing thread and poplins woven with combed cotton yarn, as well as approximately 100 tons of alpaca yarns and fabrics and possibly a few specialities made with mixtures of alpaca hair and other fibres.

Table 186 groups the different rates which have been estimated for the growth of demand up to 1965, and can be used for projecting the respective quantums of the various types of textiles. The resulting rates of growth for total demand were utilized to project the values in table 187.

A study of the industry's possibilities of improving both volume and quality of output in the future indicates that the ratio of production to demand might be raised substantially. In 1955, it was about 84 per cent for cotton, wool and woven filament and 62 per cent for cut-fibre yarns and fabrics. It is thought that the industry could easily reach a production percentage which would vary from 92 per cent in the case of cotton to 96 per cent in that of cut fibres. This is the assumption which has been adopted in preparing the projections for soft-fibre yarns and fabrics in table 187. Here, further details are given concerning the percentages which would correspond to the domestic production of raw materials for textiles, and the manufacture of textiles for export and internal consumption. Table 188 was assembled on the basis of these ratios and of the rates of growth for demand. It includes, expressed in quantum terms, projections for soft-fibre textile production up to 1965. It shows that, by 1965, production for flat yarns and fabrics from soft fibres would have to double; that the most notable expansion in absolute terms would be in the cotton industry (which would have to add 10 000 tons a year to the 13 119 produced in 1955); and that the most important development, relatively speaking, would take place in the production of cut-fibre flat yarns and fabrics, which would have a volume four and a half times greater than in 1955. A comparison will be made later between the estimated development of production and existing capacity.

2. *Knitted goods*

The knitted goods branch has been dealt with separately from cotton and other fabrics as it represents a primary demand not for fibres but for products of the other textile branches which have just been considered. A relatively low rate of growth (38 per cent) has been assumed for knitted goods demand, since much of its development will take place in artisan production, particularly of woollens. Nevertheless, the whole of production has been assumed to be domestic in origin by 1965. Indeed, given the characteristics of the industry in Peru—very small scales of economic production—it may even by then be turning out specialities which command a restricted market.

3. *Hard-fibre fabrics and cordage*

Peruvian demand for hard-fibre fabrics may be divided into two parts: what may be termed "real" demand, which consists of sacking needed for the manufacture of bags for packing cotton and various other products for internal consumption, and "poten-

Table 188

PERU: PROBABLE GROWTH OF PRODUCTION OF SOFT-FIBRE FLAT YARNS AND FABRICS

(Annual tons)

Item	*Production in 1955*	*Decennial rate of growth of production (Percentage)*	*Production increment*	*Production in 1965*
Flat cotton yarns and fabrics	13 119	76	10 000	23 119
Flat woollen yarns and fabrics	1 930	106	2 040	3 970
Flat cut-fibre yarns and fabrics	1 275	367	4 675	5 950
Flat fabrics woven from filament	1 304	88	1 150	2 454
Total	*17 628*	*102*	*17 865*	35 493

SOURCES: Data for 1955: tables 87, 88 and 89.

tial" demand, which represents sacks for exports, principally sugar. In spite of its problems (which will be discussed later), the market for the former group naturally offers a solid foundation for the future development of the industry, whereas the manufacture of sacks for export products is not yet susceptible of transformation into a market with "real" demand. The goods for which the sacks serve as wrapping can enter the country duty-free and their present prices are lower than the products of Peruvian industry which is still in an early stage of development.

In order to establish the hypothetical growth of demand for hard-fibre fabrics, it has none the less assumed that by 1965 at least a quarter of the jute sacks consumed annually (3 000 tons) would be produced domestically and could therefore absorb materials made in Peru. This assumption is not based on the current situation of the industry and its market, but on the conviction that future policy should favour the gradual nationalization of sacking and sack production. Such a step would be justified because this industry represents an outflow of foreign exchange amounting to more than 70 million soles; it concerns materials that are essential for Peruvian exports and should therefore be supplied from domestic sources; and lastly, the industries which produce sacking and sacks—together with other textiles—absorb a large labour force which does not require costly training.

On these grounds, it has been estimated that demand for hard-fibre fabrics to serve as raw materials and intermediate products for industry would be 47 per cent more than at present (1 400 tons), thereby keeping pace with the production of cotton which is the principal consumer. In addition, as already stated, 3 000 tons would constitute the raw material for export sacks. Fabrics for consumption have been assumed to grow at the same rate as cotton fabrics since they have the same type of market (chiefly wearing apparel). To sum up, demand for hard-fibre fabrics in 1965 has been estimated at 5 740 tons, which represents an increment of 212 per cent over the 1955 level (see table 189).

Peru's chances of expanding the manufacture of sacking—and perhaps that of sacks as well—are impeded by its present shortage of raw materials. This is a problem which ought to be solved without delay, for the interests of foreign exporters of hard-fibre fabrics make it unlikely that Peru can depend upon a supply of cheap fibre in future. It is therefore essential to adopt a policy of promoting the cultivation of hard fibres, which are thought to have a market in Peru, although no reliable investigation has yet been made on this point.[4] Jute is currently grown in the neighbourhood of Iquitos and kenaf in Bagua, a department on the Amazon. The crops are very small, being chiefly of an experimental nature, and give rise to serious problems. Jute cultivation, for instance, is hampered by the difficulty of obtaining labour in Iquitos when required. Furthermore, the fibre has to be transported across the cordillera and over long distances beyond before reaching its utilization centres. Kenaf production has to overcome the technical problems of retting and other processing operations. The idea of planting kenaf in the Tumbes area, on the north-west border of the country, has been ruled out because the crop, being malvaceous, may act as a stepping-stone over which the plagues which harass the cotton plantations in Ecuador can cross to those in Peru. There is the possibility—still uninvestigated—of planting jute still within the Tumbes region but in much more suitable conditions than those of the Iquitos area.

Briefly, the cultivation of hard fibres will need considerable encouragement, but it may be the answer to the biggest problem facing an industry which has ample scope for expansion. As to the possibilities of producing hard-fibre fabrics, a rate of growth of 374 per cent has been assumed up to 1965, which is equivalent to raising the proportion of domestic production that satisfies demand from 38 to 58 per cent. In these conditions, the industry would have to add some 2 600 tons by 1965 to the output of 700 achieved in 1955. The reason for expecting such a rapid rate of

[4] The ECLA mission has suggested that the Peruvian Government should undertake a study, firstly, to determine the technological properties of existing fibres, and secondly, to examine the ecology of certain districts of Peru in order to decide whether they are suitable for growing jute, kenaf and other hard fibres. For this purpose, the wide experience, both positive and negative, acquired by other countries, such as Mexico, might be drawn upon.

Table 189

PERU: PROBABLE GROWTH OF DEMAND FOR AND PRODUCTION OF HARD-FIBRE YARNS AND FABRICS

(Annual tons;[a] rates of growth expressed as percentages)

	1955			*Hypothesis for 1965*					
	For raw materials and intermediate products	*For consumption*	*Total*	*For raw material and intermediate products*		*For consumption*		*Total*	
				(Tons)	*(Rate)*	*(Tons)*	*(Rate)*	*(Tons)*	*(Rate)*
Demand	1 400	4 300	1 830	5 060	262	680	59	5 740	212
Production	500	2 000	700	2 640	428	680	240	3 320	374
Imports	900	2 300	1 130	2 420	169	—	—100	2 420	114
Ratio of production demand	(36)	(47)	(38)	(52)	—	(100)	—	(58)	—

a In order to simplify the estimates, production has been expressed in terms of average equivalent tons which do not correspond exactly to the real figures but reflect the approximate number of machine/hours required.

Table 190

PERU: CAPACITY OF TEXTILE MACHINERY REQUIRED IN 1965

Item	Total annual production (Tons)	Spinning mills			Weaving mills			
		Annual production (Tons)	Average yield per spindle/year (Kg)	Number of spindles required	Usual ratio of fabric to yarn	Annual production (Tons)	Average yield per loom/year (Tons)	Number of looms required
Cotton	23 119	23 119	110	210 000	0.75	17 300	3.5	4 950
Wool	3 970	3 970	140	28 400	0.78	3 100	3.0	1 030
Cut fibre	5 950	5 950	185	32 200	1.00	5 950	2.8	2 120
Filament	2 454	—	—	—	—	2 454	2.8	880
Hard fibres	3 320	3 320	350	9 500	1.00	3 320	12.0	280
Total	*38 813*	*36 359*	—	*280 100*	—	*32 124*	—	*9 260*

development, which would raise production four times above its actual level, is that, in attempting to balance supply and demand in respect of domestic fibres, Peru would first have to create the capacity to absorb such fibres before it could set up incentives to expand the plantations. In other words, it would have to break the vicious circle which consists of the non-production of fibres because of the lack of sufficient manufacturing capacity to utilize them, and the lack of such capacity because of the non-existence of domestic raw materials.

The projections of demand, production and imports, expressed in physical terms, are summarized in table 189, and their values in table 187 which links these projections with those for the rest of the textile industry.

The cordage industry would also benefit from the development of new sources of raw materials, although not as much as hard-fibre fabrics. At present, it is partly dependent on *cabuya*, a type of agave which is also used for coarse materials. Demand for cordage products has been assumed to rise at the rate of 70 per cent in harmony with that of over-all economic development. Production, on the other hand, will grow by 146 per cent if the proportion of demand satisfied by the industry is to be increased from 53 to 77 per cent. These projections, which differentiate between output for raw materials and output for consumption, are given in table 187.

4. *Estimated machinery and labour requirements*

On the basis of the production projections mentioned above, an estimate has been made of total spindle and loom requirements in each branch of the textile industry (see table 190). Given an estimate which takes into account the yields per spindle and per loom corresponding to modern machinery, the respective totals arrived at are 280 100 spindles and 9 260 looms. These productive capacity requirements are compared in table 191 with the number of spindles and looms belonging to the industry at present, which can probably be used up to 1965 or even later, since they are modern and in a good state of repair. By means of a branch-by-branch comparison, it may be concluded that by 1965, 217 250 new spindles and 5 000 new looms would have to be added to existing machinery. It must be stressed here that, as indicated in chapter V, a large proportion of the industry's equipment, except in the case of machinery for cut fibre and for weaving hard fibre, is obsolete and should be immediately replaced by modern equipment. In this way, the industry, which already has the advantage of being able to depend upon raw materials of excellent quali-

Table 191

PERU: NEW MACHINERY REQUIRED BY THE TEXTILE INDUSTRY UP TO 1965

Machinery and equipment	Existing capacity in 1957	Obsolete machinery due for replacement	Existing capacity in 1957 which would continue to operate	Capacity required in 1965	New machinery required to 1965
Cotton spindles	195 360	148 360	47 000	210 000	163 000
Wool spindles	57 050	52 850	4 200	28 400	24 200
Cut-fibre spindles	10 950	—	10 950	32 200	21 250
Hard-fibre spindles	2 361	1 661	700	9 500	8 800
Total spindles	*265 721*	*202 871*	*62 850*	*280 100*	*217 250*
Cotton looms	6 081	2 381	3 700	4 950	1 250
Wool looms	908	788	120	1 030	910
Artificial-fibre looms	1 121	761	360	3 000	2 640
Hard-fibre looms	71	—	71	280	209
Total looms	*8 181*	*3 930*	*4 251*	*9 260*	*5 009*

Table 192

PERU: LABOUR REQUIREMENTS OF THE TEXTILE INDUSTRY IN 1965 [a]

Product	Productivity in 1957 (Kg/M/H)	Assumed productivity increment up to 1965 (Percentage)	Productivity in 1965 (Kg/M/H)	Production required in 1965 (Tons)	Labour required in 1965	
					Man/hours (Thousands)	Workers [b]
Spinning mills	—	—	—	(36 359)	(14 600)	(3 030)
Cotton yarns	2.37	20	2.74	23 119	8 450	1 750
Woollen yarns	0.89	40	1.25	3 970	3 170	660
Cut-fibre yarns	2.16	15	2.48	5 950	2 400	500
Hard-fibre yarns	5.20	10	5.72	3 320	580	120
Weaving mills [c]	—	—	—	(32 124)	(15 440)	(3 220)
Cotton fabrics	2.10	20	2.52	17 300	6 870	1 430
Woollen fabrics	0.55	40	0.77	3 100	4 020	840
Cut-fibre fabrics	2.57	15	2.96	5 950	2 010	420
Filament fabrics	1.36	15	1.56	2 454	1 570	330
Hard-fibre fabrics	3.10	10	3.41	3 320	970	200
Total	—	—	—	—	*30 040*	*6 250*

SOURCE: The productivity data are taken from chapter V, section IV.
a Excluding knitted goods.
b Estimated on the assumption that an average of 4 800 hours is worked annually, i.e. two shifts of eight hours each for 300 working days.
c Including the finishing of fabrics.

ty, may lower its costs, increase its internal market and open up a broad external market.

The investment needed up to 1965 to re-equip the spinning mills would be about 335 million soles, estimated on the basis of 1 535 soles per spindle, including all the preparatory machinery required to feed the spindles. The re-equipment of the weaving mills would cost about 340 million soles estimated at the rate of 67 500 soles per loom, including the equipment required for finishing the fabrics.

Labour requirements in the textile industry by 1965 have been estimated with the assistance of table 192 which assumes a 20 per cent increment in productivity for cotton goods, one of 40 per cent for woollen goods, of 15 per cent for artificial fibre fabrics and of 10 per cent for hard-fibre textiles. These rates are extremely conservative since the industry could theoretically increase its productivity from 100 per cent for artificial fibres to 430 per cent for woollen yarns.[5] The result of the estimates is that 3 030 workers would be needed in the spinning mills and 3 220 in the weaving mills, i.e. 6 250 in all.

According to industrial statistics for 1955, the factories for the spinning, weaving and finishing of fabrics employed 16 634 workers, in other words, more than two and a half times the number which would be needed for production in 1965. This figure, in its turn, would be double that in 1955. Hence, if the expansion of textile production is based on modern equipment, as it should be if costs are to be reduced and the market enlarged, the number of workers employed by the industry will have to be drastically cut instead of being added to as at present. Although the factories would only operate a single daily shift--which is obviously uneconomic--there would be a labour surplus in comparison with current employment levels. For this reason, the reorganization of the textile industry should form part of an integrated industrial development programme which would enable the manpower no longer required by the industry to find work elsewhere.

[5] See chapter V, section IV.

V. FOOTWEAR AND MADE-UP TEXTILE GOODS

1. *Footwear*

From the information supplied by manufacturers, it may be deduced that footwear demand increases at the annual rate of 5.5 per cent in the Lima-Callao area, 7 per cent in other coastal departments, 10 per cent in the sierra and 15 per cent in the departments of the *selva*. (Vulcanized footwear has been dealt with in this section, but for the purposes of production estimates and projections in monetary units, it has been included under the heading of the rubber industry in section XI of this chapter.) The rates of increase are therefore in inverse proportion to current consumption. If they are applied to demand in each of the areas named, an estimate of 11 144 000 million pairs of shoes is obtained for total demand in 1965, which is approximately double the 1955 figure (see table 193). Of this total, 9.4 million pairs are made of leather and the remainder vulcanized.

As the volume of imports is so small (about 15 000 pairs), the figures for demand can be taken for production as well.[6]

[6] Imports are substantial if expressed in terms of value, as the footwear in question is expensive. The relevant figures have been given in table 194.

Table 193

PERU: PROBABLE FOOTWEAR DEMAND IN 1965

(Thousands of pairs)

Area	Demand in 1955 [a]		Decennial rates of growth (Percentage)	Demand in 1965		Total
	Leather footwear	Vulcanized footwear		Leather footwear	Vulcanized footwear	
Lima-Callao	2 600	194	74	4 524	338	4 862
Other coastal departments	1 180	233	97	2 322	460	2 782
Departments of the sierra	850	310	157	2 174	797	2 971
Departments of the *selva*	94	39	298	374	155	529
Total	4 724	776	103	9 394	1 750	11 144

a Although, in monetary terms, imports represented 4 per cent of demand, they amounted to very little if expressed in terms of pairs of shoes. For this reason, the figures for demand in physical terms coincide with those for production.

As was pointed out in chapter V, the industry could triple its output of leather footwear and increase that of vulcanized footwear six times with its existing machinery; all that would have to be done would be to add equipment to balance capacity in some sections of the major factories. According to estimates supplied by the manufacturers themselves, the investment required for such equipment would be about 20 million soles.

If production is to be expanded without an increase of capacity to any marked extent, most factories would have to work two shifts a day instead of one.

If productivity is assumed to increase 15 per cent between 1955 and 1965, partly because because of a shift in production from artisan workshops to factories, some 4 840 additional workers would be needed in 1965 for the manufacture of leather footwear alone, i.e. about 2 065 more than the number employed in 1955. (The increase in the labour force for vulcanized footwear is discussed in section XI of this chapter.)

2. *Made-up textile goods*

As indicated in chapter V, section V, the made-up textile goods industry has developed at a very rapid rate in the last few years as it is a relative newcomer to textile manufacturing as a whole in Peru and there is a strong tendency for artisan production to be transferred to the big factories. For this reason, it has been estimated that between 1955 and 1965 demand would almost triple (an increment of 178 per cent). As the made-up goods industry has been contributing less than it should to the satisfaction of demand (56 per cent) and there are no impediments to greater import substitution, it has been assumed that domestic production could cover as much as 86 per cent of demand, which would imply an expansion of 330 per cent by 1965. Table 194 shows that this increment would imply the addition of 511 million soles' worth of made-up goods to the 155 million soles' worth produced in 1955 and would imply that demand for made-up goods intended for other industries would increase at a slightly higher rate than that for flour and sugar production, sacks for which are entirely supplied by the industry in the first case and partially in the second case. The relatively low proportion of domestic production (58 per cent), is due in this respect to the fact that large number of jute sacks would still be imported.

As it seems unlikely that the present utilization coefficient of equipment will increase, and, as stated in chapter V, it is inadvisable that more than one shift should be worked per day, the expansion of production would require a proportional increment in productive capacity and hence the investment of some 140 million soles in equipment.

An increment of at least 30 per cent may be expected in labour productivity by 1965. If this assumption is borne out, the industry could employ about 12 800 persons, i.e. 8 925 more than in 1955. Seventy per cent would consist of skilled labour.

It emerges from table 194 that artisan production of footwear and made-up goods has been assumed to expand at a fairly high rate in comparison with other branches of artisan manufacture. This is primarily because footwear—particularly for women—will still be manufactured in very small establishments which cannot be considered as factories. To a lesser extent—and probably at a slower rate than that of footwear manufacture—production of made-up goods will continue to keep ahead of most other branches of artisan activity.

VI. TIMBER

Since timber is primarily a raw material for industry rather than a commodity for consumption or investment, future demand for it cannot be estimated without the help of input-product matrices. A comparison of the figures in tables 174 and 179 shows that aggregate demand will probably expand 120 per cent between 1955 and 1965.

As regards the possibility of increasing production, Peru should aim eventually—although not necessarily by 1965—at producing all the timber it needs or at

Table 194

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE FOOTWEAR AND MADE-UP GOODS INDUSTRY

(Values in million of soles at 1955 prices: decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1955							
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	120.7	3.2	304.0	—	427.9	189.3	52	—	—100	889.2	193	—	—	1 078.5	152
	P	63.4	3.2	232.8	—	299.4	109.4	73	—	—100	855.8	268	—	—	965.2	222
	I	57.3	—	71.2	—	128.5	79.9	39	—	—	33.4	— 53	—	—	113.3	— 12
	P/D	(52)	(100)	(77)	—	(70)	(58)	—	—	—	(96)	—	—	—	(90)	—
Footwear	D	—	1.5	148.3	—	149.8	—	—	—	—100	303.6	105	—	—	303.6	102
	P	—	1.5	143.0	—	144.5	—	—	—	—100	299.1	109	—	—	299.1	107
	I	—	—	5.3	—	5.3	—	—	—	—	4.5	— 15	—	—	4.5	— 15
	P/D	—	(100)	(96)	—	(96)	—	—	—	—	(98)	—	—	—	(98)	—
Made-up goods	D	120.7	1.7	155.7	—	278.1	189.3	57	—	—100	585.6	276	—	—	774.9	178
	P	63.4	1.7	89.8	—	154.9	109.4	73	—	—100	556.7	520	—	—	666.1	330
	I	57.3	—	65.9	—	123.2	79.9	39	—	—	28.9	— 56	—	—	108.8	— 12
	P/D	(52)	(100)	(58)	—	(56)	(58)	—	—	—	(95)	—	—	—	(86)	
Artisan production	D	20.1	—	881.7	—	901.8	31.6	57	—	—	1 564.4	77	—	—	1 596.0	77
	P	20.1	—	881.7	—	901.8	31.6	57	—	—	1 564.4	77	—	—	1 596.0	77
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	—	(100)	(100)	—	—	—	(100)	—	—	—	(100)	—
Total	D	140.8	3.2	1 185.7	—	1 329.7	220.9	57	—	—100	2 453.6	107	—	—	2 674.5	101
	P	83.5	3.2	1 114.5	—	1 201.2	141.0	69	—	—100	2 420.2	117	—	—	2 561.2	113
	I	57.3	—	71.2	—	128.5	79.9	39	—	—	33.4	— 53	—	—	113.3	— 12
	P/D	(59)	(100)	(94)	—	(90)	(64)		—	—	(99)	—	—	—	(96)	—

SOURCE: Data for 1955: Ministry of Development and Public Work (*Ministerio de Fomento y Obras Públicas*), *Estadistica industrial 1955* and Ministry of Finance and Trade (*Ministerio de Hacienda y Comercio*), *Estadistica de comercio exterior, 1955*.

Symbols: D: Demand; P: Production; I: Imports; P/D: Relation of production to demand, expressed as a percentage.

least at balancing its exports and imports of wood and derived primary commodities. For the reasons given later, it has been estimated that by 1965 Peru would have gone approximately three-quarters of the way towards achieving this objective, partly on the basis of import substitution and partly by increasing its exports.

As explained in chapter V, section VI, Peru has vast timber resources, but according to statistics 40 per cent of demand to be covered by imports mainly because domestic timber is extremely costly to fell, saw and transport. These three cost elements may be reduced, but only by means of a vigorous development policy which is implicit in the recommendations contained in chapter V with respect to the industry in its present state, the salient points of which are summarized here. In the first place, it is essential to increase the yield in cubic metres of the wood utilized per hectare of forest, through an increase in the number of commercial species and a technological study of their physical features and potential uses. A case in point is that of an important enterprise in Yucatán, Mexico, which was forced to begin reducing its inventories of mahogany and *cedro* and to study other forest species which had hitherto never been used. The results were encouraging since suitable species were found for the purposes of the enterprises—the manufacture of veneers—that more than competed in beauty and physical attributes with the species that had been exhausted.

The increment in yield per hectare would lead to a number of reductions in cost since the mechanical extraction of forest products would become economical, costs per unit of timber volume would be lowered and logs could be longer and therefore easier to sell at home and abroad.

Sawmill costs would be cut by modernizing production methods and equipment and by improving maintenance of the machinery and raising log yield, expressed in terms of the volume of sawnwood.

The cost of transport over the Andes might be reduced even without improving present communications, if the value of part of the timber production could be enhanced through increased industrialization of the sawmills themselves or of their neighbourhood. For this purpose, it would be advisable to concentrate on increasing the manufacture of plywood,[7] which is acquiring a larger market in Peru that will expand even more if it has an abundant supply of good quality material. It would also be desirable to promote the production of fine veneers which could be used to cover fibre board or particle board made in the vicinity of the manufacturing centres, or bagasse board, in which case the veneers would have to be transported to sites close to the sugar mills where such board could be manufactured economically.

A programme for increasing timber processing in the neighbourhood of the extraction sites should also include studies to determine the economic feasibility of making prefabricated houses, particularly for the mining districts or oil fields.

With regard to the need to step up exports in order to bring them into line with imports, it is thought that little can be done in the case of sawnwood, chiefly, mahogany, which is shipped from Iquitos, since other production sites nearer the consumer centres, such as the State of Pará in Brazil and some Central American countries, are at an advantage in competing with Peruvian products. At best, the volume of sawnwood exports would remain at the same level in future. The only wood products which may show an upward trend for exports are veneers of fine woods, which, due to their high value per unit of weight, would be in a better position to compete with products from other countries, and fibreboard or preferably particleboard which could be shipped by river if the medium used were wood scrap, or by sea if it were bagasse.[8]

In view of the foregoing, it has been assumed that exports would amount to 30 million soles by 1965 and manufacturing production for internal consumption and raw materials to 387 million soles. This would mean a total increment of 197 per cent in manufacturing production between 1955 and 1965, which would raise the ratio of total domestic production to demand from 71 per cent in 1955 to 82 per cent in 1965 (see table 195). Independently of construction costs and the improvement of roads into the jungle—the latter being an important prerequisite for the reduction of costs—heavy investment would be needed to introduce mechanical systems for conveying logs, to modernize at least 60 per cent of the plant and to purchase supplementary equipment to raise yield in the sawmills and cut production costs. It has been estimated that such investment would be about 100 million soles at 1955 prices.

Employment will probably not increase more than 110 per cent over its current figure, i.e. some 2 800 persons, in view of the present low level of productivity that can be raised substantially as a result of the innovations to be made.

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[7] Peru has only two plywood factories, one of moderate size at Quincemil and an extremely small one at Pucallpa.

[8] It is estimated that a medium-size plant manufacturing 1 965 square metres per hour of particle board without veneer, three-quarters of an inch thick, would need a capital of some 725 000 dollars, of which 77 per cent would represent the cost of the installed equipment, 10 per cent that of the buildings and 15 per cent the working capital and the cost of starting operation. While the internal market was developing it might be possible to export part of the output to the United States where the current f.o.b. factory price is 150 dollars per thousand feet of board, three-quarters of an inch thick. If packing costs are reckoned at 10 dollars, the transport of a thousand square feet at 32 dollars (30 dollars per ton), internal transport costs at 5 dollars and entry duties into the United States at 30 per cent of the c.i.f. value, the net sales price of domestic board would be about 68 dollars per thousand feet, which would give 14 dollars profit per thousand square feet in a plant working two shifts daily for 300 days a year. Much larger profits could be obtained if the boards exported were covered with a mahogany or red cedro veneer, which commands high prices on the United States market.

Table 195

PERU: DEMAND AND PROJECTION DEVELOPMENT HYPOTHESIS FOR THE WOOD, FURNITURE, AND PRINTING AND PUBLISHING INDUSTRIES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Wood																
Manufacturing industry	D	135.5	18.3	50.4	19.8	224.0	343.3	153	30.1	64	79.0	56	80.9	308	533.3	138
	P	101.1	18.3	5.1	16.0	140.5	261.7	159	30.1	64	52.1	940	73.2	357	417.1	197
	I	34.4	—	45.3	3.8	83.5	81.6	138	—	—	26.9	— 41	7.7	102	116.2	39
	P/D	(75)	(100)	(10)	(81)	(63)	(76)		(100)		(66)		(91)		(78)	
Artisan production	D	44.0	—	17.0	—	61.0	67.0	52	—	—	26.0	52	—	—	93.0	52
	P	44.0	—	17.0	—	61.0	67.0	52	—	—	26.0	52	—	—	93.0	52
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	—	(100)	(100)		—		(100)		—		(100)	
Total	D	179.5	18.3	67.4	19.8	285.0	410.3	129	30.1	64	105.0	56	80.9	308	626.3	120
	P	145.1	18.3	22.1	16.0	201.5	328.7	126	30.1	64	78.1	253	73.2	357	510.1	154
	I	34.4	—	45.3	3.8	83.5	81.6	137	—	—	26.9	— 41	7.7	103	116.2	39
	P/D	(81)	(100)	(33)	(81)	(71)	(80)		(100)		(74)		(91)		(82)	
Furniture and accessories																
Manufacturing industry	D	9.1	—	20.4	30.3	59.8	39.2	332	—	—	100.4	380	50.2	65	189.8	217
	P	7.9	—	17.8	25.3	51.0	36.6	364	—	—	96.4	440	40.0	58	173.0	239
	I	1.2	—	2.6	5.0	8.8	2.6	116	—	—	4.0	54	10.2	104	16.8	91
	P/D	(87)		(87)	(83)	(85)	(93)		—		(96)		(80)		(91)	
Artisan production	D	30.0	—	160.0	14.0	204.0	37.5	25	—	—	199.0	25	17.5	25	254.0	25
	P	30.0	—	160.0	14.0	204.0	37.5	25	—	—	199.0	25	17.5	25	254.0	25
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	(100)	(100)	(100)		—		(100)		(100)		(100)	
Total	D	39.1	—	180.4	44.3	263.8	76.7	96	—	—	299.4	66	67.7	52	443.8	68
	P	37.9	—	177.8	39.3	255.0	74.1	95	—	—	295.4	66	57.5	46	427.0	67
	I	1.2	—	2.6	5.0	8.8	2.6	117	—	—	4.0	54	10.2	104	16.8	91
	P/D	(97)		(98)	(89)	(97)	(97)		—		(99)		(85)		(96)	
Printing and publishing																
Manufacturing industry	D	54.9	—	101.1	1.9	157.9	142.5	160	—	—	234.6	132	4.6	142	381.7	141
	P	53.9	—	94.5	1.9	150.3	140.4	160	—	—	222.0	135	4.6	142	367.0	144
	I	1.0	—	6.6	—	7.6	2.1	100	—	—	12.6	91	—	—	14.7	94
	P/D	(98)		(93)	(100)	(95)	(99)		—		(95)		(100)		(96)	
Artisan production	D	36.0	—	68.0	—	104.0	47.0	31	—	—	89.0	31	—	—	136.0	31
	P	36.0	—	68.0	—	104.0	47.0	31	—	—	89.0	31	—	—	136.0	31
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)		(100)	—	(100)	(100)		—		(100)		—		(100)	
Total.	D	90.9	—	169.1	1.9	261.9	189.5	109	—	—	323.6	91	4.6	142	517.7	98
	P	89.9	—	162.5	1.9	254.3	187.4	109	—	—	311.0	91	4.6	142	503.0	98
	I	1.0	—	6.6	—	7.6	2.1	110	—	—	12.6	91	—	—	14.7	94
	P/D	(99)		(96)	(100)	(97)	(99)		—		(96)		(100)		(97)	

SOURCE: Data for 1955: Ministry of Development and Public Works (*Ministerio de Fomento y Obras Públicas*), *Estadística industrial 1955*; Ministry of Finance and Trade (*Ministerio de Hacienda y Comercio*), *Estadística de Comercio Exterior 1955* and direct information.

Symbols: D: Demand; P: Production; I: Imports; P/D: Relation of production to demand, expressed as a percentage.

VII. MANUFACTURE OF FURNITURE AND FIXTURES

It has been estimated that between 1955 and 1965 demand for furniture and fixtures would expand at the rate of 68 per cent. This figure is slightly below that for consumer durables as a whole because steel furniture is bound to predominate among certain lines of production in this branch, if the recent trend continues.[9] As may be seen from table 195, and from the description of the industry in chapter V, section VII, artisan production is approximately four times greater than manufacturing output, while both together cover 97 per cent of demand. In other words, the furniture industry is faced not with the problem of import substitution but rather with that of shifting gradually from artisan activity to manufacturing proper. For projection purposes, it has been assumed that artisan production will lose ground and by 1965 will be only one and a half times greater than manufacturing activity, while in conjunction they will increase at the rate of 67 per cent. Manufacturing industry would hence expand 239 per cent—an easy achievement by any standards, since it is very small in absolute production terms.

The switch-over from artisan production to industry proper would require an investment of some 20 million soles. An increment of 125 per cent (1 900 workers) is thought to suffice for the labour force, since the mechanization of the furniture industry would considerably raise productivity.

After a rapid review of the articles which the industry is currently turning out, it may be concluded that production will have to be mechanized and a radical change made in many concepts of design and ways of economizing raw materials, if the projected evolution is to take place. In general, there is much waste of fine woods, such as cedar, in the manufacture of exaggeratedly heavy furniture which is seldom veneered on its visible surfaces, and in plywood for side tables or other pieces which are not meant for display or to be very strong. The same criticism applies to other carpentry products for household and office use.

Although it has been said that there is little scope for import substitution, there are branches in which the industry can replace imports not registered as furniture. For instance, with an adequate development policy, sewing-machine and radio furniture could be manufactured in Peru, in accordance with the specifications and under the supervision of importers of such articles. Modern techniques would have to be introduced for the drying and veneering of the wood as well as for the manufacture and finishing of the furniture. But Peru should not find this difficult because the first requirement—a relatively broad market—would be fulfilled. The problem of personnel training would be hard but manufacturers might well help to solve it.

Table 195 gives the projections which have been formulated on the basis of the above-mentioned hypothesis.

9 Although the United Nations *International standard classification of all economic activities* places metal furniture under the heading of furniture and fixtures together with wooden articles, statistical difficulties in separating the manufacture of steel furniture from other metal manufactures have made it preferable to deal with wooden furniture only in this section and to include metal furniture in section XVII on the basic metal trades.

VIII. MANUFACTURE OF PAPER AND PAPER PRODUCTS

1. *Estimated future demand for paper and paperboard*

The volume of paper and board required by the Peruvian market in 1960, 1962, 1965 and 1967 was estimated by means of logarithmic correlations between consumption of the different types and total *per capita* consumption. The correlations covered the period 1947-1956 and moving triennial averages were used in the time series in order to eliminate or at least modify the influence of changes in inventories on which no data were available. The results of the projections are summarized in table 196. They show that, between 1956 and 1965, *per capita* consumption of paper and board would increase at the annual rate of about 4.3 per cent (as against 6.5 per cent in 1947-55) while total consumption would increase at the annual rate of about 7 per cent (97 per cent in ten years), as against 8.5 per cent (126 per cent in ten years) in 1947-55.

In terms of total volume, the projections show that paper and board consumption between 1955 (average 1954-56) and 1965 would be twice as much, i.e. it would rise from 55 000 to 110 000 tons. This total includes an increase from 15 800 to 31 000 tons in newsprint consumption.[10]

2. *Development prospects for paper and board production excluding newsprint*

As stated in chapter V, section VIII, domestic industry currently covers 55 per cent of total paper and board demand. The most important item of the 25 000

10 The projections of newsprint demand were also checked against separate estimates made with elasticity coefficients which diminished as the average level of total expenditure went down. The results were slightly higher: 33 700 and 38 500 tons in 1965 and 1967 respectively. However, for the purposes of this report, the first series obtained was adopted. Moreover, the estimates of paper and board demand (excluding that for newsprint), which were made by a private firm on the basis of a simple consumption projection, give a much higher figure for demand in 1960 than that obtained by the method used in this report (63 600 as against 54 900 tons). If Peru follows the same economic trends as in the post-war period, it may easily reach or even exceed this level of consumption, but the hypothesis in Part One of this report assumes a slower rate of development for the economy and for total consumption (or expenditure). Demand might none the less increase if market prices dropped, a contingency which might arise if production became more efficient and plants were enlarged.

Table 196

PERU: DEMAND PROJECTIONS FOR PAPER AND BOARD
(Per capita *consumption in kilogrammes; total consumption in tons*)

	Correlation coefficient	Elasticity	Annual demand for paper and board						
			1955 [a]	1956		1960	1962	1965	1967
				Real	Calculated				
Newsprint									
Per capita	0.90	2.01	1.76	2.01	1.88	2.18	2.37	2.70	2.94
Total	—	—	15 771	18 408	17 200	22 000	25 200	31 000	35 300
Writing and printing paper									
Per capita	0.97	1.56	0.72	0.72	0.76	0.85	0.91	1.00	1.07
Total	—	—	6 452	6 616	7 000	8 600	9 700	11 500	12 900
Wrapping paper									
Per capita	0.86	2.10	1.66	1.83	1.78	2.08	2.28	2.61	2.85
Total	—	—	14 875	16 776	16 300	20 100	24 200	29 900	34 200
Other paper and board									
Per capita	0.83	2.32	2.03	2.29	2.18	2.60	2.86	3.32	3.67
Total	—	—	18 178	21 052	20 000	26 200	30 400	38 100	44 100
Total									
Per capita	—	—	6.17	6.85	6.60	7.71	8.42	9.63	10.53
Total	—	—	55 276	62 852	60 500	76 900	89 500	110 500	126 500

SOURCE: 1955 data based on direct information on production and import figures supplied by the Ministry of Finance and Trade, *Estadistica de Comercio Exterior*, 1954-55 and 1956.
[a] Average for 1954 to 1956.

tons imported annually in 1955-56 was newsprint, which absorbed 16 000 tons. The remaining 9 000 consisted of many different types of paper and board, some of which, such as ledger and bond paper now imported (4 000 tons a year), could be manufactured in Peru.

The annual consumption increment up to 1967, which is estimated at some 71 000 tons more than the 1955 figure, has a c.i.f. value of approximately 15 million dollars at 1955 prices or twice Peru's annual foreign exchange expenditure on paper and pulp. Clearly, Peru must strive to avoid this additional drain on its hard currency reserves by expanding domestic pulp and paper capacity on the basis of sound economic principles.

Two important facts should be borne in mind when assessing development prospects:

(*a*) Newsprint production is one of the most difficult and least profitable technical operations, particularly when non-traditional raw materials, for example woods other than coniferous, are used. Moreover, the manufacturing process needs large plants and big markets to be economic.

(*b*) Non-integrated paper production—although perhaps economically attractive to the industrialist in view of the heavy duties on paper and board imports—represents only a small saving in foreign exchange. Also, if undertaken on a large scale, it has the serious disadvantage of jeopardizing domestic supplies whenever raw materials are expensive or scarce on the world market.

In the light of both these considerations, the industry's development programme should give priority to the integrated manufacture of paper and board, excluding newsprint. In actual fact, this is already being done by established industry. Its expansion programme is summarized below.

After the modernization of machinery and the installation of new equipment, current production capacity for paper and board—36 000 tons a year in 1956—will increase by about 40 000 tons and thus amount to 76 000 by 1960. This expansion will be completely integrated, since work is almost finished on a new pulp plant based on bagasse, with an annual capacity of some 36 000 tons. It will also be able to bleach about 16 000 tons. Total pulp capacity would therefore be raised to approximately 50 000 tons a year.

If the development programme meets all expectations, the industry will be as portrayed in table 197, i.e. it will have a large surplus capacity in the early years and almost up to 1965. It may also be concluded from the same table that utilized capacity in 1960 and 1962 would no more than 70 and 80 per cent respectively, and that demand and internal supply would still be unbalanced by 1965.[11]

It is assumed that paper and board would not be shipped abroad, although small amounts have been sold in the past to Bolivia and Ecuador.[12] Since the surplus indicated in table 197 is unlikely to be used for export production, the industry is expected to work at less than its nominal capacity for several years. This would not be at all unusual for a new paper machine —the installation of which implies a sharp increase in capacity—often reaches its maximum economic yield long before its capacity has been fully utilized.

The current development programme for paper and board production excluding newsprint, is well balanced. For the moment no different or additional measures to promote further expansion in this industry seem to be required.

3. *Development prospects for newsprint manufacture*

As indicated earlier, the domestic manufacture of newsprint poses far more difficult problems than that of other paper and board. In the first place, import duties amount to approximately 12 per cent of the value of the newsprint (about 20 dollars per ton), a figure much lower than the average tax (30 to 50 per cent) levied on other paper and board. Secondly, present newsprint consumption, and even that anticipated for 1967, is much less than the output of a single modern machine. Thirdly, the country lacks conifers, the traditional raw material for this type of production. Al-

11 Although the estimate of future demand is based on the most optimistic hypothesis—made by Peruvian industrialists—there would still be a surplus capacity of approximately 14 000 tons in 1960. In other words, about 80 per cent of capacity would be utilized.

12 Exports—which totalled over 2 000 tons in 1951 when market prices were at their peak—have gradually declined. In recent years, they have amounted to only a few hundred tons.

Table 197

PERU: COMPARISON BETWEEN PROJECTED PRODUCTIVE CAPACITY AND DEMAND FOR PAPER AND BOARD (EXCEPT NEWSPRINT)

(Thousands of tons annually)

	1955 [a]	1960	1962	1965	1967
Projected productive capacity	36.0	76.0	76.0	76.0	76.0
Essential imports	8.9	2.0	2.3	2.9	3.3
Total.	44.9	78.0	78.3	78.9	79.3
Demand	38.9	54 0	64.3	79.5	91.2
Surplus (+) or deficit (−) capacity	+ 6.0	+24.0	+14.0	− 0.6	−11.9

SOURCE: See that for table 196.
a Average for 1954 to 1956.

though it is technically possible to make newsprint from non-traditional raw materials, such as the broad-leaved species of tree, production costs are unquestionably higher than in the conifer-based industry, because a larger proportion of chemical or semi-chemical pulp has to be used. Only in exceptional cases, when very inexpensive wood is used in conjunction with cheap power and a large enough market to justify an economic mill, could newsprint manufacture be undertaken on the basis of non-traditional fibrous materials without the need for heavy tariff protection.

These remarks are not intended to discourage such manufacture in Peru, but to show that its economic feasibility must be thoroughly studied. Particular attention might be given to such possible raw materials as sugar-cane bagasse and *cetico (Cecropia sp.)*, a tropical forest species which seems to offer great advantages.

(a) *Newsprint from* cetico

In 1951, a French company studied the possibilities of making newsprint on the basis of mechanical pulp from the *cetico* species which grows in unmixed stands on the river banks in the Amazon basin. It was intended to set up the mill in the town of Pucallpa which is situated on the banks of the River Ucayali and is linked to Lima by an 842-kilometre road across the Andes.

Manufacturing tests carried out in France have proved that *cetico* is suitable for the production of a mechanical pulp which, when mixed with chemical softwood pulp, gives a satisfactory sheet of newsprint. Research by the Forest Products Laboratory in Madison, Wisconsin, has also shown that *cetico* can be converted into pulp by the cold caustic soda method.

Cetico is particularly abundant on the new land formed in the rivers and riparian zones. The cost of extraction and transport to the mill would therefore be very low in comparison with current prices for softwood in the traditional newsprint-producing areas.[13]

Apart from having cheap wood at its disposal, the Pucallpa plant would also be able to obtain low-cost fuel from neighbouring sources and from the petroleum refinery at Aguas Calientes. The main drawback to the proposed site would be the high cost of transporting the finished product to the principal market of Lima. This has been estimated at about 30 dollars per ton, or approximately the same as current freight charges for newsprint shipped from Canada and the United States.

Clearly, therefore, the project for building a newsprint plant at Pucallpa will not be feasible within the period covered by this report, i.e., before 1965 or 1967.

[13] Estimates made in 1953 put the price at 2.30 dollars per 100 cubic feet at the mill site, which is more or less equivalent to 0.82 dollars per cubic metre or 2.35 dollars per dry ton.

(b) *Newsprint from sugar-cane bagasse*

During the last decade, many attempts have been made to encourage the production of newsprint from bagasse. At first they failed because some technical problems still remained to be solved. But, according to current knowledge and information and the result of manufacturing tests, newsprint of an acceptable quality can already be produced from this raw material. Although manufacturing has not yet started on a commercial scale, two projects (in Cuba and India) are well advanced in both planning and execution.

In order to produce newsprint from bagasse at a competitive price, an extensive market, cheap fibrous raw material and low-cost electricity, fuels and chemical products are all required. This combination is to be found in Peru, where dry bagasse costs about 6 dollars per ton, electricity is steam-generated at an outlay of 0.005 dollars per kWh and salt costs 5.50 dollars per ton.

The present market seems too small for the economic production of newsprint and demand will probably not be large enough to justify this type of manufacture until after 1965.[14] Hence, careful attention should be paid to the innovations introduced in this field and a detailed study prepared on manufacturing possibilities long before the market reaches 30 000 tons a year.

If there is any question of choosing between a newsprint plant based on *cetico* in the neighbourhood of Pucallpa and one based on bagasse, there is no doubt that the second is better from the economic point of view. The use of *cetico* would double the cost of raw materials and of transport to Lima, even though expenditure on wood were assumed to be as low as 2 dollars per ton at the mill site.[15]

4. *Development prospects for pulp manufacture*

The present development programme for the industry contemplates the integrated production of pulp and paper. The interested firm is building a new mill at Paramonga with an annual capacity of 36 000 tons of bagasse pulp to supplement its old plant constructed several years ago. A modification of the continuous soda method will be used, which the firm has develop-

[14] According to calculations made by the United Nations Pulp and Paper Advisory Group for Latin America, a plant with a daily capacity of 100 tons—the estimated level of Peruvian demand in 1965—would entail a production cost of 108 dollars per ton (including depreciation) and make a net profit on total capital of about 12 per cent, provided that the present level of tariff protection (12.67 per cent ad *valorem*) were maintained.

[15] The Pulp and Paper Advisory Group estimated that the costs of the raw materials and freight would be as follows:

	Cetico	*Bagasse*
Raw materials	(41.00)	(31.50)
Wood	2.00	—
Softwood pulp (imported at 90 dollars the ton)	38.00	—
Bagasse	—	9.60
Chemicals and fillings	1.00	21.90
Freight to Lima	30.00	3.40
Total	71.00	34.90

Table 198

PERU: COMPARISON BETWEEN PROJECTED PRODUCTIVE CAPACITY AND DEMAND FOR PULP

(Thousands of tons annually)

	1955 [a]	1960	1962	1965	1967
Projected productive capacity	13.0	40.0	40.0	40.0	40.0
Essential imports	8.9	12.3	14.5	17.9	20.6
Total	21.9	52.3	54.5	57.9	60.6
Demand	21.9	42.7	50.3	62.1	71.4
Surplus (+) or deficit (−) capacity	—	+ 9.6	+ 4.2	− 4.2	−10.8

SOURCE: See that for table 196.
a Average of real data for 1954 to 1956.

ed on an industrial scale. It is not known whether the existing unit will be kept in operation after the new plant has been established, but for the purposes of the present report it has been assumed that it will close down. Hence, from 1958 onwards, it is estimated that total pulp production capacity will be 76 000 tons annually (36 000 tons in the new plant and 40 000 in another in the north).

Table 198 outlines the probable situation of pulp supply and demand in 1955-67. It is analogous to that of paper and board in that there would be surplus capacity in the first few years of the following decade and a deficit of 11 000 tons towards 1967.

The estimates of pulp supply and demand were based on the following hypotheses and factors:

(*a*) The recovery of used paper would be 20 per cent of total paper and board consumption, which is equivalent to the average for 1954-56; [16]

(*b*) The present quality of the paper produced would be maintained and hence the following minimum percentages of softwood pulp (long fibre) would be required:

	Percentage
For printing and writing paper	15
For wrapping paper (including multi-wall bags)	25
Other paper and board	20

(*c*) An average of 1.1 tons of pulp per ton of paper would be consumed;

(*d*) All newsprint would be imported, as well as small quantities of special paper, as indicated in table 197;

(*e*) All long-fibre pulp would be imported, since Peru has no economically exploitable resources at the moment for producing it.

As regards the possibility of a raw material supply for long-fibre pulp, the wood of certain species of palm in the Amazon basin has an average fibre length of 2 millimetres and could therefore be regarded as a potential source. It is impossible to take it into account over the short term, however, since the trees are widely dispersed in remote areas and little is known about the properties of the woods as a raw material.

16 During the three years from 1954 to 1956, consumption of used paper showed an upward trend partly because of changes in pulp inventories and also probably because of the increased difficulty of obtaining foreign exchange for pulp imports. In any case, a supply of domestic pulp at a reasonable cost would definitely reduce the percentage of used paper recovery.

It has been demonstrated experimentally that some conifers and exotic species of bamboo can be grown on the western side of the Andes. These could be used in future as a partial replacement for imported softwood pulp. Experiments in connexion with economic yields and silvicultural problems should none the less be continued. During the next decade, these raw material sources can be treated solely as experimental.

In the case of short fibres, progress will depend on bagasse, which is exceptionally cheap in Peru. Total bagasse production—estimated at more than 1.5 million tons a year—would be enough to allow pulp manufacture to meet any foreseeable increment in demand. There is no information available on the extent to which the bagasse supply exceeds fuel requirements in the sugar industry, but the cost of a ton of fresh bagasse, which has been estimated at 3.00 dollars on the basis of the total value of its replacement by another fuel, is probably somewhat low, particularly if the mills continue to modernize their steam and power-generating plant.

5. *Economic repercussions of the development programme*

Table 199 depicts the supply and demand situation that would arise from the development programme which is being carried out for the pulp and paper industry, and from the additional expansion suggested in this report.

The development programme would raise the contribution of internal production to total consumption from 55 per cent in 1955 to almost 70 per cent in 1965, and in the case of fibrous raw materials (excluding used paper) from 60 to 71 per cent.

Table 200 shows the effects of the programme in terms of the foreign exchange needed for supplementary imports. The figures reflect an over-all development policy designed to achieve the maximum replacement of imported pulp by bagasse and the domestic manufacture of all types of paper and board, except newsprint and some special products. In spite of the ambitious nature of the programme, foreign exchange expenditure, after dropping slightly up to 1962, would continue to rise, although less rapidly than in the years immediately after 1953. There would be no radical

Table 199

PERU: HYPOTHESIS OF FUTURE SUPPLY AND DEMAND IN RESPECT OF PAPER AND PULP, IN PHYSICAL UNITS

(Thousands of tons annually)

	1955 [a]	1960	1962	1965	1967
Newsprint					
Demand	15.8	22.0	25.2	31.0	35.3
Production	—	—	—	—	—
Imports	15.8	22.0	25.2	31.0	35.3
Writing and printing paper					
Demand	6.4	8.6	9.7	11.5	12.9
Production	2.8	7.7	8.7	10.3	11.5
Imports	3.6	0.9	1.0	1.2	1.4
Wrapping paper					
Demand	14.9	20.1	24.2	29.9	34.2
Production	14.9	20.1	24.2	29.9	34.2
Imports	—	—	—	—	—
Other paper and board					
Demand	18.2	26.2	30.4	38.1	44.1
Production	12.3	25.1	29.1	36.4	42.2
Imports	5.9	1.1	1.3	1.7	1.9
Total paper and board					
Demand	55.3	76.9	89.5	110.5	126.5
Production	30.0	52.9	62.0	76.6	87.9
Imports	25.3	24.0	27.5	33.9	38.6
Pulp from bagasse					
Demand	13.0	30.5	35.8	44.2	50.8
Production	13.0	30.5	35.8	44.2	50.8
Imports	—	—	—	—	—
Softwood pulp					
Demand	8.9	12.3	14.5	17.9	20.6
Production	—	—	—	—	—
Imports	8.9	12.3	14.5	17.9	20.6
Total pulp					
Demand	21.9	42.8	50.3	62.1	71.4
Production	13.0	30.5	35.8	44.2	50.8
Imports	8.9	12.3	14.3	17.9	20.6

SOURCE: See that for table 196.
a Average for 1954 to 1956.

change in this situation until the domestic production of newsprint became economically justifiable.

At first sight the prospects seem disheartening, in view of the tremendous efforts made by established industry to increase its production on the basis of indigenous raw materials. They are much more favourable, however, when regarded from the standpoint of what would happen if such an expansion did not take place.

6. *Cellulose for artificial fibres*

Cellulose for artificial fibres is considered apart from pulp for paper in order to avoid confusion. Demand for the former would increase in step with artificial fibre production, i.e. 200 per cent from 1955 to 1965. In terms of volume, it would increase from 1 360 to 4 080 tons, which would not be a large enough amount to warrant the establishment of a plant to manufacture it from wood.

Chapter V, section XII shows that at least 600 tons of purified cellulose could be manufactured at present on the basis of 800 tons of linters which are exported but could be kept in the country. Nevertheless, in this report it has been assumed that up to 1965 requirements would be covered by imports.

Table 200

PERU: PROBABLE FOREIGN EXCHANGE EXPENDITURE ON PAPER AND PULP IMPORTS

(Millions of dollars at 1955 prices)

	1955 [a]	1960	1962	1965	1967
Newsprint	2.65	3.74	4.28	5.27	6.00
Other paper and board	3.49	1.20	1.38	1.74	1.98
Softwood pulp	1.25	1.72	2.03	2.51	2.88
Total	7.39	6.66	7.69	9.52	10.86
Difference with respect to 1955	—	−0.73	+0.30	+2.13	+ 3.47

a Average for 1954 to 1956.

7. *Paper and paperboard manufactures*

Demand for these manufactures has been assumed to expand more rapidly than total consumption and the main industries using them as auxiliary materials (processed foodstuffs, footwear, cement) because they are gradually expected to replace other products employed in bottling, wrapping and serving. However, the contribution of internal production towards the satisfaction of demand would improve only moderately (from 36 to 47 per cent). A wide margin has to be preserved for importing articles that are very strong or of a highly specialized type. At the moment these arouse little interest in view of their restricted market and their dependence on raw materials from abroad. Between 1955 and 1965, demand would rise from 44.1 to 92.5 million soles (an increment of 110 per cent) and production from 15.8 to 43.5 million soles (an increment of 175 per cent).

8. *Development of the branch as a whole*

A general recapitulation of the industry's development has been made in table 201 which includes, expressed in monetary terms, all the hypotheses of growth which were previously formulated in physical units. It is impossible to obtain an accurate impression of the repercussions resulting from the progress made with respect to each item, since it is difficult to assess the effect of the replacement of certain qualities by others. For instance, the replacement of softwood pulp by bagasse pulp may make it necessary to use more of the latter; or, in making multi-wall bags, the utilization of kraft paper made from bagasse instead of ordinary kraft paper may require a greater number of sheets to give the same degree of strength.

The rates of growth in table 201 are the same as those previously applied to the quantum. Printing and writing paper and the category known as "other paper and board" are excepted (the rates for these items were adjusted for 1965 with a price increment of 15 per cent to allow for the replacement of imports of greater value than products manufactured in 1955); wrapping paper is also excluded (a price reduction of 15 per cent was assumed in order to take into account probable benefits of scale and improvements in manufacturing processes).

The over-all results in the table show that the value of domestic production would almost triple between 1955 and 1965 while that of imports would increase by only 50 per cent. During the same period, domestic production would represent 68 per cent of the total value of consumption instead of 54 per cent, an important achievement in view of the increment of 116 per cent in demand.

The estimated development would require an investment of roughly 250 to 300 million soles, including that already being made to raise papermaking capacity to 76 000 tons and pulp capacity to 40 000. It is assumed that at least 1 400 additional workers would have to be added to the industry's present labour force (1 750).

IX. PRINTING AND PUBLISHING

Demand and production estimates for printing and publishing indicate a 98-per-cent expansion in 1955-65, which exceeds that of 86 per cent registered in the preceding decade (see table 195). This development would mean that the 254 million soles produced by the industry in 1955 were doubled, which in turn implies that the proportion of demand satisfied by domestic production would remain constant in the future (97 per cent).

It was explained in chapter V that the two basic difficulties of which entrepreneurs in this branch of industry complain are the paper shortage and the lack of trained personnel. The cost of paper is likely to improve in the future, as domestic production of this raw material develops on a sounder basis, with production units of higher capacity. The scarcity of trained technicians and workers aggravates the difficult situation of this industry, which utilizes only 30 per cent of its installed production capacity. Consequently, its future development must be grounded on the rapid training of personnel, and on a deliberate effort to ensure that production increments are achieved on the basis of fuller utilization of equipment, that is, by increasing the number of hours worked daily, rather than production capacity.

To attain the projected degree of development, the industry would have to purchase a certain amount of supplementary machinery, mainly to balance its equipment and renew some component parts whose yield is by now very low. Investment requirements for the attainment of this last objective are estimated at 30 per cent of the current value of equipment, that is, at 32 million soles. The additional personnel needed would number some 2 300 workers, on the assumption of a 25-per-cent increase in productivity, which would be relatively easy to achieve by means of the above-mentioned rapid training programme.

X. MANUFACTURE OF LEATHER AND LEATHER PRODUCTS

The most satisfactory basis on which to estimate future demand for tannery products is the probable development of the footwear industry, since it consumes 90 per cent of the leather produced, and this

Table 201

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE PULP AND PAPER INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Newsprint	D	50.4	—	—	—	50.4	99.1	96	—	—	—	—	—	—	99.1	96
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	50.4	—	—	—	50.4	99.1	96	—	—	—	—	—	—	99.1	96
	P/D	(0)	—	—	—	(0)	(0)	—	—	—	—	—	—	—	(0)	—
Printing and writing paper [a]	D	25.9	—	16.8	—	42.7	61.4	138	—	—	23.9	42	—	—	85.3	100
	P	15.4	—	3.2	—	18.6	56.6	269	—	—	20.7	547	—	—	77.3	316
	I	10.5	—	13.6	—	24.1	4.8	— 54	—	—	3.2	— 76	—	—	8.0	— 67
	P/D	(59)	—	(19)	—	(44)	(92)	—	—	—	(87)	—	—	—	(91)	—
Wrapping paper [b]	D	65.1	1.4	—	—	66.5	113.1	74	—	—100	—	—	—	—	113.1	70
	P	65.1	1.4	—	—	66.5	113.1	74	—	—100	—	—	—	—	113.1	70
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	—	—	(100)	(100)	—	—	—	—	—	—	—	(100)	—
Other paper and board [a]	D	48.7	—	20.5		69.2	130.3	167	—	—	36.0	76	—	—	166.3	140
	P	39.0	—	7.8		46.8	126.1	224	—	—	33.1	324	—	—	159.2	240
	I	9.7	—	12.7		22.4	4.2	— 43	—	—	2.9	— 77	—	—	7.1	— 71
	P/D	(80)	—	(38)		(68)	(97)	—	—	—	(92)	—	—	—	(96)	—
Paper and board manufactures	D	33.2	0.1	9.4	1.4	44.1	56.1	69	—	—100	33.5	256	2.9	107	92.5	110
	P	13.1	0.1	2.6	—	15.8	31.6	141	—	—100	11.9	358	—	—	43.5	175
	I	20.1	—	6.8	1.4	28.3	24.5	22	—	—	21.6	218	2.9	107	49.0	73
	P/D	(40)	(100)	(28)	—	(36)	(56)	—	—	—	(36)	—	—	—	(47)	
Pulp from bagasse	D	12.2	—	—	—	12.2	41.5	240	—	—	—	—	—	—	41.5	240
	P	12.2	—	—	—	12.2	41.5	240	—	—	—	—	—	—	41.5	240
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	(100)	—	—	—	—	—	—	—	(100)	(100)
Softwood pulp for paper	D	26.6	—	—	—	26.6	53.5	101	—	—	—	—	—	—	53.5	101
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	26.6	—	—	—	26.6	53.5	101	—	—	—	—	—	—	53.5	101
	P/D	(0)	—	—	—	(0)	(0)	—	—	—	—	—	—	—	(0)	—
Cellulose acetate and purified cellulose for artificial fibres	D	8.6	—	—	—	8.6	25.8	200	—	—	—	—	—	—	25.8	200
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	8.6	—	—	—	8.6	25.8	200	—	—	—	—	—	—	25.8	200
	P/D	(0)	—	—	—	(0)	(0)	—	—	—	—	—	—	—	(0)	—
Total	D	270.7	1.5	46.7	1.4	320.3	580.8	114	—	—	93.4	100	2.9	107	677.1	112
	P	144.8	1.5	13.6	—	159.9	368.9	155	—	—	65.7	383	—	—	434.6	172
	I	125.9	—	33.1	1.4	160.4	211.9	68	—	—	27.7	— 16	2.9	107	242.5	51
	P/D	(50)	(100)	(29)	—	(50)	(64)	—	—	—	(70)	—	—	—	(64)	—

Source: 1955 data, direct information and Ministry of Finance and Trade, *Estadística de Comercio Exterior 1955*.

Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.

a In these cases, the rates of growth of production reflect, in addition, an increase in prices of 15 per cent as a result of important substitutions of greater value per ton than that of products manufactured in 1955.

b The rate of growth of production reflects, in addition, a decrease in prices of 15 per cent anticipated because of economies of scale and manufacturing processes.

proportion is not expected to alter substantially in the future.[17] Although a relative increase in the manufacture of leather goods for industrial use is likely, it is also probable that leather will be superseded by plastic materials in other articles.

The contribution of domestic production to the satisfaction of demand cannot be expected to increase still further, since it is already very high (93 per cent) and the supply of raw materials is subject to marked limitations, both in quality and in quantity. It is therefore assumed that the share of domestic production may even decline slightly; for projection purposes, it has been fixed at 92 per cent. In these circumstances, the production of the tanneries would expand by 106 per cent, which would mean that by 1965 approximately 12.2 million square feet of leather and 3 700 tons of sole leather would be added to the 1955 production figures, which were 11.5 million square feet and 3 500 tons, respectively.

The obstacle which this postulated development might encounter is the supply of hides. Although estimates of probable meat production for the middle of the next decade suggest that enough large hides will be available, a considerable proportion of calf-hide consumption may have to depend on imports of fresh and salt hide, since it is extremely unlikely that by 1965 the stock-farming situation in Peru will be such that some 300 000 head of young animals can be slaughtered yearly without danger to the growth of the cattle population.

The manufacture of leather goods will also be restricted by the limitations of the available raw material. Nevertheless, according to estimates, it could follow a trend parallel to the evolution of the tanneries and considerably more intensive than in the past. Here the ideal course of action would be to raise standards of quality and style for factory-made consumer goods, and to push production of leather goods for industrial consumption, such as textile accessories, for which there is an excellent market in Peru. If industry proper concentrated its efforts on the manufacture of higher-quality goods, artisan production could shoulder the responsibility for other popular consumer goods which are not required to meet high standards of quality and presentation.

Table 202 presents the above-mentioned hypothesis in monetary terms. It may be noted that a higher rate of growth is assigned to artisan production than to industry proper. It is believed that as regards both leather and footwear the energetic expansion of artisan production will continue, however rapidly industry proper progresses. This has been the course of events in countries similar to Peru, mainly because, as the development process advances, the fields corresponding to each of these types of manufacturing activity ultimately become clearly demarcated, and the customary competition between them is reduced to a minimum. In Peru itself specialization of this type is already observable. The factories are tending to concentrate on the production of leather-goods requiring standardization, a higher degree of mechanization and repetitive operations—for instance, the pickers, picking-straps and divider-straps used in the textile industry. On the other hand, artisan production can compete successfully in lines where frequent readjustments have to be made to meet the demands of fashion, and which do not call for mechanization or repetitive work; examples are belts, women's handbags and even certain kinds of travel goods.

The achievement of the factory output assumed for this whole branch of production would entail no substantial additions to the industry's installed capacity, since the current level of utilization is only 35 per cent. Supplementary equipment would rather be required to balance the capacity of the tanneries in certain channels or lines of production, to replace obsolete machinery and to mechanize internal transport. It is estimated that for this purpose not more than about 30 million soles (at 1955 prices) would be needed.

Manpower requirements can be calculated on the basis of 40-per-cent increment in productivity which is a fairly realistic hypothesis, taking into account reasonable progress in the use of mechanical means of internal transport in the tanneries, whereby a certain amount of indirect labour would be superseded. According to this hypothesis, by 1965 the industry would be employing about 2 900 workers or some 920 more than in 1955.

[17] In the United States, footwear absorbs 80 per cent of the output of leather.

XI. RUBBER MANUFACTURES

It is logical to assume that demand for tyres and inner tubes will follow a growth trend parallel to that of the vehicle park. A recent period—1950-55—was selected for the study of this latter, as marked fluctuations are registered in the trends observable throughout the decade 1945-55. In round figures, an expansion of 200 per cent in 10 years is assumed for all vehicles in the aggregate.[18]

Total potential demand for tyres can be broken down into two categories, the sum of production plus

	Park in 1950	*Park in 1955*	*Decennial growth of park (Percentage)*
Passenger-cars	31 984	54 415	189
Lorries and delivery vans	24 030	43 616	230
Buses	3 453	5 530	157
Total	59 467	103 561	203

In section XVII of the present chapter, demand for passenger cars

[18] The average rate of growth of the vehicle park was calculated on the basis of the following data:

imports, which may be called "real demand", and the number of tyres and inner tubes which enter the country as part of the vehicles that are imported, to which the term "implicit demand" may be applied. As can be seen from table 203, in 1955 real demand stood at 4 273 tons of tyres with their inner tubes (very approximately, 150 000 tyres and an equal number of inner tubes). This figure, added to the 852 tons represented by tyres and inner tubes imported along with vehicles, gives a total potential demand of 5 125 tons, which would increase to 15 375 tons (approximately 550 000 sets of tyres and inner tubes) by 1965.

Broadly speaking, there are no difficulties likely to prevent Peruvian industry from satisfying this demand in the future, except in the case of those types and sizes of tyres for which the market is small and which consequently cannot be economically manufactured. To take these latter into account, all that is needed is to project current imports (478 tons) on the basis of the same growth rate of 200 per cent previously adopted for demand, since, as was shown in chapter V, section XI, imports in 1955 were abnormally high because the plant installed was inadequate to meet demand. With respect to the problem of substituting domestic production for the tyres and inner tubes imported along with vehicles—a development tantamount to importing the latter without tyres—it is believed that a solution can be found, although as yet no motor-vehicle assembly plants exist in Peru. For purposes of transporting the vehicle on its wheels from its place of origin, it would simply have to be fitted with mechanical tyres which would be exchanged in Peru for others of domestic manufacture and would then be returned to the car factory for use in the event of future exports.

The proportion of total future potential demand which can be satisfied by domestic industry will therefore almost entirely depend upon the policy that Peru elects to follow with regard to import substitution in respect of tyres and inner tubes. It is appropriate to point out here that the manufacture of tyres, like that of accumulators and spare parts for vehicles, must be contemplated as part of an over-all programme for the progressive development of the motor-vehicle industry, in which the activities mentioned are preliminary stages to be followed by the installation of assembly plants and, subsequently, the gradual substitution of domestically-manufactured for imported parts. Table 203 shows the effect of various degrees of substitution in respect of implicit imports of tyres. It is worth noting that, if all such imports were replaced by domestic production, the increment in output might reach 268 instead of 200 per cent by 1965, even if separate imports of tyres were allowed to increase at the same rate as is postulated for demand.

In the projections in monetary terms which were prepared to determine how the development of this industry would stand in relation to over-all economic development (see again table 203), a conservative estimate was adopted, namely, that there would not yet be any substitution in respect of implicit imports, and that the growth of production would keep parallel to that of demand, i.e., that the percenatge represented by its conrtibution (86 per cent in monetary terms and 89 per cent in physical terms, in relation to real demand) would remain unchanged up to 1965. In these circumstances, production would attain a volume of 11 385 tons (approximately 400 000 sets of tyres and inner tubes), thus trebling the 1955 figure.

A comparison of the output assumed for 1965 with the industry's current production capacity of 6 000 tons yearly shows that the plant would have to be expanded by 90 per cent, which would cost about 175 million soles. The increase in production would entail the employment of about 570 more workers, given a 10-per-cent improvement in productivity.

To date, the industry has produced tyres for lorries and passengers cars. The manufacture of tyres for tractors, over 150 tons of which were imported in 1955, may shortly prove to be a sound economic proposition.

In the case of the other rubber industries [19] demand is assumed to expand at the distinctly rapid rate of 169 per cent, but it must be noted that this assumption takes into account the propensity of many factories to replace rubber by synthetic resins, owing to the increasingly favourable reception accorded to the latter. In contrast to the hypothesis adopted for the manufacture of tyres, it is considered that in the rest of the industry production might expand at an extremely high rate (354 per cent in 1955-65). In the light industries which constitute a major proportion of the group, the length of economic production series is not of such vital importance as in the heavy industry, and it is therefore estimated that this activity could substitute domestic production for a substantial volume of imported goods, and thus raise its contribution to the satisfaction of demand from the 1955 figure of 33 per cent to 56 per cent in 1956. Nevertheless, as can be seen in table 204, imports would increase by 77 per cent. The production increment postulated would call for the investment of about 20 million soles and the employment of some 830 additional workers, if it were assumed to be possible for productivity to rise by 20 per cent.

is estimated at a rate of slightly under 189 per cent. In this section it was felt preferable not to reduce the figure adopted, as other new types of tyres which are not taken into account here, such as tyres for tractors, would cause demand to expand.

[19] Including the light industry manufacturing a variety of items, mainly consumer goods; the heavy industry producing conveyor belts, transmission belts, etc.; and the manufacture of vulcanized footwear, some aspects of which were dealt with in Section V of the present chapter.

Table 202

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR MANUFACTURE OF LEATHER AND LEATHER GOODS (OTHER THAN FOOTWEAR)

(Values in millions of soles at 1955 prices: decennial growth rates in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	165.2	5.5	9.4	0.2	180.3	346.8	110	5.2	— 5	19.5	107	0.4	100	371.9	106
	P	152.7	5.5	6.7	0.2	165.1	319.9	111	5.2	— 5	14.4	115	0.4	100	339.9	106
	I	12.5	—	2.7	—	15.2	26.9	115	—	—	5.1	89	—	—	32.0	111
	P/D	(92)	(100)	(71)	(100)	(92)	(92)	—	(100)	—	(74)	—	(100)	—	(91)	—
Tanneries	D	165.2	5.3	—	—	170.5	346.8	110	5.2	— 2	—	—	—	—	352.0	107
	P	152.7	5.3	—	—	158.0	319.9	111	5.2	— 2	—	—	—	—	325.1	106
	I	12.5	—	—	—	12.5	26.9	115	—	—	—	—	—	—	26.9	115
	P/D	(92)	(100)	—	—	(93)	(92)	—	(100)	—	—	—	—	—	(92)	—
Manufacture of leather goods (other than footwear)	D	—	0.2	9.4	0.2	9.8	—	—	—	—100	19.5	107	0.4	100	19.9	103
	P	—	0.2	6.7	0.2	7.1	—	—	—	—100	14.4	115	0.4	100	14.8	108
	I	—	—	2.7	—	2.7	—	—	—	—	5.1	89	—	—	5.1	89
	P/D	—	(100)	(71)	(100)	(72)	—	—	—	—	(74)	—	(100)	—	(74)	—
Artisan production	D	95.9	—	3.2	—	99.1	209.5	96	—	—	5.3	66	—	—	214.8	117
	P	95.9	—	3.2	—	99.1	209.5	96	—	—	5.3	66	—	—	214.8	117
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	—	(100)	(100)	—	—	—	(100)	—	—	—	(100)	—
Total	D	261.1	5.5	12.6	0.2	279.4	556.3	113	5.2	— 5	24.8	97	0.4	100	586.7	110
	P	248.6	5.5	9.9	0.2	264.2	529.4	113	5.2	— 5	19.7	99	0.4	100	554.7	110
	I	12.5	—	2.7	—	15.2	26.9	115	—	—	5.1	89	—	—	32.0	111
	P/D	(95)	(100)	(79)	(100)	(95)	(95)	—	(100)	—	(79)	—	(100)	—	(95)	—

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior, 1955.*
Symbols: D: Demand; P: Production; I: Investment; P/D: Percentage relationship between production and demand.

Table 203

PERU: HYPOTHESIS OF GROWTH OF DEMAND FOR TYRES AND PRODUCTION CAPACITY DEVELOPMENT REQUIREMENTS

		Data for 1955 (Tons)	*Hypothesis for 1965*							
			In default of implicit-import substitution		*Given 50 per cent implicit-import substitution*		*Given 75 per cent implicit-import substitution*		*Given total implicit-import substitution*	
			Volume (Tons)	*Decennial growth (Percentage)*	*Volume (Tons)*	*Decennial growth (Percentage)*	*Volume (Tons)*	*Decennial growth (Percentage)*	*Volume (Tons)*	*Decennial growth (Percentage)*
Potential demand	Dp = Dr + Di	5 125	15 375	200	15 375	200	15 375	200	15 375	200
Demand implicit in imports of cars	Di	852	2 556	200	1 278	50	640	— 25	—	—100
Real demand	Dr = P + I	4 273	12 819	200	14 097	229	14 735	245	15 375	260
Production	P	3 795	11 385	200	12 663	234	13 301	250	13 941	268
Imports	I	478	1 434	200	1 434	200	1 434	200	1 434	200
Contribution of production to satisfaction of potential demand	P/Dp	(74)	(74)	—	(82)	—	(87)	—	(91)	—
Contribution of production to satisfaction of real demand	P/Dr	(89)	(89)	—	(90)	—	(90)	—	(91)	—
Current production capacity	C	6 000	6 000	—	6 000	—	6 000	—	6 000	—
Requisite expansion of capacity by 1965.	P-C	—	5 385	90	6 663	111	7 301	122	7 941	132

Table 204

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE RUBBER INDUSTRY

(Values in millions of soles at 1955 prices; decennial growth rates in percentages)

Item		Data for 1955					Hypothesis for 1965								
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	20.7	0.3	4.7	124.9	150.6	78.1	277	—	—100	12.0	155	346.0	177	436.1	190
	P	9.8	0.3	1.0	91.7	102.8	51.0	420	—	—100	7.4	640	275.9	201	334.3	225
	I	10.9	—	3.7	33.2	47.8	27.1	149	—	—	4.6	24	70.1	111	101.8	113
	P/D	(47)	(100)	(21)	(73)	(68)	(65)	—	—	—	(62)	—	(80)	—	(77)	—
Tyres and inner tubes	D	—	0.1	—	99.9	100.0	—	—	—	—100	—	—	300.0	200	300.0	200
	P	—	0.1	—	85.9	86.0	—	—	—	—100	—	—	258.0	200	258.0	200
	I	—	—	—	14.0	14.0	—	—	—	—	—	—	42.0	200	42.0	200
	P/D	—	(100)	—	(86)	(86)	—	—	—	—	—	—	(86) [a]	—	(86) [a]	—
Other manufactures	D	20.7	0.2	4.7	25.0	50.6	78.1	277	—	—100	12.0	155	46.0	84	136.1	169
	P	9.8	0.2	1.0	5.8	16.8	51.0	420	—	—100	7.4	640	17.9	209	76.3	354
	I	10.9	—	3.7	19.2	33.8	27.1	149	—	—	4.6	24	28.1	46	59.8	77
	P/D	(47)	(100)	(21)	(23)	(33)	(65)	—	—	—	(62)	—	(39)	—	(56)	—
Artisan production	D	23.3	—	0.6	9.0	32.9	34.1	46	—	—	—	—	12.9	43	47.0	43
	P	23.3	—	0.6	9.0	32.9	34.1	46	—	—	—	—	12.9	43	47.0	43
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	(100)	(100)	(100)	—	—	—	—	—	(100)	—	(100)	—
Total	D	44.0	0.3	5.3	133.9	183.5	112.2	155	—	—100	12.0	126	358.9	168	483.1	163
	P	33.1	0.3	1.6	100.7	135.7	85.1	157	—	—100	7.4	363	288.8	187	381.3	181
	I	10.9	—	3.7	33.2	47.8	27.1	149	—	—	4.6	24	70.1	111	101.8	112
	P/D	(75)	(100)	(30)	(75)	(74)	(76)	—	—	—	(67)	—	(80)	—	(79)	—

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadística Industrial 1955* and Ministry of Finance and Trade, *Estadística de Comercio Exterior 1955*.

Symbols: D: Demand; P: Production; I: Investment; P/D: Percentage relationship between production and demand.

a The 86-per-cent relationship deriving from monetary figures corresponds to that of 89 per cent obtained on the basis of tons of tyres, since the value per unit of weight is higher for imports than for production.

Table

PERU: MATRIX OF BALANCE OF SUPPLY AND DEMAND FOR PRODUCTS PER
(To

Item			*Nitric acid*	*Ammonium nitrate*	*Ammonium sulphate*	*Superphosphates*	*Copper sulphate*	*Nitroglycerine*	*Electrolytic caustic soda*
Ammonia (expressed in terms of N_2) .	1955	Rd	—	—	—				
		Id	2 840	730	5 900				
		Pd	2 840	730	5 900				
	1965	Rd	21 280	11 800	23 600				
		R	(100)	(100)	(100)				
		Pd	21 280	11 800	23 600				
Nitric acid (expressed in terms of N_2) .	1955	Rd		—				—	
		Id		1 000				1 800	
		Pd		1 000				1 800	
	1965	Rd		15 800				5 400	
		R		(100)				(100)	
		Pd		15 800				5 400	
Nitrates (expressed in terms of N_2) . .	1955	Rd							
		Id							
		Pd							
	1965	Rd							
		R							
		Pd							
Sulphuric acid.	1955	Rd			—	—	1 213	—	134
		Id			15 400	6 650	—	230	158
		Pd			15 400	6 650	1 213	230	292
	1965	Rd			61 300	45 600	3 540	527	533[a]
		R			(100)	(100)	(100)	(100)	(100)
		Pd			61 300	45 600	3 540	527	533
Ammonium sulphate (expressed in terms of N_2)	1955	Rd							
		Id							
		Pd							
	1965	Rd							
		R							
		Pd							
Phosphates (expressed in terms of P_2O_5)	1955	Rd							
		Id							
		Pd							
	1965	Rd							
		R							
		Pd							
Nitroglycerine	1955	Rd							
		Id							
		Pd							
	1965	Rd							
		R							
		Pd							
Copper sulphate	1955	Rd							
		Id							
		Pd							
	1965	Rd							
		R							
		Pd							

Symbols: Rd: Real demand, or consumption of products as such; Id: Implicit demand, or content of product in imported manufactures; Pd: Potential demand;
[a] Figure based on an output of electrolytic caustic soda amounting to 5 330 tons, which would be the volume corresponding to the estimated consumption of chlorine.

TAINING TO THE AMMONIA-SULPHURIC ACID-PHOSPHORIC ACID COMPLEX

ns)

Mining	*Rayon (Other than for tyres)*	*Woollen textiles*	*Explosives*	*Non-ferrous metallurgy*	*Tanning*	*Petroleum refining*	*Agriculture*	*Other chemical products*	*Other uses*	*Total*	*Decennial rates of growth of demand (Percentage)*
		40							193	233	
		7							—	9 477	
		47							193	9 710	
		87							386	57 153	488
		(93)							(100)	—	
		81							386	57 147	24 500
									40	40	
									—	2 800	
									40	2 840	
									80	21 280	648
									(100)	—	
									80	21 280	52 900
							1 730			1 730	
							—			—	
							1 730			1 730	
							27 600			27 600	1 500
							(100)			—	
							27 600			27 600	1 500
666	1 602	172		10 450	232	369		100	103	15 041	
—	2 054	30		—	—	—		—	—	24 522	
666	3 656	202		10 450	232	369		100	103	39 563	
1 998	11 950	376		74 400	480	586		300	206	201 796	410
(100)	(74)	(93)		(100)	(92)	(83)		(100)	(100)		
1 998	8 850	350		74 400	442	486		300	206	198 532	1 220
							5 900			5 900	
							—			—	
							5 900			5 900	
							23 600			23 600	300
							(100)			—	
							23 600			23 600	300
							4 150			4 150	
							—			—	
							4 150			4 150	
							28 550			28 550	588
							(100)			—	
							28 550			28 550	588
			1 800							1 800	
			—							—	
			1 800							1 800	
			5 400							5 400	200
			(100)							100	
			5 400							5 400	200
							39	40		2 426	
2 347							—	—		—	
—							39	40		2 426	
2 347							58	120		7 219	197
7 041							(100)	(100)		—	
(100)							58	120		7 219	197
7 041											

R: Relationship between domestic production and demand, in respect of the item consuming the product.

The manufacture of chemicals and chemical products is among those branches of industry where the opportunities for development are greatest, both because its contribution to the satisfaction of domestic demand is lagging somewhat behind that of other activities, and because such demand will expand to an exceptional extent, inasmuch as the products concerned constitute essential raw materials for many of the more dynamic industries.

Demand and production possibilities for chemical products were studied first in connexion with two industrial complexes whose future importance for Peru seems likely to be great, and secondly in relation to a series of items taken individually. The former are the "ammonia-sulphuric acid-phosphoric acid" complex, which includes fertilizers and explosives, and the "soda-chlorine" complex, which covers products used as inputs in a great many manufactures. Future demand and industrial development prospects had to be studied concurrently with these industrial complexes, because, as often happens with industries of this type, the decision to submit proposals for a new activity frequently derives from the need to absorb the by-products of another, or the surpluses resulting from some line of manufacture which must be developed on a relatively large scale if it is to prove economic. To facilitate the study of the relationship between production and consumption, recourse was had to matrices of the balance of supply and demand (see tables 205 and 208), which are simply input-output tables expressed in terms of either physical or technical units. On the basis of these matrices, future total, potential and "real" demand were calculated for each industry or for the products making up the complex. The production capacity required in 1965 was subsequently projected on the basis of a relationship between production and demand which was in turn determined by technical and market considerations (see table 206).

1. *Products pertaining to the ammonia-sulphuric acid-phosphoric acid complex*

The development of demand for this complex is to a great extent linked to probable consumption of fertilizers and explosives, but in the case of sulphuric acid it depends upon the over-all development of the industry, since this item is used as an input in almost all the important line of manufacture concerned. Existing relationships between the complex and the various branches of industry are expressed in the matrix of balance of supply and demand (see again table 205), and are explained in the paragraphs which follow.

(a) *Fertilizers*

Probable demand for fertilizers can be estimated on the basis of the expansion of land under cultivation and the requisite intensity of application of fertilizers per unit of area.

Irrigation projects in course of execution, or the study of which has reached an advanced stage, include the conversion of 300 000 hectares of waste land into cultivable soil before 1965. Owing to financing difficulties, it is likely that by that date only half the proposed extent—150 000 hectares—will be definitely incorporated into the area under cultivation. Most of this new land is on the coast, and consumption of fertilizers may logically by expected to be the same as that currently registered in the coastal belt. If this figure is established as 100 kilogrammes of nitrogen per hectare, and if the nitrogen-phosphoric acid ratio most suitable for the coast is recognized to be 3:2, the new land would presumably require, at the current rate of application of fertilizers, about 15 000 tons of nitrogen yearly and 10 000 of phosphoric acid.

To estimate the growth of consumption resulting from more intensive use of fertilizers is a more complicated matter. It depends on the efforts made and the policy pursued with a view to the application of fertilizers to over 1.2 million hectares of cultivated land in the *sierra* and the *selva*, where unit consumption is at present extremely low.[20]

Two hypotheses, which might be designated minimum and probable, may therefore usefully be postulated; a third and maximum hypothesis is not presented, since it is considered impossible for domestic industry to satisfy the whole of the country's potential fertilizer requirements within the next ten years.

(i) *Intensified application of fertilizers: minimum hypothesis.* Of the 500 000 hectares under cultivation in the coastal belt, 50 per cent is used mainly for cotton and sugar-cane, and receives, on an average, 144 kilogrammes of fertilizers per hectare; one-fourth is devoted to special crops, such as rice and certain vegetables, and receives about 96 kilogrammes per hectare; and fruit-growing takes up most of the remaining 125 000 hectares, where practically no fertilizers are applied. As a minimum hypothesis, it might be assumed that the first 250 000 hectares would be treated with 160 kilogrammes of fertilizer per hectare; that in the next 125 000 hectares consumption would rise from 96 to 120 kilogrammes; and that in the last 125 000, which are farmed almost in their entirety by small-holders, no system of fertilizing worthy of mention would as yet be introduced. These figures would imply an increase in consumption of nitrogen from 48 100 to 55 000 tons. In the *sierra*, the use of fertilizers is confined to some 64 000 hectares (6.4 per cent of the land under

[20] The geographical distribution of consumption is very uneven. The coastal valleys, which represent less than 30 per cent of the area under cultivation, absorb 94 per cent of the total input of fertilizers, while the rest of the area—over 70 per cent—receives 6 per cent only. It is interesting to note, however, that while on the coast the annual rate of increase of consumption of fertilizers has been 8 per cent since the early, fifties, in the *sierra*, it has been 30 per cent.

Table 206

PERU: DEVELOPMENT HYPOTHESIS FOR MANUFACTURE OF PRODUCTS PERTAINING TO THE SODA-CHLORINE AND AMMONIA-SULPHURIC ACID-PHOSPHORIC ACID COMPLEXES

(Tons)

		1955	1965	Decennial rate of growth (Percentage)
Caustic soda	Rd	9 242	25 490	176
	P	1 341	12 745	850
	I	7 901	12 745	61
	P/Rd	(15)	(50)	
Chlorine	Rd	1 188	4 676	293
	P	1 888 [a]	4 676	293
	I	—	—	—
	P/Rd	(100)	(100)	
Sodium carbonate	Rd	8 203	15 295	87
	P	—	10 000	—
	I	8 203	5 295	— 35
	P/Rd	(0)	(66)	
Hydrochloric acid	Rd	1 133	2 652	134
	P	1 086	2 652	144
	I	47	—	— 100
	P/Rd	(96)	(100)	
Hypochlorides	Rd	1 880	3 799	102
	P	313	3 799	1 115
	I	1 567	—	— 100
	P/Rd	(17)	(100)	
Ammonia for fertilizers and nitric acid (expressed in terms of N_2) [b]	Rd	—	56 680	—
	P	—	56 680	—
	I	—	—	—
	P/Rd	—	(100)	—
Ammonia for other uses (expressed in terms of N_2)	Rd	233	467	100
	P	—	467	—
	I	233	—	— 100
	P/Rd	(0)	(100)	
Nitric acid for fertilizers [b] and nitroglycerine	Rd	—	21 200	—
	P	—	21 200	—
	I	—	—	—
	P/Rd	—	(100)	
Nitric acid for other uses	Rd	40	80	100
	P	—	80	—
	I	40	—	— 100
	P/Rd	(0)	(100)	
Nitrates	Rd	1 730	27 600	1 500
	P	—	27 600	—
	I	1 730	—	— 100
	P/Rd	(0)	(100)	
Sulphuric acid for fertilizers [b]	Rd	—	106 900	—
	P	—	106 900	—
	I	—	—	—
	P/Rd	—	(100)	
Sulphuric acid (other than for fertilizers)	Rd	15 041	91 632	510
	P	14 763	91 632	520
	I	278	—	— 100
	P/Rd	(98)	(100)	
Ammonium sulphate (expressed in terms of N_2)	Rd	5 900	23 600	300
	P	—	23 600	—
	I	5 900	—	— 100
	P/Rd	(0)	(100)	
Phosphates (expressed in terms of P_2O_5)	Rd	4 150	28 550	588
	P	—	28 550	—
	I	4 150	—	— 100
	P/Rd	(0)	(100)	
Nitroglycerine	Rd	1 800	5 400	200
	P	—	5 400	—
	I	1 800	—	— 100
	P/Rd	(0)	(100)	
Copper sulphate	Rd	2 426	7 219	197
	P	1 766	7 219	308
	I	660	—	— 100
	P/Rd	(73)	(100)	

Symbols: Rd: Real demand; P: Production; I: Imports; P/Rd: Percentage relationship between production and real demand.

a Production for domestic consumption only. Exports of 223 tons effected in 1955 are not taken into account in this table.

b In table 209, showing production in monetary terms, these items are included under manufacture of nitrogenous fertilizers and nitroglycerine, since they are taken to constitute stages in the processing of such products.

Table 207

PERU: PROBABLE BALANCE OF PRODUCTION OF FERTILIZERS AND DEMAND, 1965

(Tons of N_2 and P_2O_5)

	Minimum hypothesis		*Probable hypothesis*	
	Nitrogen	*Phosphoric acid*	*Nitrogen*	*Phosphoric acid*
Over-all demand	74 500	53 450	88 700	68 550
For new land	15 000	10 000	15 000	10 000
To intensify application of fertilizers in coastal belt	55 000	36 700	62 500	41 750
To intensify application of fertilizers in sierra	4 500	6 750	11 200	16 800
Production of guano [a]	*37 500*	*40 000*	*37 500*	*40 000*
Demand for chemical fertilizers	37 000	*13 450*	51 200	*28 550*
Project under way for manufacture of nitrogenous fertilizers [b]	16 000	—	16 000	—
Project under way for manufacture of phosphate fertilizers	—	3 500	—	3 500
New capacity that must be projected	21 000	9 950	35 200	25 050

a It is assumed that annual average production of guano up to 1965 will be about 250 000 tons, equivalent to 37 500 tons of N_2 and 40 000 of P_2O_5.
b Including doubling of the plant for the manufacture of synthetic ammonia.

cultivation in the whole of that zone), with an average application of approximately 50 kilogrammes of fertilizer per hectare, and, according to estimates, not less than about 3 000 hectares are annually incorporated into the area where fertilizers are used. If the present average consumption per unit of area is assumed to remain constant, the *sierra's* annual demand for nitrogen should amount to 4 500 tons by 1965.

In the case of phosphoric acid, the minimum hypothesis would warrant 1965 consumption figures of 36 700 tons in the coastal areas currently under cultivation (the ratio between nitrogen and phosphoric acid being assumed to stand at 3:2), and 6 750 tons in the *sierra* (with a corresponding ratio of 1:1.5).

(ii) *Intensified application of fertilizers: probable hypothesis.* Between 1946 and 1951, demand for fertilizers in the coastal districts of Peru increased at an annual rate of 8 per cent, but at the same time the area under cultivation expanded by 2 per cent yearly. The annual increment due to intensification of the use of fertilizers was therefore 6 per cent. It was possible to maintain this comparatively high rate because of the low price of guano, but that it will be kept up in the near future seems unlikely. Moreover, owing to supply limitations, any gap between demand for fertilizers and guano production would have to be bridged to an increasing extent with chemical fertilizers, the price of which is much higher per unit of nitrogen and of phosphoric acid. As the increase in the cost may cause a decline in the rate of expansion of consumption,[21] it was deemed wise to fix the probable rate of growth of demand in the coastal area at only 3 per cent annually for the next few years. In the *sierra*, too, where the rate of increase has been 30 per cent, it was considered justifiable to reduce the estimated annual increment to 15 per cent for the near future. On the basis of current consumption (1956), probable demand in 1965 would amount to 62 500 tons of nitrogen in the coastal belt and 11 200 tons in the *sierra*. Phosphoric acid requirements would be 41 750 tons on the coast and 16 800 tons in the *sierra*, in accordance with the ratios given above.

(iii) *Prospects for the development of production.* As was explained in chapter V, section XII, Peru's only domestically-produced fertilizer is the guano obtained from islands whose annual supply capacity is limited in the future to 250 000 tons, equivalent to 37 500 tons of nitrogen and 40 000 of phosphoric acid. Of the projects in course of execution, two are worth taking into consideration. One is a nitrogenous fertilizer project which, after doubling its capacity for the production of synthetic ammonia, would yield about 16 000 tons of nitrogen in the form of fertilizers; the other would manufacture a volume of phosphate fertilizers equivalent to 3 500 tons of phosphoric acid. Table 207 shows the balance between the total output referred to and demand as estimated in accordance with the minimum and probable hypotheses.

If, for projection purposes, the data of the probable hypothesis were adopted, the additional development of the industry concerned, over and above the two projects mentioned, would have to provide 35 200 tons of nitrogen and 25 050 tons of phosphoric acid, which are the deficits shown in table 207. The nitrogen deficit could be met by the installation of a plant with a daily synthetic ammonia production capacity of 100 tons; its output would be the basis for a yearly production of about 125 000 tons of ammonium sulphate or 76 000 of ammonium nitrate, or 55 000 of urea. In the first case, the total fixed investment required would range from 10.5 to 12 million dollars, and in the second, from 11.75 to 13.25 million. If the deficit were covered with two units having a daily synthetic ammonia production capacity of 50 tons each, fixed investment per unit would amount to approximately 6.5 to 7.4 million dollars in the case of ammonium sulphate, 6 to 7 million in that of ammonium nitrate and 7.5 to 8.5 million in that of urea.

21 Studies carried out recently in the United States show that the trend of fertilizer consumption follows the fluctuations of income rather than soil requirements; if a rise in the price of fertilizers is among the factors adversely affecting the farmer's income, he is very likely to reduce his consumption of fertilizers.

Since less investment would be needed in the case of ammonium nitrate, and the cost of production per unit of nitrogen would also be lower, this fertilizer would seem to be the more advisable, as long as it is proved to be suitable for mixing with guano.

Although the cost of installation and of production per unit of nitrogen is more advantageous in the case of a plant with a daily capacity of 100 tons than in that of two 50-ton units, market considerations or questions relating to the supply of capital might weight the balance in favour of the installation, in successive stages, of two units with a 50-ton daily capacity for the production of ammonia and its derivatives.

The 25 000-ton phosphoric acid deficit could be covered with a plant whose daily superphosphates production capacity was 250 tons, and which would require fixed investment totalling 600 000 to 700 000 dollars with the exclusion of the sulphuric acid plant, or from 1.2 to 1.3 million dollars with its inclusion.

If a total demand for phosphoric acid amounting to 28 550 tons has to be satisfied, the implication is that about 100 000 tons of phosphate rock, with an average phosphoric acid content of 30 per cent, would have to be available yearly, as well as an annual supply of some 77 000 tons of sulphuric acid for treating it. The second requisite seems to present no difficulties; but the former would do so, unless economically exploitable phosphorites were discovered in Peru. There is news of fairly large deposits in the departments of Cuzco and Puno; and of others, in the form of coprolites, in the departments of Piura and Ica. Given the importance of these raw materials for the national economy, geological research should be carried out to ascertain whether domestic sources of supply really will be available.[22]

(b) *Sulphuric acid*

If the fertilizers industry were to develop along the lines contemplated in the preceding paragraphs, demand for sulphuric acid would increase by almost 184 000 tons annually between 1955 and 1965. This figure exceeds the sum of the capacities represented by the projects under study or in course of execution. One of these, with an annual capacity of 10 000 tons, on the basis of the contact procedure, was approaching completion in 1957; most of its output would be earmarked for the manufacture of superphosphates.

If the fertilizers industry failed to develop to the extent indicated in the foregoing paragraphs, ILO would have to export sulphuric acid to some of the Pacific coast countries—low production costs would make this a possibility—despite the difficulties inherent in handling it.

(c) *Explosives*

The expected development of mining will imply a marked increase in demand for safety explosives, estimated at 200 per cent between 1955 and 1965. There is nothing to prevent the whole of this demand from being covered by Peruvian production, since all the basic raw materials—glycerine, nitric acid, sulphuric acid and ammonium nitrate—will come from domestic sources.

Peru's first nitroglycerine factory, installed with the technical and financial assistance of foreign capital, is expected to enter production during the second half of 1959. With its entry into operation, the country will be able to produce about 4 000 tons of explosives annually, accounting for 75 per cent of current consumption in mining and civil engineering works; this means that when the new plant is running normally, substantial increases in production capacity will have to be projected.

According to the projections formulated in this study, by 1965 the explosives industry will have to add another 1 400 tons to the annual capacity projected at present.

2. *Products pertaining to the soda-chlorine complex*

Projections of demand on the part of various industries, mainly those manufacturing artificial fibres, pulp, glass, insecticides and soap, were used to determine potential and real demand for the principal products, pertaining to the soda-chlorine complex. The results can be seen in table 208, while table 206 gives estimates of the production capacity required in 1965, based on the aforesaid projection of demand. Each of the most important products is dealt with in some detail below.

(a) *Sodium alkalis*

The increment in demand for sodium alkalis during the period 1955-65, estimated on the basis of the probable expansion of consumption in the various lines of manufacture which use them as inputs, works out at 176 per cent in the case of caustic soda and 87 per cent in that of sodium carbonate, which would bring annual total demand up to 25 490 tons for soda and 15 295 for carbonate.

As was shown in chapter V, section XII, current capacity for the manufacture of caustic soda amounts to 1 340 tons, and there is as yet no plant installed for the production of sodium carbonate. A project is at present afoot for the installation of an electrolytic plant to the north of Lima to manufacture commercial caustic soda, in Hooker cells, as well as high-grade soda in mercury cells. It is believed that production might begin in 1960, but up to the time at which the data for the present report were collected the exact capacity of the plant in question had not yet been determined.[23]

22 At the time of going to press, information was received as to substantial phosphates deposits in the Sechura desert; prospecting is under way, and data on grades, reserves and impurities are not yet available.

23 The project originally comprised installed capacity for 18 000 tons of caustic soda, of which 7 200 tons would be converted into 9 250 tons of sodium carbonate, but a more thorough study of the market and market conditions led to the substitution of a project for a plant with lower capacity which would not produce sodium carbonate.

Table

PERU: MATRIX OF BALANCE OF SUPPLY AND DEMAND FOR PRODUCTS

(To

			Hydrochloric acid (30 per cent)	*Polyvinyl chloride*	*Tanning*	*Glass*	*Artificial fibres*	*Insecticides*
Caustic soda	1955	Rd			2		1 240	
		Id			—		1 470	
		Pd			2		2 710	
	1965	Pd			4		8 850	
		R			(92)		(74)	
		Rd			4		6 550	
Chlorine	1955	Rd	300	—				—
		Id	12	35				1 210
		Pd	312	35				1 210
	1965	Pd	730	1 200				1 800
		R	(100)	(100)				(61)
		Rd	730	1 200				1 100
Sodium carbonate	1955	Rd			6	6 247		
		Id			—	813		
		Pd			6	7 060		
	1965	Pd			13	14 120		
		R			(92)	(77)		
		Rd			12	10 850		
Hydrochloric acid	1955	Rd						
		Id						
		Pd						
	1965	Pd						
		R						
		Rd						
Hypochlorides	1955	Rd						
		Id						
		Pd						
	1965	Pd						
		R						
		Rd						

Symbols: Rd: Real demand, or consumption of product as such; Id: Implicit demand, or content of product in imported manufactures; Pd: Potential demand;

PERTAINING TO THE SODA-CHLORINE COMPLEX, 1955 AND 1965
ns)

Hypo-chlor-ides	*Cotton and woollen textiles*	*Pulp for paper*	*Sugar*	*Soap (Includ-ing oil refin-ing)*	*Deter-gents*	*Petro-leum refin-ing*	*Other chemi-cal prod-ucts*	*Other uses*	*Total*	*Decenial rates of growth of demand (Percentage)*
	165	2 695		4 550	65	160	290	75	9 242	
	13	1 460		135	15	—	—	—	3 093	
	178	4 155		4 685	80	160	290	75	12 335	
	289	11 800		11 100	195	254	870	150	33 512	172
	(93)	(71)		(80)	(70)	(83)	(100)	(100)	—	
	270	8 400		8 900	136	210	870	150	25 490	176
330	4	339					15	200	1 188	
10	—	93					—	—	1 360	
340	4	432					15	200	2 548	
680	7	795					45	400	5 657	122
(100)	(93)	(71)					(100)	(100)	—	
680	7	514					45	400	4 676	293
	530	65		240	15		610	490	8 203	
	75	40		7	5		—	—	940	
	605	105		247	20		610	490	9 143	
	980	298		583	50		1 830	980	18 854	106
	(93)	(71)		(80)	(70)		(100)	(100)	—	
	910	212		466	35		1 830	980	15 295	87
							386	747	1 133	
							—	—	—	
							386	747	1 133	
							1 158	1 494	2 652	134
							(100)	(100)	—	
							1 158	1 494	2 652	134
	172	42	505				221	940	1 880	
	17	29	—				—	36	82	
	189	71	505				221	976	1 962	
	306	201	756				663	1 952	3 878	97
	(93)	(71)	(100)				(100)	(100)	—	
	285	143	756				663	1 952	3 799	102

R: Relationship between domestic production and demand, in respect of the item consuming the product.

(b) *Chlorine*

The biggest problem encountered by the development of the alkalis industry in Peru along the line planned—with electrolytic plant—is that of finding uses for chlorine so as to reduce manufacturing costs and get rid of this by-product without difficulty.

Domestic demand currently stands at about 1 200 tons, while in the future, if estimated on the basis of various industries' probable consumption, it seems likely to reach about 4 676 tons by 1965—a very low figure in comparison with the 11 200 tons which that year's estimated production of caustic soda (12 745 tons) would yield as a by-product. This comparison clearly shows that the expansion of electrolytic soda production would be severely handicapped, and that it would be well worth Peru's while to pursue an energetic policy for the promotion of industries which consume chlorine, such as those manufacturing insecticides and raw materials for plastic goods.

(c) *Insecticides*

The two most popular chlorinated insecticides at present are DDT and BHC. In 1955, Peruvian agriculture consumed 680 tons of different preparations based on DDT, of which their total content amounted to 340 tons, and 2 220 tons of several BHC combinations with a hexachlorbenzene content of 450 tons.[24] Almost 90 per cent of these insecticides are used in cotton-growing. In the last two years the application of insecticides has been carried to such an extreme that the species which control the development of pests have been exterminated, and reduced cotton crops have been the final result. It is estimated that the output of two small plants—one for DDT and one for BHC, with a capacity of one and two tons per 8 hours, respectively—would be enough to satisfy demand over the next few years. The former would operate on the basis of imported monochlorbenzene and chloral manufactured domestically from chlorine and ethyl alcohol; the latter would import benzene and chlorurate it in Peru. Investment requirements would amount to 200 000 and 225 000 dollars for the DDT and BHC plants, respectively. The cost of production—at 1957 raw material prices—would be about 920 dollars per ton of technical DDT and 350 dollars per ton of BHC. This latter cost is almost the same as the current price of imported BHC, but the DDT would be from 10 to 25 per cent dearer. This does not mean, however, that its manufacture would be inadvisable, since the cost would be sure to decrease once lower-priced raw materials were available. It is assumed in this study that by 1965 there would be plants producing some 225 tons of DDT and 540 tons of BHC, consuming 240 tons of chlorine in the first case and 850 in the second, that is, about 1 100 tons annually between the two.

[24] Ministry of Agriculture, Agricultural Protection Department, Resumen total de insecticidas, fungicidas, herbicidas, fumigantes y coadyuvantes vendidos en el país en 1955 (Total sales of insecticides, fungicides, weed-killers, fumigants and accessories in Peru, 1955).

(d) *Polyvinyl chloride*

Consumption of plastic materials in Peru is still modest, but since 1950 has increased at the fairly high annual rate of 8 per cent.[25] It has not been possible in the present study to consider future prospects for the expansion of the plastics market, since their analysis would entail detailed research, covering, *inter alia*, the possibilities of replacing containers and packing materials of all kinds by plastic substitutes. For purposes of projecting the development of the industry, polyvinyl chloride alone was selected, because substantial quantities of chlorine are required for its manufacture, and because, apart from other uses—for example, in cable covers, treatment of textiles, floor tiles, various moulded goods and as a substitute for rubber—it could be utilized for the manufacture of irrigation pipes for agriculture, an application which is rapidly becoming widespread and for the development of which Peru offers ample scope.[26]

Even without knowledge of the market prospects that may be afforded by consumption of pipes for agriculture, it is assumed that Peru could set up a plant of at least the smallest economic dimensions for producing this type of resin. It would have an annual capacity of 1 800 tons, would consume about 1 200 tons of chlorine and would cost approximately 1.2 million dollars.

(e) *Calcium chloride*

Several chlorinated products are consumed in Peru, but in every case demand is too limited to warrant domestic production for the time being. The manufacture of calcium chloride, however, might be worth considering, since the adhesive quality imparted by its hygroscopicity enables it to be used for hardening non-asphalted roads. It seems to be well suited to the Peruvian coastal belt, where rainfall is low but the climate is very damp. Its current sale price—57.3 dollars per ton—might be reduced if it were manufactured with domestically-produced chlorine. Initial installed capacity for 2 800 tons of calcium chloride annually would cost 50 000 dollars, would consume 2 000 tons

[25] Resin consumption figures in recent years were as follows:

	1955	*1956*
Cellulose acetate flakes	218	293
Granulated polystyrene	50	110
Granulated polyethylene	18	66
Granulated urea formaldehyde	54	66
Granulated cellulose ethyl	25	45
Granulated phenol formaldehyde	18	25
Acrylics (sheet and rolled products)	225	159
Acrylics (40-per-cent emulsions)	9	23
Alkylic resins	100	122
Phenolic resins	82	98
Miscellaneous plastic materials (sheet and rolled products)	193	236
Total	*1 090*	*1 510*

[26] These pipes are generally used in short sections by means of which water is syphoned out of the secondary irrigation on the upper boundary of the area to be irrigated.

of chlorine and would allow some 680 kilometres of road surface to be hardened yearly.[27] As this application of calcium chloride would call for prior experiment in Peru, it is not included in the projections prepared for the present study, but it is noted here as a development with interesting possibilities, which would be one way of consuming chlorine.

3. *Pharmaceutical products*

As far as the manufacture of pharmaceutical specifics for consumption is concerned, a 78-per-cent increase in demand may reasonably be expected; this corresponds to an elasticity of 1.5, similar to that observed in countries with an economic structure and rate of development analogous to Peru's.

Substantial progress in the manufacture of raw materials for the pharmaceutical industry is not thought to be possible within the next 10 years, since the market is much too narrow to justify the installation of a plant of economic dimensions, and there is a constant risk that the items such plant is intended to produce may quickly become obsolete in consequence of new medical discoveries, as is often the case with antibiotics. Where a considerable margin does exist for the substitution of domestic production for imports is in the mixing, making up (in tablet form or in solution) and packing of medicaments, processes which, although they partake more of the nature of marketing than of industry, are profitable to the country inasmuch as they employ domestic labour and enlarge the internal market for glass and plastic containers, labels and cardboard boxes.

Hence it is assumed that the manufacture of pharmaceutical products for consumption might increase by 219 per cent, which would add 181 million soles to the 83 produced by this activity in 1955. With this development, the share of domestic production in the satisfaction of consumer demand would rise from 56 to 88 per cent. The increment in the manufacture of raw materials and intermediate products would be only 81 per cent, thereby adding a further 21 million soles to the 26 million produced in 1955. In this case the proportion corresponding to domestic production would decrease from 26 to 24 per cent (see table 209).[28]

4. *Artificial fibres*

The rate of growth of demand for artificial fibres was determined when, in section IV of the present chapter, the probable expansion of the cut fibre and filament textile industries was estimated at 226 per cent, in the aggregate, for the period 1955-65. This increase must chiefly be ascribed to demand for cut fibres, which in physical terms would rise by 367 per cent, whereas demand for filament would do so by 88 per cent only (see again table 188).

The foregoing figures imply that by 1965 demand for artificial fibres would reach 8 400 tons, of which about 6 000 would be cut fibre. In view of the noticeable tendency to replace rayon and acetate by other fibres which cannot as a rule be economically manufactured without large units, the share of the domestic chemicals industry in the satisfaction of demand for artificial fibres is assumed to contract slightly (from 44 to 43 per cent in physical units, or from 69 to 64 per cent in monetary terms). In brief, the industry's production would expand by 200 per cent, which would mean the addition of 2 395 tons annually to the 1 195 produced in 1955. Most of this expansion will probably be affected in the existing rayon factories, but there is also a possibility that others may be set up, specializing in a different type of product, such as nylon, which Peru plans to spin on the basis of imported polymers. As has already been pointed out on several occasions, the greatest effort would have to be concentrated on the production of cut fibres, demand for which trends to increase very dynamically, owing to their own characteristics and to their usefulness for wool and cotton mixtures.

5. *Paint and enamel*

The basis on which future paint consumption can best be estimated seems to be provided by building activities, which in turn are assumed to expand by 89 per cent between 1955 and 1965. This hypothesis would give an annual growth rate rather lower than that of 7 per cent noted in 1955-56, when there was something approaching a boom in construction.[29]

In physical terms, about 950 000 gallons of paint would have to be produced in 1965. To attain this figure, existing production capacity would have to be virtually doubled. But there would be little increase in the proportion of demand satisfied by domestic production; it would rise only from 62 to 69 per cent, because the market is too narrow to warrant the manufacture of many of the raw materials needed, and there is consequently little economic incentive to undertake an activity which is confined to the mixing and packing of the products.

6. *Soap*

Future demand for soap was determined on the basis of the elasticity coefficients recorded in countries with an economic structure and conditions similar to those of Peru. A ten-year growth rate of 82 per cent was

[27] It is used at a rate of 1.1 kilogrammes per square metre. At the current price of 1.1 soles per kilogramme, this would mean that for every kilometre of road surface 4 metres wide, 4 850 soles' worth of hardening agent would be consumed. It is extremely easy to apply.

[28] In the production of penicillin, for example, the penicillin itself represents a minimum proportion of the total cost. Packing operations constitute an important costs item which may even require a good deal of mechanization and a fair amount of manpower. The cost of containers and labels is also significant.

[29] A ten-year growth rate of 89 per cent for building activities implies an elasticity of 8.85 in relation to the increase in gross investment, which was that registered in 1945-55.

Table 209

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE CHEMICALS INDUSTRY

(Values in millions of soles: decennial growth rates in percentage)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	638.0	20.3	377.8	1.0	1 037.1	1 939.0	204	17.3	−15	861.9	128	2.6	160	2 820.7	172
	P	196.5	20.3	226.9	1.0	444.7	1 275.5	549	17.3	−15	579.3	155	2.6	160	1 874.6	322
	I	441.5	—	150.9	—	592.4	663.5	50	—	—	282.6	87	—	—	946.1	60
	P/D	(31)	(100)	(60)	(100)	(43)	(66)	—	(100)	—	(67)	—	(100)	—	(66)	—
Ammonia (other than for fertilizers and nitric acid)	D	1.0	—	—	—	1.0	2.0	100	—	—	—	—	—	—	2.0	100
	P	—	—	—	—	—	2.0	—	—	—	—	—	—	—	2.0	—
	I	1.0	—	—	—	1.0	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Hydrochloric acid [a]	D	0.7	—	—	—	0.7	1.6	134	—	—	—	—	—	—	1.6	134
	P	0.4	—	—	—	0.4	1.6	144	—	—	—	—	—	—	1.6	144
	I	0.3	—	—	—	0.3	—	−100	—	—	—	—	—	—	—	−100
	P/D	(57)	—	—	—	(57)	(100)	—	—	—	—	—	—	—	(100)	—
Nitric acid (other than for fertilizers and nitroglycerine)	D	0.3	—	—	—	0.3	0.6	100	—	—	—	—	—	—	0.6	100
	P	—	—	—	—	—	0.6	—	—	—	—	—	—	—	0.6	—
	I	0.3	—	—	—	0.3	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Sulphuric acid (other than for fertilizers) [b]	D	5.8	—	—	—	5.8	91.6	510	—	—	—	—	—	—	91.6	510
	P	5.2	—	—	—	5.2	91.6	520	—	—	—	—	—	—	91.6	520
	I	0.6	—	—	—	0.6	—	−100	—	—	—	—	—	—	—	−100
	P/D	(90)	—	—	—	(90)	(100)	—	—	—	—	—	—	—	(100)	—
Sodium carbonate	D	6.5	—	—	—	6.5	12.0	85	—	—	—	—	—	—	12.0	85
	P	—	—	—	—	—	7.9	—	—	—	—	—	—	—	7.9	—
	I	6.5	—	—	—	6.5	4.1	− 37	—	—	—	—	—	—	4.1	− 37
	P/D	—	—	—	—	—	(66)	—	—	—	—	—	—	—	(66)	—
Calcium carbide	D	5.1	—	—	—	5.1	18.5	263	—	—	—	—	—	—	18.5	263
	P	—	—	—	—	—	18.5	—	—	—	—	—	—	—	18.5	—
	I	5.1	—	—	—	5.1	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Chlorine	D	22.4	—	—	—	22.4	88.0	293	—	—	—	—	—	—	88.0	293
	P	22.4	—	—	—	22.4	88.0	293	—	—	—	—	—	—	88.0	293
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	(100)	—	—	—	—	—	—	—	(100)	—
Polyvinyl chlorine	D	0.3				0.3	33.6	—	—	—	—	—	—	—	33.6	9 900
	P	—				—	33.6	—	—	—	—	—	—	—	33.6	—
	I	0.3				0.3	—	—	—	—	—	—	—	—	—	−100
	P/D	(0)				(0)	(100)	—	—	—	—	—	—	—	(100)	

See end of table for source and footnotes.

Table 209 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE CHEMICALS INDUSTRY

(Values in millions of soles: decennial growth rates in percentage)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Detergents for consumption . .	D	—	—	26.7	—	26.7	—	—	—	—	80.0	200	—	—	80.0	200
	P	—	—	24.0	—	24.0	—	—	—	—	56.0	133	—	—	56.0	133
	I	—	—	2.7	—	2.7	—	—	—	—	24.0	789	—	—	24.0	789
	P/D	—	—	(90)	—	(90)	—	—	—	—	(70)	—	—	—	(70)	—
Artificial fibres.	D	79.4	—	—	—	79.4	259.0	226	—	—	—	—	—	—	259.0	226
	P	54.9	—	—	—	54.9	165.0	200	—	—	—	—	—	—	165.0	200
	I	24.5	—	—	—	24.5	94.0	284	—	—	—	—	—	—	94.0	284
	P/D	(69)	—	—	—	(69)	(64)	—	—	—	—	—	—	—	(64)	—
Synthetic nitrogenous fertilizers.	D	53.0	—	—	—	53.0	355.0	570	—	—	—	—	—	—	355.0	570
	P	—	—	—	—	—	355.0	—	—	—	—	—	—	—	355.0	—
	I	53.0	—	—	—	53.0	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Phosphates and superphosphates	D	7.3	—	—	—	7.3	50.4	590	—	—	—	—	—	—	50.4	590
	P	—	—	—	—	—	50.4	—	—	—	—	—	—	—	50.4	—
	I	7.3	—	—	—	7.3	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Carbonic gas.	D	3.2	—	—	—	3.2	8.8	175	—	—	—	—	—	—	8.8	175
	P	3.2	—	—	—	3.2	8.8	175	—	—	—	—	—	—	8.8	175
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)				(100)	(100)	—	—	—	—	—	—	—	(100)	—
Glycerine	D	2.4	0.2	—	—	2.6	5.2	117	—	—	—	—	—	—	5.2	100
	P	2.0	0.2	—	—	2.2	5.2	160	—	—	—	—	—	—	5.2	136
	I	0.4	—	—	—	0.4	—	−100	—	—	—	—	—	—	—	−100
	P/D	(83)	(100)	—	—	(85)	(100)	—	—	—	—	—	—	—	(100)	—
Hypochlorides	D	2.4	—	—	—	2.4	4.8	102	—	—	—	—	—	—	4.8	102
	P	0.4	—	—	—	0.4	4.8	115	—	—	—	—	—	—	4.8	115
	I	2.0	—	—	—	2.0	—	−100	—	—	—	—	—	—	—	−100
	P/D	(17)	—	—	—	(17)	(100)	—	—	—	—	—	—	—	(100)	—
Insecticides	D	88.8	—	—	—	88.8	132.5	49	—	—	—	—	—	—	132.5	49
	P	34.2	—	—	—	34.2	80.7	136	—	—	—	—	—	—	80.7	136
	I	54.6	—	—	—	54.6	51.8	− 5	—	—	—	—	—	—	51.8	− 5
	P/D	(39)	—	—	—	(39)	(61)	—	—	—	—	—	—	—	(61)	—
Soap.	D	—	—	72.5	—	72.5	—	—	—	—	132.0	82	—	—	132.0	82
	P	—	—	70.1	—	70.1	—	—	—	—	129.0	84	—	—	129.0	84
	I	—	—	2.4	—	2.4	—	—	—	—	3.0	25	—	—	3.0	25
	P/D	—	—	(97)	—	(97)	—	—	—	—	(98)	—	—	—	(98)	—
Non-edible fats.	D	35.1	—	—	—	35.1	70.0	99	—	—	—	—	—	—	70.0	99
	P	5.1	—	—	—	5.1	17.5	243	—	—	—	—	—	—	17.5	243
	I	30.0	—	—	—	30.0	52.5	75	—	—	—	—	—	—	52.5	75
	P/D	(15)	—	—	—	(15)	(25)	—	—	—	—	—	—	—	(25)	—

See end of table for source and footnotes.

Table 209 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE CHEMICALS INDUSTRY

(Values in millions of soles: decennial growth rates in percentage)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Nitroglycerine	D	40.6	—	—	—	40.6	122.0	200	—	—	—	—	—	—	122.0	200
	P	—	—	—	—	—	122.0	—	—	—	—	—	—	—	122.0	—
	I	40.6	—	—	—	40.6	—	−100	—	—	—	—	—	—	—	−100
	P/D	—	—	—	—	—	(100)	—	—	—	—	—	—	—	(100)	—
Oxygen	D	4.7	—	—	—	4.7	17.0	262	—	—	—	—	—	—	17.0	262
	P	4.7	—	—	—	4.7	17.0	262	—	—	—	—	—	—	17.0	262
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	(100)	—	—	—	—	—	—	—	(100)	—
Paint and enamel	D	45.3	—	—	1.0	46.3	84.9	87	—	—	—	—	2.6	160	87.5	89
	P	27.7	—	—	1.0	28.7	58.1	110	—	—	—	—	2.6	160	60.7	111
	I	17.6	—	—	—	17.6	26.8	52	—	—	—	—	—	—	26.8	52
	P/D	(61)	—	—	(100)	(62)	(68)	—	—	—	—	—	(100)	—	(69)	—
Toilet articles	D	—	—	33.8	—	33.8	—	—	—	—	67.6	100	—	—	67.6	100
	P	—	—	28.9	—	28.9	—	—	—	—	64.2	122	—	—	64.2	122
	I	—	—	4.9	—	4.9	—	—	—	—	3.4	− 31	—	—	3.4	− 31
	P/D	—	—	(86)	—	(86)	—	—	—	—	(95)	—	—	—	(95)	—
Pharmaceutical products	D	101.1	0.2	146.8	—	248.1	199.9	97	—	—	307.7	78	—	—	507.4	104
	P	26.1	0.2	82.8	—	109.1	47.3	81	—	—	264.3	219	—	—	311.4	183
	I	75.0	—	64.0	—	139.0	152.6	104	—	—	43.4	− 32	—	—	196.0	41
	P/D	(26)	(100)	(56)	—	(44)	(24)	—	—	—	(88)	—	—	—	(61)	—
Caustic soda [c]	D	12.9	—	—	—	12.9	33.1	176	—	—	—	—	—	—	33.1	176
	P	1.6	—	—	—	1.6	16.6	850	—	—	—	—	—	—	16.6	850
	I	11.3	—	—	—	11.3	16.5	61	—	—	—	—	—	—	16.5	61
	P/D	(12)	—	—	—	(12)	(50)	—	—	—	—	—	—	—	(50)	—
Sulphide of carbon	D	1.0	—	—	—	1.0	4.6	360	—	—	—	—	—	—	4.6	360
	P	1.0	—	—	—	1.0	3.0	200	—	—	—	—	—	—	3.0	200
	I	—	—	—	—	—	1.6	—	—	—	—	—	—	—	1.6	—
	P/D	(100)	—	—	—	(100)	(65)	—	—	—	—	—	—	—	(65)	—
Sodium sulphide	D	1.3	—	—	—	1.3	3.4	162	—	—	—	—	—	—	3.4	162
	P	0.8	—	—	—	0.8	3.4	325	—	—	—	—	—	—	3.4	325
	I	0.5	—	—	—	0.5	—	−100	—	—	—	—	—	—	—	−100
	P/D	(62)	—	—	—	(62)	(100)	—	—	—	—	—	—	—	(100)	—
Copper sulphate	D	8.8	—	—	—	8.8	25.9	194	—	—	—	—	—	—	25.9	194
	P	4.7	—	—	—	4.7	25.9	451	—	—	—	—	—	—	25.9	451
	I	4.1	—	—	—	4.1	—	−100	—	—	—	—	—	—	—	−100
	P/D	(53)	—	—	—	(53)	(100)	—	—	—	—	—	—	—	(100)	—
Candles	D	—	—	21.3	—	21.3	—	—	—	—	27.3	28	—	—	27.3	28
	P	—	—	21.1	—	21.1	—	—	—	—	27.3	29	—	—	27.3	29
	I	—	—	0.2	—	0.2	—	—	—	—	—	−100	—	—	—	−100
	P/D	—	—	(99)	—	(99)	—	—	—	—	(100)	—	—	—	(100)	—

See end of table for source and footnotes.

Table 209 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE CHEMICALS INDUSTRY

(Values in million of soles: decennial growth rates in percentage)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Sodium and potassium xanthate	D	14.8	—	—	—	14.8	44.5	201	—	—	—	—	—	—	44.5	201
	P	0.7	—	—	—	0.7	44.5	536	—	—	—	—	—	—	44.5	536
	I	14.1	—	—	—	14.1	—	−100	—	—	—	—	—	—	—	−100
	P/D	(5)	—	—	—	(5)	(100)	—	—	—	—	—	—	—	(100)	—
Other chemical products . . .	D	93.8	19.9	76.7	—	190.4	270.3	188	17.3	−13	247.3	222	—	—	534.5	182
	P	1.4	19.9	—	—	21.3	6.7	379	17.3	−13	38.5	—	—	—	62.1	192
	I	92.4	—	76.7	—	169.1	263.6	186	—	—	208.8	172	—	—	472.4	179
	P/D	(1)	(100)	(0)	—	(11)	(2)	—	(100)	—	(16)	—	—	—	(12)	—
Artisan production	D	186.1	—	—	—	186.1	—	—	—	—	—	—	—	—	—	—
	P	186.1	—	—	—	186.1	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	—	—	—	—	—	—	—	—	—	—
Total	D	824.1	20.3	377.8	1.0	1 223.3	1 939.0	135	17.3	−15	861.9	128	2.6	160	2 820.7	131
	P	382.6	20.3	226.9	1.0	630.9	1 275.5	233	17.3	−15	579.3	155	2.6	160	1 874.6	198
	I	441.5	—	150.9	—	592.4	663.5	50	—	—	282.6	87	—	—	946.1	60
	P/D	(46)	(100)	(60)	(100)	(52)	(66)	—	(100)	—	(67)	—	(100)	—	(66)	—

SOURCES: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955*; Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.

Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.

a For 1965, hydrochloric acid is valued at an average price of 0.62 soles per kilogramme which, if applied to 1955 volumes, would give the following result: D = 0.70; P = 0.67; P/D = 96.

b For 1965, sulphuric acid is priced at 1 sol per kilogramme, on the assumption of future conditions favourable to low costs. At this price the data for 1955 would have worked out as follows: D = 15.1; P = 14.8; I = 0.3; P/D = 98.

c For 1965, caustic soda is valued at an average price of 1.30 soles per kilogramme, which, if applied to 1955 volumes, would give the following result: D = 12.0; P = 1.7; I = 10.3; P/D = 15.

thus obtained. On such an assumption, by 1965 Peru's consumption of soap would amount to about 21 000 tons. It is considered that not less than 98 per cent could be produced at home, which would imply the addition of some 9 000 tons to the 1955 output of 11 500 tons. Production capacity, however, would need to be expanded by only 75 per cent.

7. *Other chemical products*

The course likely to be followed by demand for other chemical products was estimated on the basis of the expansion expected to take place in the various sectors using them. Demand figures once postulated, the possibilities for the manufacture of such products in Peru were evaluated in accordance with criteria that in almost every case were discussed with representatives of the industry concerned. Data on probable consumption and production are presented in table 209.

8. *Summary of fixed capital and staffing requirements for the expansion of the chemicals industry*

For the sake of simplicity, it was thought preferable to sum up in a single table equipment and personnel requirements for the expansion of each branch of the chemicals industry, in accordance with the growth targets and hypotheses presented in the foregoing paragraphs (see table 210). The results bear eloquent witness to the investment effort that would have to be made in this line of manufacturing; but it would be fully justified, not only because the industry produces raw materials for other important activities, but also because it would in itself contribute about 10 per cent of the future expansion of Peru's manufacturing output and over 11 per cent to the absorption of new active population by manufacturing industry as a whole.

In short, the development of the chemicals industry up to 1965 would require 10 850 additional workers and investment to a value of 1 868 million soles.

XIII. PETROLEUM AND COAL DERIVATIVES INDUSTRY

The projections made with the help of input-product matrices (tables 174 and 179) indicate that total demand for petroleum and coal derivatives intended for raw materials and internal consumption should increase at the rate of 87 per cent between 1955 and 1965. This means that exports would disappear completely.[30]

Electric energy purchased has been included here in order to link it up with energy produced by the industry for its own use, which appears in statistics under the heading of fuels consumed. By including the former in this way, the figures for the whole branch represent, although very roughly, a sort of energy balance-sheet for the industrial sector; on the one side is the inflow of energy in the form of fuels and electric energy purchased, and on the other the outflow in the form of fuels for industry and consumption and electric energy sold by industry for public use.

When the demand projections were made it was borne in mind that Peru has had an exaggerated tendency to use energy produced from petroleum derivatives rather than from water or from coal and other fuels, although this tendency will probably be modified in future in view of a probable petroleum shortage and the relative abundance of water and coal.

The estimates of future demand given in table 211, were made as follows:

(*a*) The industry's consumption of electric energy in 1955 (257.9 million soles) was projected up to 1965 at the rate of 120 per cent, which was obtained from a separate projection of consumption in some of the more important branches, i.e. petroleum refining, sugar refining, the basic non-ferrous metal trades and other industries as a whole. It was borne in mind when making the estimate that a probable increase in the mechanization of these industries would lead to a disproportionate rise in electric energy consumption compared with the expansion in production volume;

(*b*) The projection of demand for coke, tar and their derivatives as industrial inputs took into account the growth of production in the basic non-ferrous metal trades (98 per cent) which are now the principal consumers. The possibility of an expansion in iron and steel capacity through the use of blast furnaces, with the corresponding increase in coke consumption was discounted as unlikely to take place before 1965 (see section XV);

(*c*) The difference between the two projections, with respect to total production for raw materials and intermediate products in 1965, was assumed to be demand for petroleum derivatives;

(*d*) With regard to demand for products intended for consumption, those corresponding to electricity (503.1 million soles) and to charcoal (11.9 million soles) were estimated to increase at the same rate as the population (28 per cent) and the difference between this estimate and the projection of total products for consumption was assumed to correspond to petroleum derivatives used in non-industrial transport and as domestic fuel.

Briefly, it was considered that demand would increase during the period under review at the rate of 67 per cent for coke, coke derivatives and charcoal and 51 per cent for petroleum derivatives. If the latter rate is re-estimated by deducting the value of exports from demand in 1955, the resulting figure is 117 per cent.[31]

[30] It has been assumed that if anything were exported in 1965 it would be crude and not its derivatives. The rate of 87 per cent was obtained by dividing total demand in 1965 (2 873 million soles) by demand in 1955, after deducting exports (1 852—318).

[31] If the expansion of total demand is calculated on the basis of consumption of petroleum derivatives in each sector of the economy, and of the probable evolution of such consumption, the rate

Table 210

PERU: SUMMARY OF DEVELOPMENT HYPOTHESIS FOR THE CHEMICALS INDUSTRY, AND ESTIMATE OF MANPOWER AND INVESTMENT REQUIREMENTS

Item or product	*Unit*	*Production in 1955*	*Production in 1965*	*Expansion of production*		*Annual capacity in 1955* [a]	*Expansion of capacity*		*Additional workers needed*	*Additional investment needed* [b]
				Number of units yearly	*Percentage*		*Number of units yearly*	*Percentage*		
Ammonia, nitric acid and fertilizers nitrogenous	Tons of N_2 in final products	—	57 147	57 147	—	—	57 147	—	750	570
Hydrochloric acid	Tons	1 086	2 652	1 566	144	1 500	1 152	77	30	4
Sulphuric acid	Tons	14 763	198 532	183 769	12 500	18 000	180 532	1 000	60	45
Sodium carbonate	Tons	—	10 000	10 000	—	—	10 000	—	90	10
Calcium carbide	Tons	—	9 160	9 160	—	—	9 160	—	100	20
Polyvinyl chloride	Tons	—	1 800	1 800	—	—	1 800	—	50	23
Detergents for consumption	Tons	1 980	4 620	2 640	133	2 000	2 620	131	600	60
Artificial fibres	Tons	1 198	4 360	3 162	264	1 450	2 910	200	2 250	150
Phosphate fertilizers	Tons of P_2O_5	—	28 550	28 550	—	—	28 550	—	300	20
Carbonic gas	Tons	1 134	3 120	1 986	175	1 134	1 986	175	40	5
Glycerine	Tons	127	312	165	145	1 000	—	—	90	—
Hypochlorides	Tons	313	3 799	3 486	1 115	400	3 399	850	50	5
Insecticides	Tons	9 650	22 700	16 340	136	9 650	13 050	136	82	300
Soap	Tons	11 500	21 200	9 700	84	12 000	9 200	77	600	30
Non-edible fats	Millions of soles	5.1	17.5	12.4	243	6.0	11.5	192	250	25
Nitroglycerine and explosives	Tons	—	5 400	5 400	—	—	5 400	—	150	140
Oxygen	Cubic millimetres	622	2 250	1 628	262	700	1 550	222	120	14
Paint and enamel	Thousands of gallons	450	950	500	111	500	450	90	450	30
Toilet articles	Millions of soles	28.9	64.2	35.3	122	30.0	34.2	114	220	10
Pharmaceutical products	Millions of soles	109.1	311.6	202.5	183	125.0	186.6	149	3 000	230
Caustic soda	Tons	1 341	12 745	11 404	850	1 400	11 345	810	120	30
Sulphide of carbon	Tons	359	1 077	718	200	370	707	191	30	6
Sodium sulphide	Tons	321	1 360	1 039	325	330	1 030	312	40	4
Copper sulphate	Tons	1 766	7 219	5 453	308	1 800	5 419	300	250	25
Candles	Tons	3 885	5 025	1 140	29	4 000	1 025	31	30	2
Sodium and potassium xanthate	Tons	58	369	311	536	60	309	515	200	50
Other chemical products	Millions of soles	21.3	63.7	42.4	151	21.3	42.4	199	900	60
Total									10 852	1 868

a In cases where no direct information was available on existing production capacity in 1955, it was assumed to be slightly higher than production in that year.
b For converting 1955 dollars to soles of the same year an exchange rate of 19 soles to the dollar was used.

Table 211

PERU: PROJECTION OF DEMAND AND DEVELOPMENT HYPOTHESIS FOR THE PETROLEUM DERIVATIVES AND COAL INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Export		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Petroleum derivatives	D	205.2	318.0	527.6	—	1 051.8	390.3	90	—	—	1 201.6	128	—	—	1 591.9	51
	P	191.1	318.0	402.0	—	912.1	339.9	78	—	—	973.1	142	—	—	1 313.0	44
	I	14.1	—	125.6	—	139.7	50.4	257	—	—	228.5	82	—	—	278.9	100
	P/D	(94)	(100)	(74)	—	(87)	(87)	—	—	—	(80)	—			(82)	
Coke and tar and their derivatives; charcoal	D	28.5	—	11.9 [a]	—	40.4	56.5	98	—	—	15.2	28	—	—	67.3	67
	P	25.3	—	11.9	—	37.2	56.5	106	—	—	15.2	28	—	—	67.3	81
	I	3.2	—	—	—	3.2	—	−100	—	—	—	—	—	—	—	−100
	P/D	(89)	—	(100)	—	(92)	(100)	—	—	—	(100)	—			(100)	—
Electricity [b]	D	257.9	—	503.1	—	760.0	565.6	120	—	—	644.0	28	—	—	1 214.0	60
	P	257.9	—	503.1	—	760.0	565.6	120	—	—	644.0	28	—	—	1 214.0	60
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	—	(100)	(100)	—			(100)	—			(100)	—
Total	D	491.6	318.0	1 042.6	—	1 852.2	1 012.4	106	—	—	1 860.8	79	—	—	2 873.2	55
	P	474.3	318.0	917.0	—	1 709.3	962.0	103	—	—	1 632.3	78	—	—	2 594.3	52
	I	17.3	—	125.6	—	142.9	50.4	191	—	—	228.5	82	—	—	278.9	95
	P/D	(96)	(100)	(88)	—	(92)	(95)	—	—	—	(88)	—	—	—	(90)	—

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadística Industrial 1955*; Ministry of Finance and Trade, *Estadística de Comercio Exterior 1955*; direct information from Ministry of Development and Public Works and Ministry of Agriculture.

Symbols: D: Demand; P: Production; I: Imports; P/D: Relation between production and demand, expressed as a percentage.

a Corresponds to charcoal consumption, which could be considered as artisan production. This activity is registered in the Supply Department (*Dirección de Abastecimiento*) of the Ministry of Agriculture only (588 662 50-kilogramme sacks at an average price of 20.2 soles per sack).

b This item comprises only electric energy purchased. It has been included in this branch in order to relate it to energy produced by the industry for its own consumption which appears in the statistics as fuels consumed.

The most important conclusion to be drawn from the demand statistics in table 211 is that domestic demand for petroleum derivatives increases at a higher rate than petroleum production, according to the hypothesis formulated in Part One of this study, which discounts the possibility of such production on a large scale before 1965 in eastern Peru and on the continental shelf. In fact, production would increase at the rate of 44 per cent while, as demonstrated earlier, internal demand would expand at that of 117 per cent during 1955 to 1965. This means that, on the basis of the same hypothesis, Peru would have to stop exporting petroleum and its derivatives by 1965 and step up its imports of these items in order to satisfy demand.

obtained is 154 per cent which is higher than that adopted in this study. It should be remembered, however, that for reasons given in the text, there would probably be a relative replacement of energy produced from petroleum derivatives by energy of other types, which would considerably lower the above-mentioned rate. The estimates based on consumption structure are as follows:

	In terms of value		
	Relative consumption in 1955	*Sectoral rate of growth (Percentage)*	*Relative consumption in 1965*
Extractive industry	15.3	200	46.0
Manufacturing industry	15.3	100	30.6
Transport	51.8	200	155.0
Energy for public use	6.4	28	8.2
Domestic consumption	10.4	28	13.3
Miscellaneous	0.8	28	1.0
Total	100.0	154	254.1

Table 211 indicates that the branch in question might be considered as self-sufficient except as regards petroleum derivatives which, for the reasons given, would be able to satisfy no more than 82 per cent of demand. An expansion in the internal supply of these derivatives would call for an almost proportional enlargement of the refineries since those in existence already provide more than 90 per cent of the country's output and are working at virtually full capacity. An expansion of capacity would probably involve total replacement of the cracking units, as those in use[32] are more or less obsolete and cannot produce the high-octane petrol needed for modern explosion engines. Partial expansion and modernization could be achieved by means of a combined plant turning out 20 000 barrels of crude per day, and equipped for direct distillation, catalytic cracking, reforming (for raising the octane number) and polymerization (for using the gases from direct distillation and cracking). This unit would import some 160 million soles' worth at 1955 prices and employ about 30 workers.

By 1965, some 75 000 tons of coke would be produced, which would mean a 160-per-cent increment in productive capacity, an investment of approximately 60 million soles and employment for 50 additional workers.

To sum up, the expansion of petroleum derivatives and coal production would signify an investment of some 220 million soles at 1955 prices and employment for 80 persons.

[32] Four thermal units giving a total of 16 000 gallons a day.

XIV. MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS

Demand for most of the items in this branch is related to construction activity, since the products in question are either used directly in it or consist of the raw materials required by it. As the products referred to in this section and in that on the iron and steel industry and basic metal trades are those for which demand expands in step with the construction of houses and buildings and not those whose development is primarily related to the expansion of industrial construction, the aggregate rate assumed for construction (119 per cent) was divided into two parts; one of these constitutes the probable decennial increment in non-industrial construction (89 per cent) and the second the increment in industrial construction proper (173 per cent).[33]

[33] During 1945 to 1955, construction expanded 191 per cent (see annex I, table 6), which implies an elasticity coefficient of 1.26 with respect to the increase of 134 per cent observed in gross investment (see chapter I, table 11). As this coefficient is unusually high—undoubtedly because of an exceptional amount of construction activity—it was thought best to adopt a much lower one of only 1.05 for projecting construction in 1965 as a function of the increase in gross investment. It was also judged advisable to analyse the decennial rate of growth thus obtained (119 per cent) by dividing it into two parts representing the respective trends of industrial and non-industrial construction. This was done by using growth ratios calculated in other parts of this report and weighted by the estimates of the stock of capital in 1955 which appear in chapter I, table 10. The computations and their results are given below:

Growth ratios:

Extractive and manufacturing industry (see tables 174, 179 and 181)	2.38
Electricity industry (see chapter IX)	3.25
Gross investment	2.11

Stock of capital in 1955 (millions of soles):

Extractive and manufacturing industry	21 287
Electricity industry	7 367
Total	28 654
Non-industrial sectors	52 069
Grand total	80 723

Rate of non-industrial construction:

$$\frac{80\,723 \times 2.11^{1.05} - 21\,287 \times 2.38^{1.05} - 7\,363 \times 3.25^{1.05} = 1.89}{52\,069} = 89\ \%$$

Rate of industrial construction:

$$\frac{80\,723 \times 2.11^{1.05} - 52\,069 \times 1.89 = 2.73}{28\,654} = 173\ \%$$

Rate of aggregate construction: $2.11^{1.05} = 2.19 = 119\ \%$.

1. *Cement and cement products*

Before any attempt is made to project a rate of growth for cement demand, the development possi-

Table 212

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965								
		Raw materials intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Export		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	65.2	2.2	57.7	306.1	431.2	170.9	162	—	—100	111.7	94	653.3	114	935.9	117
	P	54.2	2.2	20.5	230.7	307.6	153.3	182	—	—100	72.9	256	538.5	134	764.7	149
	I	11.0	—	37.2	75.4	123.6	17.6	60	—	—	38.8	4	114.8	52	171.2	39
	P/D	(83)	(100)	(36)	(75)	(71)	(90)		—		(65)		(83)		(82)	
Cement	D	13.4	1.0	—	148.0	162.4	48.6	263	—	—100	—	—	280.0	89	328.6	102
	P	11.8	1.0	—	141.5	154.3	45.8	288	—	—100	—	—	264.3	87	310.1	101
	I	1.6	—	—	6.5	8.1	2.8	75	—	—	—	—	15.7	142	18.5	128
	P/D	(88)	(100)	—	(96)	(95)	(94)		—		—		(95)		(95)	
Cement products	D	3.0	—	0.3	33.7	37.0	10.2	240	—	—	—	—100	115.0	240	125.2	240
	P	3.0	—	0.3	28.5	31.8	10.2	240	—	—	—	—100	105.2	268	115.4	263
	I	—	—	—	5.2	5.2	—	—	—	—	—	—	9.8	88	9.8	88
	P/D	(100)	—	(100)	(85)	(86)	(100)		—		—		(91)		(92)	
Plaster and lime	D	—	—	—	7.1	7.1	—	—	—	—	—	—	12.0	69	12.0	69
	P	—	—	—	7.0	7.0	—	—	—	—	—	—	11.9	70	11.9	70
	I	—	—	—	0.1	0.1	—	—	—	—	—	—	0.1	—	0.1	—
	P/D	—	—	—	(99)	(99)	—		—		—		(99)		(99)	
Glass	D	48.8	0.4	30.0	10.7	89.9	112.1	130	—	—100	47.7	59	20.2	89	180.0	100
	P	39.4	0.4	15.0	5.1	59.9	97.3	147	—	—100	27.1	81	12.5	145	136.9	128
	I	9.4	—	15.0	5.6	30.0	14.8	58	—	—	20.6	37	7.7	38	43.1	43
	P/D	(81)	(100)	(50)	(48)	(67)	(87)		—		(57)		(62)		(76)	
China and majolica	D	—	—	26.1	40.9	67.0	—	—	—	—	61.4	135	81.8	100	143.2	114
	P	—	—	5.2	6.0	11.2	—	—	—	—	45.8	781	33.5	160	79.3	610
	I	—	—	20.9	34.9	55.8	—	—	—	—	15.6	— 25	48.3	38	63.9	15
	P/D	—	—	(20)	(15)	(17)	—		—		(75)		(41)		(55)	
Marble	D	—	—	—	11.0	11.0	—	—	—	—	—	—	14.5	32	14.5	32
	P	—	—	—	10.6	10.6	—	—	—	—	—	—	13.7	29	13.7	29
	I	—	—	—	0.4	0.4	—	—	—	—	—	—	0.8	100	0.8	100
	P/D	—	—	—	(96)	(96)	—		—		—		(94)		(94)	
Miscellaneous clay products	D	—	0.8	1.3	54.7	56.8	—	—	—	—100	2.6	100	129.8	137	132.4	134
	P	—	0.8	—	32.0	32.8	—	—	—	—100	—	—	97.4	205	97.4	197
	I	—	—	1.3	22.7	24.0	—	—	—	—	2.6	100	32.4	43	35.0	46
	P/D	—	(100)	(0)	(59)	(58)	—		—		(0)		(75)		(75)	
Artisan production	D	54.8	—	40.7	31.0	126.5	93.3	70	—	—	62.1	52	80.1	158	235.5	86
	P	54.8	—	40.7	31.0	126.5	93.3	70	—	—	62.1	52	80.1	158	235.5	86
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	—	(100)	(100)	(100)	(100)		—		(100)		(100)		(100)	
Total	D	120.0	2.2	98.4	337.1	557.7	264.2	120	—	—100	173.8	77	733.4	118	1 171.4	110
	P	109.0	2.2	61.2	261.7	434.1	246.6	126	—	—100	135.0	120	618.6	136	1 000.2	130
	I	11.0	—	37.2	75.4	123.6	17.6	60	—	—	38.8	4	114.8	52	171.2	39
	P/D	(91)	(100)	(62)	(78)	(78)	(93)		—		(78)		(84)		(85)	

SOURCES: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Relation of production to demand, expressed as a percentage.

bilities open to the manufacture of products which require cement as a raw material should be explored. In section XV it is explained that iron and steel products will be fairly scarce in Peru at least during the period covered by this survey, which means that substitutes will have to be found which do not employ iron as a raw material. The most important case in point is perhaps that of the corrugated or smooth laminas used in construction which, if made of steel, would divert some of the iron and steel industry's capacity for manufacturing the flat products that the metal transforming industry will need in ever-greater quantities. Both in this case as well as in that of tanks and large-diameter, low-pressure piping, it would be best to try and channel demand towards cement products, such as fibrous and asbestos cement and prefabricated reinforced concrete structures, which Peruvian industry could manufacture very economically in various parts of the country. Hence, a fairly rapid rate of growth has been assumed for production of cement goods (263 per cent in 1955-65), which in its turn, has been brought into line with that of demand for cement as a raw material (see table 212).

With respect to demand for cement to be used directly in construction work, it has been assumed that the rate of growth will be nearer that of non-industrial than industrial construction, owing to the latter's more pronounced tendency to use steel instead of reinforced concrete structures.

The proportion of demand satisfied by domestic cement manufacture has been assumed to remain virtually constant (95 per cent) since, as explained in chapter V, section XIV, some cement imports cannot be replaced owing to the fact that certain parts of the country which are far from production centres find it easier to bring cement in from abroad than from Peruvian factories. The assumed expansion would mean that plants would exceed their 1955 production level of 1 150 000 by 600 000 tons. In the conditions projected, the manufacture of cement products would increase 263 per cent in the period under review, and domestic industry would cover 92 instead of 86 per cent of internal demand.

As the cement industry's present capacity is 719 000 tons a year, it would have to expand a further 431 000 tons by 1965. Plans for such expansion exist at both the projection and practical stages; they envisage the installation of five new plants at Pacasmayo, Chiclayo, Tarma, Arequipa, and Sicuani, which will jointly raise the country's total capacity to more than 1.2 millions tons annually (see chapter V, table 147). Internal demand would thus be fully satisfied and the geographical distribution of production improved considerably; this, in its turn, would probably help to diminish imports in the areas that are now far from production centres. The projected expansion up to 1965 would mean the investment of about 285 million soles at 1955 prices and the employment of 880 workers, if a conservative assumption of a 20-per-cent increase in labour productivity is adopted.

Only 67 per cent of capacity for the manufacture of cement products is utilized, which indicates that an expansion of 143 per cent would be required to satisfy demand in 1965; this would involve the expenditure of some 25 million soles in equipment and plant, and the engagement of an additional 1 200 workers.

2. *Plaster for construction*

As plaster is being gradually replaced by other construction materials, the growth of demand will probably not exceed 69 per cent in 1955-65. Even if production is considered to be sufficient to satisfy nearly the whole of plaster demand (99 per cent), installed capacity would not require any amplification if demand were to expand, since the country's leading enterprises —which supplies about 60 per cent of domestic output—has just doubled its plant. It is thought that the industry's capacity would be adequate in 1965, even if certain kinds of special plaster began to be manufactured, such as acoustic plaster, or plaster products, such as boards.

3. *Glass products*

It has been assumed that demand for glass products will have expanded 100 per cent by 1965. This sup-

Table 213

PERU: ESTIMATED GROWTH OF TOTAL GLASS DEMAND

Product	*Relative distribution of consumption in 1955 (Relative values and percentage)*	*Activity to which the growth of demand is related*	*Rate of growth between 1955 and 1965 (Percentage)*	*Relative distribution of consumption in 1965*	
				(Relative values)	*(Percentage)*
Bottles for beverages	27	Beverages production	97	53	26
Other bottles	16	Chemical industry	198	48	24
Plate glass	17	Non-industrial construction	89	32	16
Other glass and crystal products	40	Consumer goods, except foostuffs, beverages and wearing apparel	67	67	34
Total	100		100	200	100

position is based on the structure of demand in 1955 and the rate at which each of the most important branches is expected to increase (see table 213). In table 212, the aggregate increment in demand has been divided into its three components, namely, demand for raw materials, for consumption and for investment.

Fairly substantial progress is expected of production in all branches, especially in those manufacturing containers and plate glass, and the industry's total contribution to the satisfaction of demand will probably rise from 67 to 76 per cent. This development, which is 128 per cent in relative terms, means that production would increase from 60 to 137 million soles annually between 1955 and 1965. Productive capacity would have to virtually double in the bottle and plate glass branches, treble in those turning out other types of containers, and expand 67 per cent with respect to the remaining items. Two of the new products which might be added as replacements for imports are neutral glass used in containers for pharmaceutical, and fluorescent light tubes.

The investment required for such development may be as much as 100 million soles at 1955 prices and the additional labour force needed in all branches of the glass industry may amount to slightly more than 1 000 persons. The latter estimate took into account a fairly high increase of 30 per cent in productivity, deriving partly from a replacement of manual and semi-manual by fully mechanized operations in container manufacture, and also from a possible reduction in the number of indirect workers if transport in the plants using semi-manual procedures is mechanized, at least to a certain extent.

4. *Porcelain and majolica*

It has been assumed that demand for majolica and sanitary fitments will have to expand at the same decennial rate as that of non-industrial construction (89 per cent). A much higher rate of 146 per cent is projected for china, porcelain and earthenware, since past experience in Peru shows that the income-elasticity of demand in this branch is very high. Demand for all three together would expand 114 per cent, according to estimates made with the help of table 214.

The porcelain and majolica industry is one of the most backward in the country, satisfying a mere 17 per cent of domestic demand in 1955. As pointed out in chapter V, section XIV, its situation is the result of technical difficulties which raised costs, thereby preventing the industry from competing with imported goods. Nevertheless, it is believed that this is one of the branches that could make the best use of technical assistance from foreign experts and that, by means of such help, together with an adequate provision of capital to expand plant, it would be quite easy to increase production sevenfold and thus raise the industry's share in the satisfaction of demand from 17 to 50 per cent in 1955-65. One of the prerequisites for perfecting the techniques used would be the establishment of a small laboratory to analyse raw materials and test finished products.

In the conditions assumed, the branch as a whole could add some 68 millions soles by 1965 to the 11 million produced in 1955. For this purpose it would require new plant, and some of the existing installations which still consist of beehive furnaces worked by hand would have to be modernized. The total investment and additional labour needed would be 50 million soles and 1 150 workers respectively, if an increase of at least 30 per cent is assumed in labour productivity.

5. *Marble and onyx*

An extremely slow rate of growth of 32 per cent has been assumed for marble and onyx demand, since

Table 214

PERU: ESTIMATED GROWTH OF DEMAND FOR CHINA, MAJOLICA AND MISCELLANEOUS CLAY PRODUCTS

Product	*Relative distribution of consumption in 1955 (Relative values and percentage)*	*Activity to which the growth of demand is related*	*Rate of growth between 1955 and 1965 (Percentage)*	*Relative distribution of consumption in 1965*	
				(Relative values)	*(Percentage)*
China and majolica:					
Sanitary fitments	30	Non-industrial construction	89	57	27
Majolica	26	Non-industrial construction	89	49	23
China, porcelain and ceramics	44	—	146 [a]	108	50
Total	*100*	—	*114*	*214*	*100*
Miscellaneous clay products:					
Refractory bricks	25	Industrial construction	173	68	29
Other bricks	25	General construction	119	55	24
Other clay products	50	General construction	119	111	47
Total	100	—	134	234	100

a Rate estimated independently on the basis of direct information.

it is doubtful whether many buildings incorporating these materials will be built in future (i.e. for Ministries, banks, offices and luxury accommodation). As observed in chapter V, section XIV, the industry's production capacity has expanded in the last few years more rapidly than demand, with the result that firms would be able to satisfy double the current requirements. The small increase which has been estimated in production by 1965 would therefore not call for further investment or any addition to the industry's present labour force.

6. *Miscellaneous clay products*

The development of total demand for miscellaneous clay products has been estimated by combining the projected rates of growth of demand for refractory bricks, other bricks and remaining clay products (see table 214). The result shows that demand for the branch as a whole would have to increase 134 per cent between 1955 and 1965. With respect to non-refractory bricks and other clay products, such as pipes, tiles and ordinary tableware, the industry could meet the whole of domestic demand, but in the case of refractory bricks it is natural not to expect it to satisfy the requirements of industrial development before 1965. For this reason, it has been supposed that total production of miscellaneous clay products would cover 75 per cent of demand, which is in any case a great improvement on the situation in 1955, when it satisfied only 58 per cent. Output would thus rise from 32.8 to 97.4 million soles; it would need an investment of some 54 million soles and nearly 3 200 additional workers.

7. *Summary of fixed capital and labour requirements for the assumed expansion in the industry*

Table 215 outlines the comparisons which have been made between required production in 1965 and existing capacity in 1955—the basis for estimating the additions to capacity indicated in the same table—and gives the probable increases in labour productivity by branch on the basis of the estimated labour needed to obtain the hypothetical production increment. Briefly, 7 447 more workers would have to be employed apart from the 6 753 already working in 1955, and a further 514 million soles invested in the development of the industry.

XV. IRON AND STEEL INDUSTRY

In section XVII of the present chapter the evaluation of development prospects for the metal transforming industry in terms of probable production by 1965, was accompanied by estimates of the volumes of raw materials—for example, cast-iron, flat products, bars and shapes, tubing, wire, non-ferrous metals and other imported metals—which the industry would require in order to meet the postulated production targets (see table 231). Table 216 shows the quantities of raw materials with which the iron and steel industry would have to supply the metal transforming industries in combination with the needs of other direct consumers of iron and steel products, such as the railways, the construction sector and the petroleum industry. In brief, total requirements in 1965 worked out at over 212 000 tons yearly, a volume which represents more than four times Chimbote's current production capacity. Even on the assumption that a large proportion of this probable input is constituted by non-current products, which the country will in any case have to import, Peru will obviously have to make an energetic effort to promote the rapid growth of its iron and steel industry, since this is of basic importance for the development of a large number of dynamic industries.

To cover the deficit which seems likely to exist in 1965, the industry might proceed along such lines as are broadly indicated in the following paragraphs.

1. *Cast-iron*

As can be seen from the above-mentioned table of estimates of raw materials for the metal transforming industries the great majority of these will need cast-iron, but in relatively small quantities in each case, with the exception of the manufacture of cast-iron sanitary appliances, machinery for mining and pumps. As modern foundries must operate on a relatively large scale if investment in mechanization and control laboratories is to prove a sound economic proposition, the development of Peru's metal transforming and iron and steel industries should ideally be based on the centralization of most of the casting, as a means of preventing the installation of small and inefficient foundries alongside the metal transforming industries. This has been the general rule in other countries in process of industrial development, with the result that costs have been high and the quality not invariably all that could be desired. However this branch of industry evolves, there is no difficult in the way of Peru's becoming completely self-sufficient as regards its products.

Since Peru imports a substantial quantity of machinery and equipment of which the component parts include heavy castings, generally of crude design and not requiring a high degree of technique, a progressive import substitution policy ought to include the provision of incentives conducive to the final assembly of the machinery or equipment in Peru itself, in the most suitable cases, with domestically-manufactured castings. The field of application might range from extremely simple parts, such as bases for heavy machinery, to others entailing more delicate work, such as parts for sewing-machine heads.

The manufacture of cast-iron tubing could be in-

Table 215

PERU: SUMMARY OF DEVELOPMENT HYPOTHESES FOR THE MANUFACTURE OF NON-METALLIC MINERAL PRODUCTS AND ESTIMATED LABOUR AND INVESTMENT REQUIREMENTS

Item of products	*Unit*	*Production in 1955*	*Decennial rate of growth of production (Percentage)*	*Production in 1965*	*Production capacity in 1955*	*Required increment in capacity*	*Labour force in 1955*	*Assumed increment in labour productivity (Percentage)*	*Additional labour required*	*Additional investment required (Millions of soles at 1955 prices)*
Cement	Thousands of tons	544.6	101	1 090.0	719.0	371.0	1 302	20	878	285
Cement products	Millions of soles	31.8	263	115.4	47.5	67.9	667	30	1 193	25
Plaster and lime	Thousands of tons	57.3	70	97.5	150.3	—	— [a]	—	—	—
Glass	Thousands of tons	30.2	128	68.7	30.2	38.5	1 375	30	1 035	100
China and majolica	Millions of soles	11.2	610	79.3	17.0	62.3	256	30	1 144	50
Marble and onyx	Tons	720.0	30	935.0	1 000.0	—	300	—	—	—
Miscellaneous clay products	Millions of soles	32.8	197	97.4	47.0	50.4	2 853	40	3 197	54
Total							6 753		7 447	514

SOURCE: Direct information and Ministry of Development and Public Works, *Estadistica Industrial 1955*.
a Included in other items.

Table 216

PERU: IRON AND STEEL REQUIREMENTS IN 1955 AND 1965
(Tons)

Product \ *Use*	*Data for 1955*						*Hypothesis for 1965*					
	Railways	*Construction*	*Metal transforming industry*	*Petroleum*	*Others*	*Total*	*Railways*	*Construction*	*Metal transforming industry* [a]	*Petroleum*	*Others*	*Total*
Casting			1 060		2 559	3 619			16 746		4 820	21 566
Cast iron tubes					2 559	2 559					4 820 [b]	4 820
Other casting			1 060			1 060			16 746			16 746
Flat rolled products		6 354	18 141			24 495		8 250	55 026			63 276
Tinplate for containers and caps			6 528 [c]			6 528			15 850			15 850
Galvanized sheet		6 354				6 354		8 250 [d]				8 250
Other sheet and plate			11 613			11 613			39 176			39 176
Bars, shapes and narrow plate	5 239	26 984	18 975			51 198	9 800	59 000	48 167			116 967
Rails	5 239					5 239	9 800 [e]					9 800
Building rod		26 984				26 984		59 000 [f]				59 000
Wire and other bars, shapes and narrow plates			18 975			18 975			48 167			48 167
Seamless tubes with diameter over 5 cm				7 300		7 300				10 500 [g]		10 500
Total	5 239	33 338	38 176	7 300	2 559	86 612	9 800	67 250	119 939	10 500	4 820	212 309

SOURCE: 1955 data: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
a See table 231.
b Calculated with a decennial growth of 89 per cent, parallel with that of construction in general (see footnote 24 in chapter VIII, section XIV).
c The 1955 figures relates to consumption not imports. For 1965 it has been assumed that there will be imports of containers but not of tinplate.
d Calculated with a growth somewhat less than that of construction as it is suggested that galvanized sheet be replaced with asbestos-cement and fibre cement.
e The length of track in operation (public and private) was 3 500 km in 1955. It was assumed that (*a*) the length of track would not increase by 1965; (*b*) that the average weight of track is 56 tons per km; (*c*) that the value of track is 2 375 soles per ton; and (*d*) that the replacement rate is 5 per cent per year. The input in track for 1965 was therefore calculated as follows: 3 500 × 56 × 2 375 = 23.3 million soles at 1955 prices. The value of track equipment was estimated as equivalent to 5 per cent of the value of track itself (23.3 million soles). The replacement input was calculated at a rate of 12 per cent per year or 23.3 × 0.12 = 3.0 million soles at 1955 prices.
f Estimated with a rate of growth of 119 per cent, the same as construction in general.
g Decennial growth of 44 per cent, parallel with that of petroleum (see table 211).

tegrated with the activities of the Chimbote steel mill, or constitute a specialized department in one of the foundries. The volume of demand projected for 1965, however, would fully justify even the establishment of an independent foundry. The technical aspects of the manufacture of cast-iron tubing have been satisfactorily tackled in other Latin American countries, so that the development of this activity is unlikely to present problems in Peru.

Although the statistics used in the present study included no data on production of cast-iron sanitary appliances research revealed the existence of at least two establishments which had already successfully embarked upon this line of manufacture, which may both feasibly and desirably be developed to the point of satisfying the domestic market. Certain technical problems arise because the casting must be free from defects and present a suitable surface for enamelling, but such difficulties can be overcome through the adoption of the technical advances achieved in the last ten years.[34]

2. *Flat-rolled products*

Chimbote's current capacity for the rolling of flat products stands at about 15 000 tons per annum. According to the figures given in table 216, in 1965 total demand should be in the neighbourhood of 63 000 tons, of which about 9 000 would be constituted by plate, which it is worth while to import because the volume required is relatively small, and the type of production involved would tend to upset the balance between steel-making capacity and rolling capacity. It might be assumed that of the remainder a further 10 000 tons of rolled products would necessarily have to be imported, because they would include a considerable number of types or dimensions for which there is no market large enough to warrant their production. The remaining 44 000 tons would have to be produced at Chimbote, which would entail the trebling of existing capacity for the rolling of flat products. This capacity could not be more than doubled before 1965, with relatively moderate investment. The expansions concerned would consist mainly in the addition of a finishing mill and electric reducing furnace[35] and an electric steel-making furnace. Furthermore, as some of the rolled products for the metal transforming industry would have to be suitable for deep drawing, it might be necessary to add a plant for thermic normalizing treatment.

As the doubling of capacity for the manufacture of flats would still not bring production up to the 44 000 tons which it is assumed have to be laminated in Peru, careful thought would have to be given to the selection of such a production programme as would yield the greatest benefits from the standpoint of the national economy. At first sight, it would seem that effort should be concentrated on the manufacture of tinplate and of the rolled products which would be used as raw material in the metal transforming industry. Domestic production of tinplate is important inasmuch as it would help to reduce the cost of containers for the tinned fish which is exported by Peru, and, as has already been pointed out, this is absolutely essential if such tinned goods are to be capable of competing on the world market in the future. This activity would call for the installation of tinning equipment of the immersion type, which is the best suited for relatively small volumes of production, and would enable Peruvian manufacturers to meet the canning industry specifications for high-grade rolled products.

The according of priority to tinplate for the manufacture of containers and to rolled products for the metal transforming industry would mean that production of galvanized laminas could not increase sufficiently to cover potential demand in 1965. To avert the need for imports, measures might be adopted to encourage the manufacture of substitutes for galvanized rolled products suitable for use in construction, such as smooth or corrugated asbestos cement or fibrous cement sheet, in accordance with the suggestions put forward in connexion with the development of industries manufacturing non-metallic mineral products. Another possible substitute might be creosoted board, to be used for lower-cost roofing.

In the model used in this report it is assumed that by 1965 Chimbote should be able to manufacture about 16 000 tons of tinplate, 6 000 tons of galvanized rolled products and 8 000 tons of other rolled products and plate. On the other hand, it would be necessary to import some 2 000 tons of galvanized rolled products and over 31 000 tons of other rolled products and plate (see table 217).

3. *Bars, wire rod, shapes and narrow plate*

According to the estimates presented in table 216, demand for bars, wire rod, shapes and strip would reach about 117 000 tons by 1965. As regards domestic manufacturing prospects, the first step must be to discount some 10 000 tons of rails which would still have to be imported because they represent a wide variety of dimensions, in volumes too small to justify their production.[36] Another 20 000 tons, mainly of bars and shapes, would also have to be deducted, because the

[34] The investment and manpower required for the expansion of foundries are not specified, because they were to a major extent taken into account in the estimate of requirements deriving from the growth of the metal transforming industry (for investment, see table 234).

[35] In this report the possibility or desirability of installing blast furnaces instead of electric furnaces to increase capacity at Chimbote is not analysed. The reason is that, in the first place, the establishment of a blast furnace would require a market for about 250 000 tons yearly, which would correspond to a later period than that covered by the present document; secondly, the matter calls for extremely detailed study of the possibilities for absorption of the electric potential which would be available in future in the Chimbote area, the prospects for the utilization of domestic coking coal like that of Oyón, and other considerations which would be outside the general scope of this report.

[36] See the notes to table 227 for an estimate of demand for railway material.

Table 217

PERU: HYPOTHESIS OF POTENTIAL SATISFACTION OF DEMAND FOR IRON AND STEEL PRODUCTS IN 1965

Product	Domestic production		Imports	Total
	Chimbote [a]	Other producers [b]		
Smelting	—	(21 566)	—	(21 566)
Cast-iron tubes	—	4 820	—	4 820
Other smelting	—	16 746	—	16 746
Flat products	(30 000)	—	(33 276)	(63 276)
Tinplate	15 850	—	—	15 850
Galvanized sheet	6 250	—	2 000 [c]	8 250 [c]
Other sheet and plate	7 900	—	31 276	39 176
Bars, shapes, wire and narrow plate	(50 000)	(37 000)	(29 967)	(116 967)
Rails	—		9 800	9 800
Rod for construction	22 000	37 000	—	59 000
Other bars, shapes, wire and narrow plate	28 000	—	20 167	48 167
Welded tubes	—	—	(10 500)	(10 500)
Total	*80 000*	*58 566*	*73 743*	*212 309*

a The Chimbote figures are based on the assumption that the capacity for rolling flat products will be doubled.
b Makes allowance for further development in productive capacity proposed in the text.
c A partial substitution of asbestos-cement products for corrugated iron sheet has been assumed.

variety of types involved or the specialized nature of their composition would preclude their manufacture in Peru. By 1965, therefore, a balance of 87 000 tons of bars, shapes and strip would remain to be manufactured annually by Peru's own steel making industry. At present enough steel is available for about 35 000 tons of bars and shapes to be rolled at Chimbote, but the incorporation of the electric reducing furnace and the electric steel-making furnace mentioned above would permit the production of up to 15 000 tons of bars and shapes; this would leave a deficit of 37 000 tons, to eliminate which it is suggested that study be devoted to the possibility of installing a new semi-integrated steel mill operating on the basis of scrap and of electric energy.

The new project might comprise an electric furnace for the casting of the scrap [37] and a small rolling-mill, mainly for rod, both of which might be situated in the Lima-Callao area—the most important source of scrap and the biggest market not only for rod to be used in construction but also for small shapes. As will be seen in chapter IX, sufficient electric energy will be available in this area in the future for development on these lines.

It is of interest to note that a plant of this type is operating successfully in several Latin American countries—which even use imported scrap—and can compete on favourable terms with the large integrated mills in respect of products which weigh too little per unit of length and fetch too low a sales price to be produced economically in integrated mills that can manufacture heavier and higher-priced products.

37 In order not to overload the distribution grid with the peak demand of a high capacity electric furnace, it would be preferable to use two 6-ton furnaces, the operation of which would be regulated in such a way that one would be working at the load casting stage when the other was at the stage of steel refining.

4. *Non-current steels*

Irrespective of whether a sizeable market for non-current steels does or does not exist at present, it is felt to be important for Peru to bear in mind, in research on the development of steel making, the possibility of manufacturing non-current and quality steels with a view to the opportunities that may be afforded by a Latin American common market. This suggestion is grounded on the need to obtain the highest possible yield from existing steel making installations—which, on account of the electric furnaces, are particularly suitable for quality steels—and on the excellence of Peruvian iron ore. To begin with, it is thought that little difficulty would attach to the manufacture of certain quality steels which do not require a complicated processing technique and for which there is already a growing market in Peru. A case in point is that of silicon steel, which is used in the manufacture of motors and transformers. On much the same lines as were indicated in the preceding paragraph in connexion with the manufacture of rod, the gradual introduction of Chimbote into the field of non-current steels might form part of a programme for intensifying the yield of a plant by using it for products of higher value.

The expansion of Chimbote's production capacity in the manner described would probably not require more than 85 million soles for fixed investment; not a large sum, if it is taken into consideration that a more efficient distribution of overhead expenditure might substantially reduce the cost of products which are used as raw material in the more dynamic industries. The labour force would not need to be larger than that existing at the time when Chimbote entered production (1958), since, as was explained in Chapter V, section XV, there is plenty of room for an increase in the productivity of manpower.

Table 218

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE IRON AND STEEL INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Casting	D	2.9	—	—	8.3	11.2	22.9	690	—	—	—	—	15.7	89	38.6	245
	P	1.7	—	—	—	1.7	22.9	1 247	—	—	—	—	15.7	—	38.6	2 171
	I	1.2	—	—	8.3	9.5	—	– 100	—	—	—	—	—	–100	—	– 100
	P/D	(59)	—	—	(0)	(15)	(100)		—		—		(100)		(100)	
Cast iron tubes	D	—	—	—	8.3	8.3	—	—	—	—	—	—	15.7	89	15.7	89
	P	—	—	—	—	—	—	—	—	—	—	—	15.7	—	15.7	—
	I	—	—	—	8.3	8.3	—	—	—	—	—	—	—	–100	—	– 100
	P/D	—	—	—	(0)	(0)	—		—		—		(100)		(100)	
Other casting	D	2.9	—	—	—	2.9	22.9	690	—	—	—	—	—	—	22.9	690
	P	1.7	—	—	—	1.7	22.9	1 247	—	—	—	—	—	—	22.9	1 247
	I	1.2	—	—	—	1.2	—	– 100	—	—	—	—	—	—	—	– 100
	P/D	(59)	—	—	—	(59)	(100)		—		—		—		(100)	
Flat rolled products	D	70.7	—	—	28.4	99.1	183.3	159	—	—	—	—	36.8	30	220.1	122
	P	—	—	—	—	—	95.4	—	—	—	—	—	27.9	—	123.3	—
	I	70.7	—	—	28.4	99.1	87.9	24	—	—	—	—	8.9	– 69	96.8	– 2
	P/D	(0)	—	—	(0)	(0)	(52)		—		—		(76)		(56)	
Tinplate for containers	D	30.0	—	—	—	30.0	72.8	143	—	—	—	—	—	—	72.8	143
	P	—	—	—	—	—	72.8	—	—	—	—	—	—	—	72.8	—
	I	30.0 [a]	—	—	—	30.0 [a]	—	– 100	—	—	—	—	—	—	—	– 100
	P/D	(0)	—	—	—	(0)	(100)		—		—		—		(100)	
Galvanized sheet	D	—	—	—	28.4	28.4	—	—	—	—	—	—	36.8	30	36.8	30
	P	—	—	—	—	—	—	—	—	—	—	—	27.9	—	27.9	—
	I	—	—	—	28.4	28.4	—	—	—	—	—	—	8.9	– 69	8.9	– 69
	P/D	—	—	—	(0)	(0)	—	—	—		—		(76)		(76)	
Other sheet and plate	D	40.7	—	—	—	40.7	110.5	172	—	—	—	—	—	—	110.5	172
	P	—	—	—	—	—	22.6	—	—	—	—	—	—	—	22.6	—
	I	40.7	—	—	—	40.7	87.9	116	—	—	—	—	—	—	87.9	116
	P/D	(0)	—	—	—	(0)	(21)		—		—		—		(21)	
Bars, shapes and narrow plate	D	39.9	—	—	85.9	125.8	101.6	155	—	—	—	—	183.9	114	285.5	127
	P	—	—	—	—	—	60.0	—	—	—	—	—	148.7	—	208.7	—
	I	39.9	—	—	85.9	125.8	41.6	4	—	—	—	—	35.2	– 59	76.8	– 39
	P/D	(0)	—	—	(0)	(0)	(59)		—		—		(81)		(73)	
Rails	D	—	—	—	13.2	13.2	—	—	—	—	—	—	24.8	88	24.8	88
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	13.2	13.2	—	—	—	—	—	—	24.8	88	24.8	88
	P/D	—	—	—	(0)	(0)	—		—		—		(0)		(0)	

See end of table for source and footnotes.

Table 218 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE IRON AND STEEL INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Building rod	D	—	—	—	62.2	62.2	—	—	—	—	—	—	136.0	119	136.0	119
	P	—	—	—	—	—	—	—	—	—	—	—	136.0	119	136.0	119
	I	—	—	—	62.2	62.2	—	—	—	—	—	—	—	−100	—	−100
	P/D	—	—	—	(0)	(0)	—		—		—		(100)		(100)	
Other bars, shapes and narrow plate	D	39.9	—	—	10.5	50.4	101.6	155	—	—	—	—	25.4	142	127.0	152
	P	—	—	—	—	—	60.0	—	—	—	—	—	15.0	—	75.0	—
	I	39.9	—	—	10.5	50.4	41.6	4	—	—	—	—	10.4	− 1	52.0	3
	P/D	(0)	—	—	(0)	(0)	(59)		—		—		(59)		(59)	
Seamless tubes with diameter over 5 cm	D	—	—	—	32.9	32.9	—	—	—	—	—	—	47.3	44	47.3	44
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	39.9	—	—	32.9	32.9	—	—	—	—	—	—	47.3	44	47.3	44
	P/D	—	—	—	(0)	(0)	—		—		—		(0)		(0)	
Other non-specified iron and steel products	D	—	—	—	7.9	7.9	52.9	—	—	—	—	—	20.2	160	73.1	825
	P	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	I	—	—	—	7.9	7.9	52.9	—	—	—	—	—	20.2	160	73.1	825
	P/D	—	—	—	(0)	(0)	(0)		—		—		(0)		(0)	
Total	D	113.5	—	—	163.4	276.9	360.7	217	—	—	—	—	303.9	86	664.6	140
	P	1.7	—	—	—	1.7	178.3	—	—	—	—	—	192.3	—	370.6	—
	I	111.8	—	—	163.4	275.2	182.4	63	—	—	—	—	111.6	− 32	294.0	7
	P/D	(1)	—	—	(0)	(0)	(49)		—		—		(63)		(56)	

SOURCE: 1955 data: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estedistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
a Represents real consumption not imports.

The other steel-making plant whose feasibility might be studied would require approximately 37 million soles and 200 workers. If 3 shifts were worked, it could produce an annual output of 37 000 tons of rod for construction, small shapes, wire rod, and light strip.

Table 218 shows in monetary terms the assumed development of the iron and steel industry up to 1965, as well as projections of total demand and of the imports that would be necessary in each line of production. As can be seen, the value of the production of the iron and steel industry would reach an annual figure of about 370 million soles, of which the largest proportion would correspond to the manufacture of rod for construction; next, in importance, would follow other types of bars, shapes and strip, tinplate, galvanized and other rolled products, castings and cast-iron tubing.

XVI. NON-FERROUS METALS INDUSTRY

Projections for this branch of the metallurgical industry were previously formulated, in the second chapter, in order to estimate export prospects for the products of what is termed Peru's "mining sector", which covers the extraction, processing, casting or smelting, refining, transport and sales of ores, and the production and refining of petroleum. As regards non-ferrous metals, future development prospects were estimated as depending on the current expansion programmes of the large enterprises, which, taken in the aggregate, would by 1955 add about 3 000 million soles to the 1 550 million produced in 1955. Of this increment, some 2 400 million would correspond to metal products and 600 million to ores and concentrates (see table 219).

Briefly, the large enterprises are planning to raise copper production to about 180 000 tons by 1965; to expand lead smelting capacity from 60 000 tons to 113 000 by 1965, if prices are favourable; to bring up the amount of zinc refined, which in 1956 was only a small fraction of domestic production, to 136 000 tons in the same lapse of time; and to increase the

Table 219

PERU: GROWTH HYPOTHESIS FOR SUPPLY OF METALS, MINERALS AND CONCENTRATES [a]

(Values in millions of soles at 1955 producer prices)

Item		*1955*	*1965*	*Decennial rate of growth (Percentage)*
Copper	Total	487.4	2 475.5	610
	Metal	432.2	1 780.0	312
	Minerals and concentrates	55.2	695.5	1 160
	Percentage relationship between metal and total	(89)	(72)	
Lead	Total	437.0	621.4	42
	Metal	301.1	562.0	87
	Minerals and concentrates	135.9	59.4	— 56
	Percentage relationship between metal and total	(69)	(91)	
Zinc	Total	229.0	464.6	103
	Metal	73.3	338.0	360
	Minerals and concentrates	155.7	126.6	— 19
	Percentage relationship between metal and total	(32)	(78)	
Silver	Total	277.7	789.2	184
	Metal	179.9	665.0	270
	Minerals and concentrates	97.8	124.2	27
	Percentage relationship between metal and total	(65)	(84)	
Gold and other non-ferrous metals	Total	120.3	197.0	64
	Metal	77.7	116.0	49
	Minerals and concentrates	42.6	81.0	90
	Percentage relationship between metal and total	(65)	(59)	
Total	Total	1 551.4	4 547.7	192
	Metal	1 064.2	3 461.0	224
	Minerals and concentrates	487.2	1 086.7	123
	Percentage relationship between metal and total	(69)	(77)	

SOURCE: 1955 data: National Institute for Mining Research and Development, *Anuario de la Industria Minera del Perú 1956* and Ministry of Finance and Trade, *Estadística de Comercio Exterior 1955*.

Estimates for 1965 based only on the expansion plans of the large companies (see chapter II, particularly table 28).

[a] Minerals and concentrates only for export as such.

Table 220

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE NON-FERROUS METAL INDUSTRY

(Values in millions of soles at 1955 prices; decennial growth rates in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate goods	Exports [a]	Consumption	Investment	Total	Raw materials and intermediate goods		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Copper	D	16.2	424.8	—	—	441.0	60.5	273	1 744.5	312	—	—	—	—	1 805.0	310
	P	7.4	424.8	—	—	432.2	35.5	380	1 774.5	312	—	—	—	—	1 780.0	312
	I	8.8	—	—	—	8.8	25.0	184	—	—	—	—	—	—	25.0	184
	P/D	(46)	(100)	—	—	(98)	(59)		(100)		—		—		(99)	
Lead	D	9.0	293.1	—	—	302.1	16.4	82	547.6	87	—	—	—	—	564.0	87
	P	8.0	293.1	—	—	301.1	14.4	80	547.6	87	—	—	—	—	562.0	87
	I	1.0	—	—	—	1.0	2.0	100	—	—	—	—	—	—	2.0	100
	P/D	(89)	(100)	—	—	(99)	(88)		(100)		—		—		(99)	
Zinc	D	3.2	71.3	—	—	74.5	24.0	650	316.4	344	—	—	—	—	340.4	356
	P	2.0	71.3	—	—	73.3	21.6	980	316.4	344	—	—	—	—	338.0	360
	I	1.2	—	—	—	1.2	2.4	100	—	—	—	—	—	—	2.4	100
	P/D	(63)	(100)	—	—	(98)	(90)		(100)		—		—		(99)	
Silver	D	11.7	168.2	—	—	179.9	56.2	380	608.8	262	—	—	—	—	665.0	270
	P	11.7	168.2	—	—	179.9	56.2	380	608.8	262	—	—	—	—	665.0	270
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	—	—	(100)	(100)		(100)		—		—		(100)	
Gold and other non-ferrous metals	D	33.3	56.2	—	3.7	93.2	91.5	175	68.5	22	—	—	6.0	62	166.0	78
	P	17.8	56.2	—	3.7	77.7	41.5	134	68.5	22	—	—	6.0	62	116.0	50
	I	15.5	—	—	—	15.5	50.0	223	—	—	—	—	—	—	50.0	222
	P/D	(53)	(100)	—	(100)	(83)	(45)		(100)		—		—		(70)	
Anodic residues [b]	D	147.9	—	—	—	147.9	611.0	312	—		—	—	—	—	611.0	312
	P	147.9	—	—	—	147.9	611.0	312	—		—	—	—	—	611.0	312
	I	—	—	—	—	—	—	—	—		—	—	—	—	—	—
	P/D	(100)	—	—	—	(100)	(100)		—		—		—		(100)	
Total	D	221.3	1 013.6	—	3.7	1 238.6	724.8	228	3 420.6	238	—	—	6.0	62	4 151.4	236
	P	194.8	1 013.6	—	3.7	1 212.1	645.4	232	3 420.6	238	—	—	6.0	62	4 072.0	238
	I	26.5	—	—	—	26.5	79.4 [c]	200	—	—	—	—	—	—	79.4	200
	P/D	(88)	(100)	—	(100)	(98)	(89)		(100)		—		(100)		(98)	

SOURCE: For 1955: Ministry of Development and Public Works, *Estadística Industrial 1955*; and Ministry of Finance and Trade, *Estadística de Comercio Exterior, 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Production/demand relationship as a percentage.
a Value at producers' prices.
b From electrolysis of copper.
c Assuming a parallel growth in industry as a whole.

Table 221

PERU: ESTIMATE OF INCREASE IN EMPLOYMENT IN NON-FERROUS METAL INDUSTRY, 1955-65

Item	Number of increase in 1955	Decennial rate of increase in production (Percentage) [a]	Assumed increase in labour productivity (Percentage)	Number of workers in 1965	Number of extra workers required
Copper	1 260	312	10	4 720	3 460
Lead	750	87	10	1 275	525
Zinc	200	360	10	835	635
Gold, silver and other non-ferrous metals	1 040	203	10	2 870	1 830
Total	3 250	225	10	9 700	6 450

SOURCE: For 1955: National Institute for Mining Research and Development, *Anuario de la Industria Minera del Perú, 1955.*
[a] Estimates based on the expansion plans of the major mining companies.

output of silver from the 1956 figure of 300 tons to 1 445 tons by the end of the period under consideration. As far as gold and other metals were concerned, reference to specific programmes was more difficult, and a rate of growth related, up to a point, with that of lead and copper was assumed.

Table 219 presents, in terms of values in millions of soles, the increments likely to be registered in the supply of metals, ores and concentrates, in accordance with the above-mentioned expansion programmes. The combination of probable metal production data, taken from this table, with the volumes that would be required by domestic industry for use as raw material in 1965, provided a basis on which to formulate the projections for this branch of the metallurgical industry appearing in table 220. As can be seen here, domestic consumption of non-ferrous metal products is insignificant in comparison with export possibilities. Total production would increase from 1 212 to 4 072 million soles, that is, by 238 per cent. Silver would make the biggest contribution to this development —485 million soles—and next in order would come zinc and lead.

To judge from the volume of investment and equipment during the last few years, it might be roughly estimated that the expansion of non-ferrous metals production would require about 2 700 million soles for machinery and equipment, at 1955 prices.

Manpower requirements might be estimated on the basis of current employment in each line of manufacture and on the assumption that aggregate productivity would increase by 10 per cent as a result of the introduction of new equipment for expansion purposes. In brief, approximately 6 450 additional workers would be required, over and above the 3 250 available in 1955 (see table 221).

For the sake of more methodical organization of this study, the iron and steel industry and the non-ferrous metals industry are dealt with in separate sections, although in reality both go to make up the branch called "basic metal industries" which appears in the general input-output tables. Table 222 presents a projection of demand and development hypotheses for these two industries, with the aim of establishing the whole group's relationship to the frame of reference that has been used as a guide in the preparation of estimates.

XVII. METAL TRANSFORMING INDUSTRY

Much as in the case of the chemicals industry, special attention has been devoted in this study, for various reasons, to the metal transforming industry. As was pointed out in chapter V, with reference to the characteristics of existing industry, this is the most backward branch of all, as regards capacity to satisfy domestic demand (23 per cent); it is probably also the principal link in the chain of industrial development, since, on the one hand, it has to manufacture the most essential requisites for the development of the majority of industries, agriculture and mining, and, on the other, it consumes large quantities of raw materials which could with advantage be domestically produced, such as, for example, iron and steel products, non-ferrous metals, tools and certain types of machinery. Lastly, this activity is an excellent means of absorbing manpower and affords more opportunities than any other for the training of skilled personnel.

To simplify the study and presentation of data, the analysis is divided into the following two parts: one dealing with "existing" industry,[38] a term applied to those lines of production in which some kind of manufacturing activity is already carried on, at least in part; and another relating to new industries, that is, activities which have not yet been initiated in Peru, or are undertaken on primitive lines or on a negligible scale.

1. *Estimate of future demand*

It must be made clear from the outset that this

[38] For the purposes of the present study any industry whose production fell below 1 million soles in 1955 was disregarded.

Table 222

PERU: SYNOPSIS OF DEMAND PROJECTIONS AND DEVELOPMENT HYPOTHESES FOR THE BASIC METALS INDUSTRIES

(Values in millions of soles at 1955 prices; decennial growth rates in percentages)

Sector		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate goods	Exports [a]	Consumption	Investment	Total	Raw materials and intermediate goods		Exports [a]		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Iron and steel industry	P	113.5	—	—	163.4	276.9	360.7	217	—	—	—	—	303.9	86	664.6	140
	D	1.7	—	—	—	1.7	178.3	—	—	—	—	—	192.3	—	370.6	—
	I	111.8	—	—	163.4	275.2	182.4	63	—	—	—	—	111.6	—32	294.0	7
	P/D	(1)	—	—	(0)	(0)	(49)		—		—		(63)		(56)	
Non-ferrous metal industry . . .	P	221.3	1 013.6	—	3.7	1 238.6	724.8	228	3 420.6	238	—	—	6.0	62	4 151.4	236
	D	194.8	1 013.6	—	3.7	1 212.1	645.4	232	3 420.6	238	—	—	6.0	62	4 072.0	238
	I	26.5	—	—	—	26.5	79.4	200	—	—	—	—	—	—	79.4	200
	P/D	(88)	(100)	—	(100)	(98)	(89)		(100)		—		(100)		(98)	
Total.	P	334.8	1 013.6	—	167.1	1 515.5	1 085.5	224	3 420.6	238	—	—	309.9	85	4 816.0	218
	D	196.5	1 013.6	—	3.7	1 213.8	823.7	319	3 420.6	238	—	—	198.3	—	4 442.6	266
	I	138.3	—	—	163.4	301.7	261.8	89	—	—	—	—	111.6	—32	373.4	23
	P/D	(59)	(100)	—	(2)	(80)	(76)		(100)		—		(64)		(92)	

SOURCE: See tables 218 and 220.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
a Values at producers' prices.

report was never intended to include a market study such as should be carried out before a decision is taken as to the desirability of any domestic manufacturing project; nor were the time or resources needed for such a study available. All that has been attempted is to determine, in broad outline and simply by means of correlations, the over-all trend which might be followed by demand in the future. Subsequently, on the basis of certain criteria and without a thorough analysis of yields in relation to profitability or of the technical problems inherent therein, possible percentage relationships between production and domestic demand are given. These must be taken only as indications of approximate magnitudes, used here for the purpose of integration with a series of aggregate projections for other industries so as to build up a model of what might, very broadly speaking, come to constitute Peru's industrial sector in 1965.

Demand for products of the metal transforming industry was projected on the basis of consumption data for 1955, obtained from official sources,[39] and of assumed rates of growth for agriculture, industry in general, mining, generation of electric energy, construction, population, the motor vehicle park, consumption of durable goods, etc. These correlation factors, together with the projection procedures adopted in certain special cases, are explained in detail in the notes to table 227.

The procedure whereby projections are formulated for a series of activities on the basis of parallel growth trends has the following drawback: no allowance is made for the fact that in many cases there may be a correlation elasticity higher or lower than 1.00, which would mean that demand for the item concerned would increase slightly more rapidly or slightly more slowly than for the line of production with which the analogy in respect of growth rates is being established. For the purposes of the present study, however, the approximate results based on parallel projections were considered sufficiently accurate, especially when it was seen that the sum of the demand figures calculated in this way did not substantially differ from the aggregate demand for the products of the metal transforming industry as deduced from the projection in the general input-output table.

The projection of demand for the products of existing industry will be found in table 223, and that of demand for products not yet manufactured is shown in tables 224, 225, 226 and 227, which correspond to the four heads under which the metal transforming industries are commonly classified, i.e., simple metal transforming manufactures; non-electrical machinery and equipment; electrical machinery, instruments, appliances and accessories; and transport equipment. All demand projections are summed up in table 228, in connexion with which it is worth while emphasizing that whereas the hypothetical increase in demand for factory-made goods is 150 per cent, it is only 11 per cent in the case of the products of artisan industry. If these two figures are compared with the corresponding percentages for other industries, it will be noted that the highest degree of transfer of demand from artisan to factory products would be registered in the metal transforming industry, mainly because in this type of activity it is very difficult for manual to compete with mechanized production, either in quality or in price. The reverse is true of the footwear and made-up textiles, leather, glass and chinaware, porcelain and pottery industries. Here artisan activities are still expected to expand on a relatively significant scale, since they efficiently serve their purpose of producing for certain sectors of the market in which industry proper cannot compete, chiefly because of the difficulty of changing over rapidly from certain products to others, or the impossibility of mechanizing operations which require large volumes of manpower and are carried out in connexion with products for which the market is very small.

Another point in connexion with the summary of demand projections (see again table 228) is that demand tends to increase a good deal more rapidly for the more complex manufactures, such as machinery and transport equipment, than for simple metal transforming products, in respect of which the development of Peruvian industry has already made some progress. Broadly speaking this fact may be said to underline the need for attention to be concentrated forthwith on the organization of the development of the metal transforming industries along lines which will gradually facilitate the undertaking of increasingly complex activities.

It will be noted that no consideration has been given to export prospects. These are very promising, especially as regards certain goods which could be economically manufactured in Peru and for which there is a market in neighbouring countries, such as pumps, compressors, aluminium windows, mining machinery and tools. Such possibilities are omitted from the study of demand because of the difficulty of conducting the necessary research outside Peru, and in deference to the desirability of presenting estimates erring, if anything, on the conservative side.

2. *Prospects for the development of production*

(a) *Expansion of existing industry*

Probable demand for various products or groups of products of existing industry having been determined, the next requisite is to estimate the proportion of such demand that could be met by domestic production. On the whole, the problem is not complicated; the percentage to be ascertained would depend mainly upon the variety of models or forms in which the product is manufactured and on the complexity of the pro-

[39] For imports, data supplied by the Ministry of Finance and Development (*Estadística de Comercio Exterior*) were used to obtain averages for 1954-55-56; domestic production data were obtained from the Ministry of Development and Public Works (*Estadística Industrial 1955*).

Table 223

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955: Raw materials and intermediate products	Data for 1955: Consumption	Data for 1955: Investment	Data for 1955: Total	Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965: Raw materials and intermediate products: Value	Hypothesis for 1965: Raw materials and intermediate products: Rate	Hypothesis for 1965: Consumption: Value	Hypothesis for 1965: Consumption: Rate	Hypothesis for 1965: Investment: Value	Hypothesis for 1965: Investment: Rate	Hypothesis for 1965: Total: Value	Hypothesis for 1965: Total: Rate
35	*Simple metallic manufactures*	D	87.5	104.0	202.4	393.9		192.6	120	216.1	108	369.9	83	778.6	98
		P	54.8	70.0	85.4	210.2		166.5	204	165.6	137	278.0	226	610.1	190
		I	32.7	34.0	117.0	183.7		26.1	− 20	50.5	49	91.9	− 21	168.5	− 8
		P/D	(63)	(67)	(42)	(53)		(86)		(77)		(75)		(78)	
352	Containers of tinplate	D	55.0			55.0	Fish preserving	106.0	93	—	—	—	—	106.8	93
		P	43.7	—	—	43.7		87.0	100	—	—	—	—	87.0	100
		I	11.3	—	—	11.3		19.0	68	—	—	—	—	19.0	68
		P/D	(79)	—	—	(79)		(82)		—		—		(82)	
	Metal caps	D	16.4			16.4	Beer and carbonated beverages	35.9	118	—	—	—	—	35.9	118
		P	4.1	—	—	4.1		29.5	620	—	—	—	—	29.5	620
		I	12.3	—	—	12.3		6.4	− 48	—	—	—	—	6.4	− 48
		P/D	(25)	—	—	(25)		(82)		—		—		(82)	
353	Ironware and other hardware	D			12.0	12.0	Construction	—	—	—	—	22.7	89	22.7	89
		P	—	—	4.1	4.1		—	—	—	—	11.4	178	11.4	178
		I	—	—	7.9	7.9		—	—	—	—	11.3	—	11.3	—
		P/D	—	—	(34)	(34)		—		—		(50)		(50)	
354	Taps and similar articles for sanitary installations	D			8.0	8.0	Construction	—	—	—	—	15.1	89	15.1	89
		P	—	—	2.8	2.8		—	—	—	—	12.1	332	12.1	332
		I	—	—	5.2	5.2		—	—	—	—	3.0	− 42	3.0	− 42
		P/D	—	—	(35)	(35)		—		—		(80)		(80)	
	Stoves, water-heaters, radiators and other non-electric heating appliances	D		17.0		17.0	Durable consumer goods	—	—	33.7	98	—	—	33.7	98
		P	—	7.2	—	7.2		—	—	14.2	97	—	—	14.2	97
		I	—	9.8	—	9.8		—	—	19.5	99	—	—	19.5	99
		P/D	—	(42)	—	(42)		—		(42)		—		(42)	
355	Structural units of steel tubing and light steel shapes (including door- and window-frames and lamp-posts)	D			18.7	18.7	Construction	—	—	—	—	35.3	89	35.3	89
		P	—	—	18.5	18.5		—	—	—	—	35.3	91	35.3	91
		I	—	—	0.2	0.2		—	—	—	—	—	—	—	—
		P/D	—	—	(99)	(99)		—		—		(100)		(100)	

See notes at end of table.

Table 223 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Structural units of tubing and light shapes, of aluminium (including door- and window frames) .	D			4.9	4.9	Construction	—	—	—	—	9.3	89	9.3	89
		P	—	—	4.9	4.9		—	—	—	—	9.3	89	9.3	89
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	—	(100)	(100)		—		—		(100)		(100)	
	Structural units of heavy shapes.	D			32.0	32.0	Construction	—	—	—	—	60.5	89	60.5	89
		P	—	—	10.2	10.2		—	—	—	—	30.3	197	30.3	197
		I	—	—	21.8	21.8		—	—	—	—	30.2	38	30.2	38
		P/D	—	—	(32)	(32)		—		—		(50)		(50)	
	Steel furniture	D			22.1	22.1	Durable consumer goods	—	—	—	—	43.8	98	43.8	98
		P	—	—	6.0	6.0		—	—	—	—	26.3	338	26.3	338
		I	—	—	16.1	16.1		—	—	—	—	17.5	9	17.5	9
		P/D	—	—	(27)	(27)		—		—		(60)		(60)	
	Silos, tanks, vats, etc. . .	D			11.6	11.6	General industrial development	—	—	—	—	23.2	100	23.2	100
		P	—	—	1.6	1.6		—	—	—	—	18.6	1 062	18.6	1 062
		I	—	—	10.0	10.0		—	—	—	—	4.6	— 54	4.6	— 54
		P/D	—	—	(14)	(14)		—		—		(80)		(80)	
	Bedsteads	D		16.8		16.8	Durable consumer goods	—	—	33.3	98	—	—	33.3	98
		P	—	15.0	—	15.0		—	—	31.6	111	—	—	31.6	111
		I	—	1.8	—	1.8		—	—	1.7	— 6	—	—	1.7	— 6
		P/D	—	(89)	—	(89)		—		(95)		—		(95)	
	Welded tubes and their fittings	D			67.9	67.9	General economic development	—	—	—	—	115.4	70	115.4	70
		P	—	—	18.3	18.3		—	—	—	—	92.3	404	92.3	404
		I	—	—	49.6	49.6		—	—	—	—	23.1	— 53	23.1	— 53
		P/D	—	—	(27)	(27)		—		—		(80)		(80)	
356	Aluminium cooking utensils and tableware. . .	D		16.2		16.2	Durable consumer goods	—	—	33.2	98	—	—	33.2	98
		P	—	12.4	—	12.4		—	—	25.6	106	—	—	25.6	106
		I	—	3.8	—	3.8		—	—	7.6	100	—	—	7.6	100
		P/D	—	(77)	—	(77)		—		(77)		—		(77)	

See notes at end of table.

Table 223 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Other domestic metal utensils (including those of cast iron and steel sheet)	D		18.4		18.4	Durable consumer goods	—	—	36.4	98	—	—	36.4	98
		P	—	3.2	—	3.2		—	—	18.2	469	—	—	18.2	469
		I	—	15.2	—	15.2		—	—	18.2	20	—	—	18.2	20
		P/D	—	(17)	—	(17)		—		(50)		—		(50)	
357	Lighting fixtures (fluorescent lighting shades, chandeliers, brackets, lamps, etc.)	D		3.1		3.1	Electricity	—	—	10.1	225	—	—	10.1	225
		P	—	1.5	—	1.5		—	—	6.6	340	—	—	6.6	340
		I	—	1.6	—	1.6		—	—	3.5	—	—	—	3.5	—
		P/D	—	(48)	—	(48)		—		(65)		—		(65)	
	Coarse and fine wire netting of iron and steel .	D			4.0	4.0	Agriculture	—	—	—	—	6.0	49	6.0	49
		P	—	—	2.4	2.4		—	—	—	—	6.0	150	6.0	150
		I	—	—	1.6	1.6		—	—	—	—	—	—	—	—
		P/D	—	—	(60)	(60)		—		—		(100)		(100)	
	Nails, tacks, staples . . .	D	12.2			12.2	Agriculture	18.2	49	—	—	—	—	18.2	49
		P	3.5	—	—	3.5		18.2	420	—	—	—	—	18.2	420
		I	8.7	—	—	8.7		—	—	—	—	—	—	—	—
		P/D	(29)	—	—	(29)		(100)		—		—		(100)	
359	Barrels, casks, drums, buckets, etc.	D			15.2	15.2	Petroleum	—	—	—	—	21.9	44	21.9	44
		P	—	—	13.3	13.3		—	—	—	—	21.9	65	21.9	65
		I	—	—	1.9	1.9		—	—	—	—	—	—	—	—
		P/D	—	—	(88)	(88)		—		—		(100)		(100)	
	Soft metal tubes for ointments and creams. . .	D	3.9			3.9	Soap	7.1	82	—	—	—	—	7.1	82
		P	3.5	—	—	3.5		6.4	83	—	—	—	—	6.4	83
		I	0.4	—	—	0.4		0.7	75	—	—	—	—	0.7	75
		P/D	(90)	—	—	(90)		(90)		—		—		(90)	
	Safes and vault accessories	D			2.2	2.2	Durable consumer goods	—	—	—	—	4.4	98	4.4	98
		P	—	—	1.0	1.0		—	—	—	—	2.2	120	2.2	120
		I	—	—	1.2	1.2		—	—	—	—	2.2	83	2.2	83
		P/D	—	—	(45)	(45)		—		—		(50)		(50)	

See notes at end of table.

Table 223 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Steel leaf springs	D		4.3	3.8	8.1	Motor vehicles	—	—	12.2	184	12.3	224	24.5	203
		P	—	2.5	2.3	4.8		—	—	12.2	388	12.3	435	24.5	410
		I	—	1.8	1.5	3.3		—	—	—	—	—	—	—	—
		P/D	—	(59)	(59)	(59)		—		(100)		(100)		(100)	
	Other simple metal manufactures produced in Peru	D		28.2		28.2	Independent projection explained in the notes	25.4	—	57.2	103	—	—	82.6	193
		P	—	28.2	—	28.2		25.4	—	57.2	103	—	—	82.6	193
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	(100)	—	(100)		(100)		(100)		—		(100)	
36	*Non-electrical machinery and equipment (except for transport)*	D	—	—	163.1	163.1		—	—	—	—	428.3	163	428.3	163
		P	—	—	20.8	20.8		—	—	—	—	229.3	1 002	229.3	1 002
		I	—	—	142.3	142.3		—	—	—	—	199.0	40	199.0	40
		P/D	—	—	(14)	(14)		—		—		(53)		(53)	
362	Machines for land preparation and cultivation. .	D			19.7	19.7	Agriculture	—	—	—	—	29.3	49	29.3	49
		P	—	—	1.2	1.2		—	—	—	—	2.9	142	2.9	142
		I	—	—	18.5	18.5		—	—	—	—	26.4	43	26.4	43
		P/D	—	—	(6)	(6)		—		—		(10)		(10)	
363	Mining machinery. . . .	D			97.9	97.9	Mining	—	—	—	—	293.0	200	293.0	200
		P	—	—	3.9	3.9		—	—	—	—	176.2	4 418	176.2	4 418
		I	—	—	94.0	94.0		—	—	—	—	116.8	25	116.8	25
		P/D	—	—	(4)	(4)		—		—		(60)		(60)	
365	Wood-working machines.	D			8.1	8.1	Timber industry	—	—	—	—	24.0	197	24.0	197
		P	—	—	2.0	2.0		—	—	—	—	5.8	190	5.8	190
		I	—	—	6.1	6.1		—	—	—	—	18.2	185	18.2	199
		P/D	—	—	(25)	(25)		—		—		(24)		(24)	
366	Lifts and escalators for buildings.	D			17.7	17.7	Construction	—	—	—	—	33.5	89	33.5	89
		P	—	—	1.4	1.4		—	—	—	—	3.4	143	3.4	143
		I	—	—	16.3	16.3		—	—	—	—	30.1	85	30.1	85
		P/D	—	—	(8)	(8)		—		—		(100)		(100)	
367	Weighing-machines and scales.	D			8.8	8.8	General economic development	—	—	—	—	15.0	70	15.0	70
		P	—	—	1.4	1.4		—	—	—	—	7.5	436	7.5	436
		I	—	—	7.4	7.4		—	—	—	—	7.5	—	7.5	—
		P/D	—	—	(16)	(16)		—		—		(50)		(50)	

See notes at end of table.

Table 223 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
369	Other non-electrical machinery	D			10.9	10.9	Independent projection explained in the notes	—	—	—	—	33.5	207	33.5	207
		P	—	—	10.9	10.9		—	—	—	—	33.5	207	33.5	207
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	—	(100)	(100)		—		—		(100)		(100)	
37	*Electrical machines, instruments, apparatus and accessories*	D	—	17.7	70.5	88.2		—	—	156.5	219	224.6	219	281.1	219
		P	—	17.7	14.7	32.4		—	—	156.5	219	195.4	1 229	251.9	677
		I	—	—	55.8	55.8		—	—	—	—	29.2	— 48	29.2	— 48
		P/D	—	(100)	(21)	(37)		—		(100)		(87)		(90)	
371	Electrical control equipment and machinery.	D			8.0	8.0	Electricity	—	—	—	—	26.0	225	26.0	225
		P	—	—	1.7	1.7		—	—	—	—	10.4	512	10.4	512
		I	—	—	6.3	6.3		—	—	—	—	15.6	148	15.6	148
		P/D	—	—	(21)	(21)		—		—		(40)		(40)	
373	Electric wire and cables	D			42.0	42.0	Electricity	—	—	—	—	136.5	225	136.5	225
		P	—	—	4.2	4.2		—	—	—	—	122.9	2 826	122.9	2 826
		I	—	—	37.8	37.8		—	—	—	—	13.6	— 64	13.6	— 64
		P/D	—	—	(10)	(10)		—		—		(90)		(90)	
379	Accumulators.	D			20.5	20.5	Motor vehicles	—	—	—	—	62.1	203	62.1	203
		P	—	—	8.8	8.8		—	—	—	—	62.1	606	62.1	606
		I	—	—	11.7	11.7		—	—	—	—	—	—	—	—
		P/D	—	—	(43)	(43)		—		—		(100)		(100)	
	Other miscellaneous electrical products	D	—	17.7	—	17.7		—	—	56.5	219	—	—	56.5	219
		P	—	17.7	—	17.7		—	—	56.5	219	—	—	56.5	219
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	(100)	—	(100)		—		(100)		—		(100)	
38	*Transport equipment*	D	—	27.4	234.3	261.7		—	—	83.0	203	731.1	212	814.1	211
		P	—	27.4	102.9	130.3		—	—	83.0	203	326.4	217	409.4	214
		I	—	—	131.4	131.4		—	—	—	—	404.7	208	404.7	208
		P/D	—	(100)	(14)	(50)		—		(100)		(45)		(50)	
381	Ship-building and repairing	D			6.7	6.7	Fishing	—	—	—	—	18.4	175	18.4	175
		P	—	—	3.0	3.0		—	—	—	—	9.8	227	9.8	227
		I	—	—	3.7	3.7		—	—	—	—	8.6	132	8.6	132
		P/D	—	—	(45)	(45)		—		—		(53)		(53)	

See notes at end of table.

Table 223 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR THE EXISTING METAL TRANSFORMING INDUSTRY

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
383	Lorries	D			114.9	114.9	Independent projection explained in the notes	—	—	—	—	380.1	230	380.1	230
		P	—	—	4.7	4.7		—	—	—	—	32.0	580	32.0	580
		I	—	—	110.2	110.2		—	—	—	—	348.1	215	348.1	215
		P/D	—	—	(4)	(4)		—		—		(9)		(9)	
	Buses	D			19.0	19.0	Independent projection explained in the notes	—	—	—	—	49.0	158	49.0	158
		P	—	—	1.5	1.5		—	—	—	—	1.0	— 33	1.0	— 33
		I	—	—	17.5	17.5		—	—	—	—	48.0	174	48.0	174
		P/D	—	—	(8)	(8)		—		—		(2)		(2)	
384	Repair of motor vehicles	D		27.4	82.0	109.4	Motor vehicles	—	—	83.0	203	248.5	203	331.5	203
		P	—	27.4	82.0	109.4		—	—	83.0	203	248.5	203	331.5	203
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	(100)	(100)	(100)		—		(100)		(100)		(100)	
	Other transport equipment	D			11.7	11.7	Transport in general	—	—	—	—	35.1	200	35.1	200
		P	—	—	11.7	11.7		—	—	—	—	35.1	200	35.1	200
		I	—	—	—	—		—	—	—	—	—	—	—	—
		P/D	—	—	(100)	(100)		—		—		(100)		(100)	
	Total	D	87.5	149.1	670.3	906.9		192.6	120	355.6	138	1 753.9	162	2 302.1	154
		P	54.8	115.1	223.8	393.7		166.5	204	305.1	165	1 029.1	360	1 500.7	281
		I	32.7	34.0	446.5	513.2		26.1	— 20	50.5	48	724.8	62	801.4	56
		P/D	(63)	(77)	(33)	(43)		(86)		(86)		(59)		(65)	

Source: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
[a] See notes to table 227.

Table 224

DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES MAKING SIMPLE METALLIC MANUFACTURES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
353	Table and kitchen cutlery	D	—	5.6	—	5.6	Durable consumer goods	—	—	11.1	98	—	—	11.1	98
		P	—	—	—	—		—	—	4.4	—	—	—	4.4	—
		I	—	5.6	—	5.6		—	—	6.7	20	—	—	6.7	20
		P/D	—	(0)	—	(0)		—		(40)		—		(40)	
	Other cutting implements (axes and machetes)	D	—	—	1.9	1.9	Agriculture	—	—	—	—	2.8	47	2.8	47
		P	—	—	—	—		—	—	—	—	1.7	—	1.7	—
		I	—	—	1.9	1.9		—	—	—	—	1.1	— 42	1.1	— 42
		P/D	—	—	(0)	(0)		—		—		(60)		(60)	
	Agricultural hand tools	D	—	—	10.6	10.6	Agriculture	—	—	—	—	15.8	49	15.8	49
		P	—	—	—	—		—	—	—	—	12.6	—	12.6	—
		I	—	—	10.6	10.6		—	—	—	—	3.2	— 70	3.2	— 70
		P/D	—	—	(0)	(0)		—		—		(80)		(80)	
353	Artisan hand tools	D	—	—	27.0	27.0	Industry in general	—	—	—	—	54.0	100	54.0	100
		P	—	—	0.3	0.3		—	—	—	—	21.6	7 100	21.6	7 100
		I	—	—	26.7	26.7		—	—	—	—	32.4	21	32.4	21
		P/D	—	—	(1)	(1)		—		—		(40)		(40)	
353	Drill rods	D	9.1	—	—	9.1	Mining	27.3	200	—	—	—	—	27.3	200
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	9.1	—	—	9.1		27.3	200	—	—	—	—	27.3	200
		P/D	(0)	—	—	(0)		(0)		—		—		(0)	
	Locks and padlocks	D	—	—	1.9	1.9	Non-industrial construction	—	—	—	—	3.6	89	3.6	89
		P	—	—	—	—		—	—	—	—	0.7	—	0.7	—
		I	—	—	1.9	1.9		—	—	—	—	2.9	53	2.9	53
		P/D	—	—	(0)	(0)		—		—		(20)		(20)	
354	Sanitary articles of cast iron	D	—	—	9.3	9.3	Non-industrial construction	—	—	—	—	17.6	89	17.6	89
		P	—	—	0.3	0.3		—	—	—	—	14.1	4 600	14.1	4 600
		I	—	—	9.0	9.0		—	—	—	—	3.5	— 61	3.5	— 61
		P/D	—	—	(3)	(3)		—		—		(80)		(80)	
355	Gas cylinders	D	—	—	2.4	2.4	Independent projection explained in the notes	—	—	—	—	11.2	365	11.2	365
		P	—	—	—	—		—	—	—	—	11.2	—	11.2	—
		I	—	—	2.4	2.4		—	—	—	—	—	—	—	—
		P/D	—	—	(0)	(0)		—		—		(100)		(100)	

See notes at end of table.

Table 224 *(Continued)*

DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES MAKING SIMPLE METALLIC MANUFACTURES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965					
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment	Total
								Value	Rate	Value	Rate	Value	Value	Rate
357	Flashlights	D	—	3.5	—	3.5	Population	—	—	4.5	28	—	4.5	28
		P	—	—	—	—		—	—	3.4	—	—	3.4	—
		I	—	3.5	—	3.5		—	—	1.1	— 69	—	1.1	— 69
		P/D	—	(0)	—	(0)		—		(75)		—	(75)	
358	Iron and steel wire	D	15.9	—	9.1	25.0	Agriculture	23.7	49	—	—	13.5	37.2	49
		P	—	—	—	—		23.7	—	—	—	13.5	37.2	—
		I	15.9	—	9.1	25.0		—	—	—	—	—	—	—
		P/D	(0)	—	(0)	(0)		(100)		—		(100)	(100)	
	Barbed wire	D	—	—	4.5	4.5	Agriculture	—	—	—	—	6.7	6.7	49
		P	—	—	—	—		—	—	—	—	6.7	6.7	—
		I	—	—	4.5	4.5		—	—	—	—	—	—	—
		P/D	—	—	(0)	(0)		—		—		(100)	(100)	
	Springs	D	2.8	—	—	2.8	Durable consumer goods	5.5	96	—	—	—	5.5	96
		P	0.9	—	—	0.9		5.0	456	—	—	—	5.0	456
		I	1.9	—	—	1.9		0.5	— 74	—	—	—	0.5	— 74
		P/D	(32)	—	—	(32)		(90)		—		—	(90)	
	Steel cables	D	—	—	7.7	7.7	Mining	—	—	—	—	23.1	23.1	200
		P	—	—	—	—		—	—	—	—	—	—	—
		I	—	—	7.7	7.7		—	—	—	—	23.1	23.1	200
		P/D	—	—	(0)	(0)		—		—		(0)	(0)	
	Electrodes of ordinary iron and steel	D	3.8	—	—	3.8	Metal transforming industries in general	12.3	223	—	—	—	12.3	223
		P	—	—	—	—		9.0	—	—	—	—	9.0	—
		I	3.8	—	—	3.8		3.3	— 12	—	—	—	3.3	— 12
		P/D	(0)	—	—	(0)		(65)		—		—	(65)	
	Electrodes of special iron and steel	D	1.8	—	—	1.8	Industries in general (other than metal-transforming)	5.8	223	—	—	—	5.8	223
		P	—	—	—	—		—	—	—	—	—	—	—
		I	1.8	—	—	1.8		5.8	223	—	—	—	5.8	223
		P/D	(0)	—	—	(0)		(0)		—		—	(0)	
359	Nuts, screws, pulley wheels, rivets, etc.	D	11.9	—	—	11.9	Metal-transforming and timber industries	55.6	367	—	—	—	55.6	367
		P	0.5	—	—	0.5		40.6	8 020	—	—	—	40.6	8 020
		I	11.4	—	—	11.4		15.0	32	—	—	—	15.0	32
		P/D	(4)	—	—	(4)		(73)		—		—	(73)	

See notes at end of table.

Table 224 *(Continued)*

DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES MAKING SIMPLE METALLIC MANUFACTURES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
359	Razors	D	—	1.5	—	1.5	Population	—	—	1.9	28	—	—	1.9	28
		P	—	—	—	—		—	—	1.5	—	—	—	1.5	—
		I	—	1.5	—	1.5		—	—	0.4	— 73	—	—	0.4	— 73
		P/D	—	(0)	—	(0)		—		(80)		—		(80)	
	Needles, pins, hairpins (except hypodermic and gramophone needles)	D	—	3.0	—	3.0	Population	—	—	3.8	28	—	—	3.8	28
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	3.0	—	3.0		—	—	3.8	27	—	—	3.8	27
		P/D	—	(0)	—	(0)		—		(0)		—		(0)	
	Other simple metallic manufactures imported in 1955	D	51.4	2.8	249.0	303.2		110.5	115	—	—	708.8	185	819.3	170
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	51.4	2.8	249.0	303.2		110.5	115	—	—	708.8	185	819.3	170
		P/D	(0)	(0)	(0)	(0)		(0)		—		(0)		(0)	
	Total	D	96.7	16.4	323.4	436.5		240.7	149	21.3	30	857.1	165	119.1	156
		P	1.4	—	0.6	2.0		78.3	—	9.3	—	82.1	—	169.7	—
		I	95.3	16.4	322.8	434.5		164.4	70	12.0	— 27	775.0	140	949.4	119
		P/D	(1)	(0)	(0)	(0)		(33)		(44)		(10)		(15)	

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
a See notes to table 227.

Table 225

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING NON-ELECTRICAL MACHINES AND EQUIPMENT (EXCEPT FOR TRANSPORT)

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
361	Boilers, economizers and related equipment . . .	D	—	—	19.1	19.1	General industrial development	—	—	—	—	38.2	100	38.2	100
		P	—	—	0.2	0.2		—	—	—	—	15.3	—	15.3	—
		I	—	—	18.9	18.9		—	—	—	—	22.9	21	22.9	21
		P/D	—	—	(1)	(1)		—		—		(40)		(40)	
	Steam machines and turbines	D	—	—	5.2	5.2	Electricity	—	—	—	—	16.9	225	16.9	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	5.2	5.2		—	—	—	—	16.9	225	16.9	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Hydraulic turbines and wheels	D	—	—	6.5	6.5	Electricity	—	—	—	—	21.1	225	21.1	225
		P	—	—	0.1	0.1		—	—	—	—	—	—	—	—
		I	—	—	6.4	6.4		—	—	—	—	21.1	230	21.1	230
		P/D	—	—	(2)	(2)		—		—		(0)		(0)	
	Diesel marine engines . .	D	—	—	26.3	26.3	Fishing	—	—	—	—	72.4	175	72.4	175
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	26.3	26.3		—	—	—	—	72.4	175	72.4	175
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Other internal combustion engines except when already installed in vehicles	D	—	—	65.3	65.3	Electricity	—	—	—	—	212.2	225	212.2	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	65.3	65.3		—	—	—	—	212.2	225	212.2	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
362	Agricultural tractors . . .	D	—	—	64.5	64.5	Agriculture	—	—	—	—	96.1	49	96.1	49
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	64.5	64.5		—	—	—	—	96.1	49	96.1	49
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Harvesting and threshing machines	D	—	—	3.8	3.8	Agriculture	—	—	—	—	5.7	49	5.7	49
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	3.8	3.8		—	—	—	—	5.7	49	5.7	49
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Machinery and equipment for processing agricultural commodities	D	—	—	39.2	39.2	Agriculture	—	—	—	—	58.4	49	58.4	49
		P	—	—	—	—		—	—	—	—	5.8	—	5.8	—
		I	—	—	39.2	39.2		—	—	—	—	52.6	34	52.6	34
		P/D	—	—	(0)	(0)		—		—		(10)		(10)	

See notes at end of table.

Table 225 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING NON-ELECTRICAL MACHINES AND EQUIPMENT (EXCEPT FOR TRANSPORT)

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
363	Concrete mixers	D	—	—	3.2	3.2	Industrial construction	—	—	—	—	6.0	89	6.0	89
		P	—	—	—	—		—	—	—	—	3.6	—	3.6	—
		I	—	—	3.2	3.2		—	—	—	—	2.4	— 25	2.4	— 25
		P/D	—	—	(0)	(0)		—		—		(60)		(60)	
	Other machinery for construction	D	—	—	43.5	43.5	Industrial construction	—	—	—	—	82.2	89	82.2	89
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	43.5	43.5		—	—	—	—	82.2	89	82.2	89
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Equipment for petroleum extraction	D	—	—	70.6	70.6	Petroleum	—	—	—	—	101.7	44	101.7	44
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	70.6	70.6		—	—	—	—	101.7	44	101.7	44
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
364	Machine-tools for metal	D	—	—	17.0	17.0	Independent projection explained in the notes	—	—	—	—	60.0	—	60.0	—
		P	—	—	0.7	0.7		—	—	—	—	—	—	—	—
		I	—	—	16.3	16.3		—	—	—	—	60.0	—	60.0	—
		P/D	—	—	(4)	(4)		—		—		(0)		(0)	
365	Dressing and spinning machines	D	—	—	20.9	20.9	Independent projection explained in the notes	—	—	—	—	52.6	—	52.6	—
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	20.9	20.9		—	—	—	—	52.6	—	52.6	—
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Flat looms and textile-finishing machines	D	—	—	31.1	31.1	Independent projection explained in the notes	—	—	—	—	79.0	—	79.0	—
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	31.1	31.1		—	—	—	—	79.0	—	79.0	—
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Circular and rectilinear knitting machines	D	—	—	9.1	9.1	Knitted goods	—	—	—	—	13.6	50	13.6	50
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	9.1	9.1		—	—	—	—	13.6	50	13.6	50
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	

See notes at end of table.

Table 225 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING NON-ELECTRICAL MACHINES AND EQUIPMENT (EXCEPT FOR TRANSPORT)

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965					
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
366	Pumps	D	—	—	44.0	44.0	Economic development	—	—	—	—	74.8	70	74.8	70
		P	—	—	1.0	1.0		—	—	—	—	44.9	4 390	44.9	4 390
		I	—	—	43.0	43.0		—	—	—	—	29.9	— 30	29.9	— 30
		P/D	—	—	(2)	(2)		—		—		(60)		(60)	
	Compressors (including pneumatic tools)	D	—	—	56.6	56.6	Mining	—	—	—	—	169.8	200	169.8	200
		P	—	—	—	—		—	—	—	—	59.4	—	59.4	—
		I	—	—	56.6	56.6		—	—	—	—	110.4	95	110.4	95
		P/D	—	—	(0)	(0)		—		—		(35)		(35)	
	Freight and other lifts (except for buildings)	D	—	—	11.4	11.4	Mining	—	—	—	—	34.2	200	34.2	200
		P	—	—	0.6	0.6		—	—	—	—	13.7	2 183	13.7	2 183
		I	—	—	10.8	10.8		—	—	—	—	20.5	90	20.5	90
		P/D	—	—	(5)	(5)		—		—		(40)		(40)	
	Cranes and other equipment for lifting and handling weights	D	—	—	14.5	14.5	Economic development	—	—	—	—	24.7	70	24.7	70
		P	—	—	—	—		—	—	—	—	7.4	—	7.4	—
		I	—	—	14.5	14.5		—	—	—	—	17.3	19	17.3	19
		P/D	—	—	(0)	(0)		—		—		(30)		(30)	
	Equipment for the transmission of mechanical energy	D	—	—	10.8	10.8	Manufacturing development	—	—	—	—	25.6	137	25.6	137
		P	—	—	0.3	0.3		—	—	—	—	20.1	—	20.1	—
		I	—	—	10.5	10.5		—	—	—	—	5.5	— 45	5.5	— 45
		P/D	—	—	(3)	(3)		—		—		(78)		(78)	
367	Calculators	D	—	—	11.2	11.2	Economic development	—	—	—	—	19.0	70	19.0	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	11.2	11.2	Economic development	—	—	—	—	19.0	70	19.0	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Typewriters	D	—	—	23.0	23.0	Economic development	—	—	—	—	39.1	70	39.1	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	23.0	23.0		—	—	—	—	39.1	70	39.1	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Accounting and statistical machines	D	—	—	9.5	9.5	Economic development	—	—	—	—	16.2	70	16.2	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	9.5	9.5		—	—	—	—	16.2	70	16.2	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	

See notes at end of table.

Table 225 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING NON-ELECTRICAL MACHINES AND EQUIPMENT (EXCEPT FOR TRANSPORT)

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Cash registers	D	—	—	4.5	4.5	Economic development	—	—	—	—	7.7	70	7.7	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	4.5	4.5		—	—	—	—	7.7	70	7.7	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Other machines for offices and shops	D	—	—	3.3	3.3	Economic development	—	—	—	—	5.6	70	5.6	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	3.3	3.3		—	—	—	—	5.6	70	5.6	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
368	Washers and dryers for domestic use, floor scrapers and polishers	D	—	12.9	—	12.9	Durable consumer goods	—	—	25.5	98	—	—	25.5	98
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	12.9	—	12.9		—	—	25.5	98	—	—	25.5	98
		P/D	—	(0)	—	(0)		—		(0)		—		(0)	
	Industrial laundry equipment	D	—	—	16.6	16.6	Economic development	—	—	—	—	28.2	70	28.2	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	16.6	16.6		—	—	—	—	28.2	70	28.2	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Sewing machines	D	—	—	67.8	67.8	Footwear and made-up textiles	—	—	—	—	144.5	113	144.5	113
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	67.8	67.8		—	—	—	—	144.5	113	144.5	113
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Industrial and domestic electric refrigerators	D	—	39.7	—	39.7	Independent projection explained in the notes	—	—	77.0	94	—	—	77.0	94
		P	—	0.2	—	0.2		—	—	46.2	—	—	—	46.2	—
		I	—	39.5	—	39.5		—	—	30.8	— 22	—	—	30.8	— 22
		P/D	—	(1)	—	(1)		—		(60)		—		(60)	
	Industrial and domestic non-electric refrigerators	D	—	6.3	—	6.3	Independent projection explained in the notes	—	—	12.2	94	—	—	12.2	94
		P	—	—	—	—		—	—	9.8	—	—	—	9.8	—
		I	—	—	6.3	6.3		—	—	2.4	— 62	—	—	2.4	— 62
		P/D	—	(0)	—	(0)		—		(80)		—		(80)	

See notes at end of table.

Table 225 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING NON-ELECTRICAL MACHINES AND EQUIPMENT (EXCEPT FOR TRANSPORT)

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
369	Valves, etc. (except for sanitary installations) .	D	—	—	21.2	21.2	Economic development	—	—	—	—	36.0	70	36.0	70
		P	—	—	—	—		—	—	—	—	12.4	—	12.4	—
		I	—	—	21.2	21.2		—	—	—	—	23.6	27	23.6	27
		P/D	—	—	(0)	(0)		—		—		(34)		(34)	
	Other non-electric machinery and equipment imported in 1955. . .	D	9.6 [b]	—	93.6	103.2	Independent projection explained in the notes	24.8	158	—	—	335.9	258	360.7	240
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	9.6	—	93.6	103.2		24.8	158	—	—	335.9	258	360.7	240
		P/D	(0)	—	(0)	(0)		(0)		—		(0)		(0)	
	Total	D	9.6	58.9	813.3	881.8		24.8	158	114.7	95	1 877.4	131	2 016.9	129
		P	—	0.2	2.9	3.1		—	—	56.0	—	182.6	—	238.6	—
		I	9.6	58.7	810.4	878.7		24.8	158	58.7	—	1 694.8	109	1 778.3	102
		P/D	(0)	(0)	(0)	(0)		(0)		(49)		(10)		(12)	

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
a See notes to table 227.
b For mining.

Table 226

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING ELECTRICAL MACHINES, INSTRUMENTS, APPARATUS AND ACCESSORIES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
371	Generators and generating assemblies	D	—	—	38.4	38.4	Electricity	—	—	—	—	124.8	225	124.8	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	38.4	38.4		—	—	—	—	124.8	225	124.8	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Electric motors, over 50 HP	D	—	—	3.5	3.5	Electricity	—	—	—	—	11.4	225	11.4	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	3.5	3.5		—	—	—	—	11.4	225	11.4	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Electric motors, 25-50 HP	D	—	—	1.3	1.3	Electricity	—	—	—	—	4.2	225	4.2	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	1.3	1.3		—	—	—	—	4.2	225	4.2	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Electric motors, under 25 HP	D	—	—	8.8	8.8	Electricity	—	—	—	—	28.6	225	28.6	225
		P	—	—	0.1	0.1		—	—	—	—	20.0	—	20.0	—
		I	—	—	8.7	8.7		—	—	—	—	8.6	— 1	8.6	— 1
		P/D	—	—	(1)	(1)		—		—		(70)		(70)	
	Transformers, over 100 kW	D	—	—	8.5	8.5	Electricity	—	—	—	—	27.6	225	27.6	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	8.5	8.5		—	—	—	—	27.6	225	27.6	225
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Transformers, under 100 kW	D	—	—	10.6	10.6	Electricity	—	—	—	—	34.5	225	34.5	225
		P	—	—	0.5	0.5		—	—	—	—	24.1	4 720	24.1	4 720
		I	—	—	10.1	10.1		—	—	—	—	10.4	3	10.4	3
		P/D	—	—	(5)	(5)		—		—		(70)		(70)	
	Electric soldering machines	D	—	—	4.9	4.9	Metal transforming industry	—	—	—	—	25.8	427	25.8	427
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	4.9	4.9		—	—	—	—	25.8	427	25.8	427
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
372	Electric stoves and ovens.	D	—	8.5	—	8.5	Durable consumer goods	—	—	16.8	98	—	—	16.8	98
		P	—	—	—	—		—	—	10.1	—	—	—	10.1	—
		I	—	8.5	—	8.5		—	—	6.7	— 21	—	—	6.7	— 21
		P/D	—	(0)	—	(0)		—		(60)		—		(60)	

See notes at end of table.

Table 226 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING ELECTRICAL MACHINES, INSTRUMENTS, APPARATUS AND ACCESSORIES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Electric utensils with resistances	D	—	5.2	—	5.2	Durable consumer goods	—	—	10.3	98	—	—	10.3	98
		P	—	—	—	—		—	—	4.1	—	—	—	4.1	—
		I	—	5.2	—	5.2		—	—	6.2	19	—	—	6.2	19
		P/D	—	(0)	—	(0)		—		(40)		—		(40)	
	Electric manual tools	D	—	—	3.3	3.3	Industry in general	—	—	—	—	6.6	100	6.6	100
		P	—	—	—	—		—	—	—	—	1.7	—	1.7	—
		I	—	—	3.3	3.3		—	—	—	—	4.9	48	4.9	48
		P/D	—	—	(0)	(0)		—		—		(25)		(25)	
	Liquidizers, mixers and other domestic utensils with small motors	D	—	9.5	—	9.5	Durable consumer goods	—	—	18.8	98	—	—	18.8	98
		P	—	—	—	—		—	—	4.7	—	—	—	4.7	—
		I	—	9.5	—	9.5		—	—	14.1	48	—	—	14.1	48
		P/D	—	(0)	—	(0)		—		(25)		—		(25)	
374	Electrical equipment for vehicles, aircrafts and trains	D	—	—	9.0	9.0	Motor vehicles	—	—	—	—	27.3	203	27.3	203
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	9.0	9.0		—	—	—	—	27.3	203	27.3	203
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
375	Electric lamps (bulbs and fluorescent tubing)	D	—	9.5	—	9.5	Electricity	—	—	30.9	225	—	—	30.9	225
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	9.5	—	9.5		—	—	30.9	225	—	—	30.9	225
		P/D	—	(0)	—	(0)		—		(0)		—		(0)	
376	Gramophones, radios, television sets and electrical detecting equipment	D	—	—	50.4	50.4	Independent projection explained in the notes	—	—	—	—	101.8	102	101.8	102
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	50.4	50.4		—	—	—	—	101.8	102	101.8	102
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	

See notes at end of table.

Table 226 *(Continued)*

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING ELECTRICAL MACHINES, INSTRUMENTS, APPARATUS AND ACCESSORIES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Telephone and telegraph equipment	D	—	—	17.8	17.8	Independent projection explained in the notes	—	—	—	—	36.0	102	36.0	102
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	17.8	17.8		—	—	—	—	36.0	102	36.0	102
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
379	Accumulators	D	—	7.5	—	7.5	Economic development	—	—	12.8	71	—	—	12.8	71
		P	—	—	—	—		—	—	10.2	—	—	—	10.2	—
		I	—	7.5	—	7.5		—	—	2.6	— 65	—	—	2.6	— 65
		P/D	—	(0)	—	(0)		—		(80)		—		(80)	
	X-ray, diathermic and similar apparatus	D	—	—	11.3	11.3	Economic development	—	—	—	—	19.2	70	19.2	70
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	11.3	11.3		—	—	—	—	19.2	70	19.2	70
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Other miscellaneous electrical products imported in 1955	D	3.8	—	91.3	95.1	Independent projection explained in the notes	9.8	158	—	—	257.2	182	267.0	181
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	3.8	—	91.3	95.1		9.8	158	—	—	257.2	182	267.0	181
		P/D	(0)	—	(0)	(0)		(0)		—		(0)		(0)	
	Total	D	3.8	40.2	259.1	303.1		9.8	158	89.6	123	705.0	172	804.4	165
		P	—	—	0.6	0.6		—	—	29.1	—	45.8	—	74.9	—
		I	3.8	40.2	258.5	302.5		9.8	158	60.5	50	659.2	155	729.5	141
		P/D	(0)	(0)	(0)	(0)		(0)		(32)		(6)		(9)	

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
[a] See notes to table 227.

Table 227

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING TRANSPORT EQUIPMENT

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
382	Locomotives and spares .	D	—	—	34.5	34.5	Independent projection explained in the notes	—	—	—	—	19.7	—	19.7	—
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	34.5	34.5		—	—	—	—	19.7	—	19.7	—
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Railway carriages	D	—	—	1.3	1.3	Independent projection explained in the notes	—	—	—	—	16.7	—	16.7	—
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	1.3	1.3		—	—	—	—	16.7	—	16.7	—
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Freight vans and wagons for mines	D	—	—	6.3	6.3	Independent projection explained in the notes	—	—	—	—	21.3	—	21.3	—
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	6.3	6.3		—	—	—	—	21.3	—	21.3	—
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Rolling stock parts . . .	D	—	—	12.7	12.7	Independent projection explained in the notes	—	—	—	—	15.1	—	15.1	—
		P	—	—	—	—		—	—	—	—	3.8	—	3.8	—
		I	—	—	12.7	12.7		—	—	—	—	11.3	—	11.3	—
		P/D	—	—	(0)	(0)		—		—		(25)		(25)	
383	Passenger cars and station-wagons	D	—	126.8	—	126.8	Independent projection explained in the notes	—	—	343.6	171	—	—	343.6	171
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	126.8	—	126.8		—	—	343.6	171	—	—	343.6	171
		P/D	—	(0)	—	(0)		—		(0)		—		(0)	
	Delivery vans.	D	—	—	53.2	53.2	Independent projection explained in the notes	—	—	—	—	175.6	230	175.6	230
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	53.2	53.2		—	—	—	—	175.6	230	175.6	230
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Jeeps and similar vehicles	D	—	—	1.9	1.9	Transport in general	—	—	—	—	5.7	200	5.7	200
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	1.9	1.9		—	—	—	—	5.7	200	5.7	200
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	

See notes at end of table.

Table 227 (*Continued*)

PERU: DEMAND PROJECTION AND DEVELOPMENT HYPOTHESIS FOR NEW INDUSTRIES PRODUCING TRANSPORT EQUIPMENT

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

United Nations classification	Item		Data for 1955				Activity or development assumed to run parallel with growth of demand [a]	Hypothesis for 1965							
			Raw materials and intermediate products	Consumption	Investment	Total		Raw materials and intermediate products		Consumption		Investment		Total	
								Value	Rate	Value	Rate	Value	Rate	Value	Rate
	Motorcycles	D	—	2.8	—	2.8	Independent projection explained in the notes	—	—	11.2	300	—	—	11.2	300
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	2.8	—	2.8		—	—	11.2	300	—	—	11.2	300
		P/D	—	(0)	—	(0)		—		(0)		—		(0)	
	Spare parts for motor-vehicles	D	—	—	118.0	118.0	Motor vehicles	—	—	—	—	357.5	203	357.5	203
		P	—	—	—	—		—	—	—	—	53.6	—	53.6	—
		I	—	—	118.0	118.0		—	—	—	—	303.9	158	303.9	158
		P/D	—	—	(0)	(0)		—		—		(15)		(15)	
	Spare parts for tractors	D	—	—	40.0	40.0	Agriculture	—	—	—	—	59.6	49	59.6	49
		P	—	—	—	—		—	—	—	—	14.9	—	14.9	—
		I	—	—	40.0	40.0		—	—	—	—	44.7	12	44.7	12
		P/D	—	—	(0)	(0)		—		—		(25)		(25)	
	Unspecified spare parts	D	—	—	24.3	24.3	Transport in general	—	—	—	—	72.9	200	72.9	200
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	24.3	24.3		—	—	—	—	72.9	200	72.9	200
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
385	Bicycles	D	—	13.0	—	13.0	Independent projection explained in the notes	—	—	52.0	300	—	—	52.0	300
		P	—	—	—	—		—	—	46.8	—	—	—	46.8	—
		I	—	13.0	—	13.0		—	—	5.2	— 60	—	—	5.2	— 60
		P/D	—	(0)	—	(0)		—		(90)		—		(90)	
386	Aircraft	D	—	—	23.7	23.7	Transport in general	—	—	—	—	71.1	200	71.1	200
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	23.7	23.7		—	—	—	—	71.1	200	71.1	200
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
389	Other transport equipment	D	—	—	18.7	18.7		—	—	—	—	53.3	185	53.3	185
		P	—	—	—	—		—	—	—	—	—	—	—	—
		I	—	—	18.7	18.7		—	—	—	—	53.3	185	53.3	185
		P/D	—	—	(0)	(0)		—		—		(0)		(0)	
	Total	D	—	142.6	334.6	477.2		—	—	406.8	185	868.5	160	1 275.3	167
		P	—	—	—	—		—	—	46.8	—	72.3	—	119.1	—
		I	—	142.6	334.6	477.2		—	—	360.0	152	796.2	138	1 156.2	142
		P/D	—	(0)	(0)	(0)		—		(12)		(8)		(9)	

NOTES TO TABLE 227

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.
a See following page.

a To determine the demand for the products of the metal transforming industry, three methods have been followed: (I) it has been assumed to run parallel with the growth of those other activities for which projections have been made in this study; (II) special projections have been made for the item or product in question; (III) estimates have been worked out in the light of other countries' experience or industrialists' opinions.

Method I

The rates used refer to the growth of the following activities (relevant tables in brackets): agriculture (174 and 179), buses (see chapter VIII, section XI, footnote 9), footwear and made-up textiles (194), lorries (see buses), delivery vans (see buses), beer and carbonated beverages (184), fish preserving (182), construction (chapter VIII, section XIV, footnote 24), general economic development (30: increase in the gross product), manufacturing development (181), industrial development (181), electric power (238), timber industry (195), metal transforming industry (228), metallurgy in general (228), soap (209), mining (28, excluding petroleum), fishing (data from table 58 as weighting factors and data for table 182 as growth rates), petroleum (211), population (30), motor-vehicles (see buses).

Method II

Freight vans

	Calculation of rate of growth of freight transported		
	1955	*Rate*	*1965*
		%	
Sugar	322	51	486
Sugar-cane	167	51	252
Coal	311	200	933
Metallic minerals	1 302	200	3 906
Others	1 685	70	2 865
Total	*3 970*	*119*	*8 706*

The number of freight vans in 1955 was 3 500. Assuming (a) that the distances do not increase, (b) that the elasticity in the increase in vans with regard to the growth of the freight transported is 0.6, (c) that the price per van is 152 000 soles at 1955 prices and (d) that the annual rate of maintenance is 2.5 per cent, the input in respect of freight vans in 1965 would be:

$3\,500 \times 2\,19^{0.6} \times 152\,000 \times 0.025 = 21.3$ million soles at 1955 prices.

Railway carriages

In 1955 there were 217 ordinary carriages and 49 rail-cars. Assuming (a) that in 1965 the number of ordinary carriages and rail-cars remains the same, (b) that the passenger traffic will grow at the same rate as the population increment (28 per cent in 10 years), (c) that equipment costs come to 1 425 000 soles per unit for ordinary coaches and 2 090 000 for rail-cars and (d) that the maintenance rate is 2.8 per cent annually, the input in respect of carriages would be:

$(217 + 49)\ 1.28 \times 0.5\ (1\,425\,000 + 2\,090\,000)\ 0.028 = 16.7$ million soles at 1955 prices.

Locomotives

In 1955 there were 150 diesel locomotives and 80 steam locomotives. Assuming that (a) this number remains unchanged until 1965 (yet includes newer and more powerful engines), (b) that the price per unit is 3 420 000 soles for diesel locomotives and 2 375 000 for steam locomotives and (c) that the annual maintenance rate is 2.8 per cent, the input in respect of locomotives in 1965 would be

$(150 \times 3\,420\,000 + 80 \times 2\,375\,000)\ 0.028 = 19.7$ million soles at 1955 prices.

Miscellaneous railway equipment (excluding track)

It has been assumed that the demand for other railway equipment (besides vans, carriages and locomotives) will grow at a decennial rate of 19 per cent as compared with demand in 1955; or, in other words that by 1965 it will attain a value of $12.7 \times 1.19 = 15.1$ million soles at 1955 prices. The rate of growth was worked out as the weighted average corresponding to all rail equipment.

	Annual input		
	1955	*1965*	*Percentage increment*
	(Thousands of soles)		
Freight vans	13.3	21.3	60
Carriages	11.5	16.7	45
Track (see table 216)	26.3	26.3	—
Locomotives	19.7	19.7	—
Total	*70.8*	*84.0*	*19*

Dressing and spinning machines (textiles)

The input for 1965 was calculated on the assumption that (a) there will be 280 100 spindles in that year (see table 191); (b) that the industry will grow at the decennial rate of 70 per cent or 5.5 per cent annually (see table 186); (c) that equipment will depreciate at the rate of 6.66 per cent a year; and that the cost per spindle (including all the related dressing machinery) will be 1 535 soles. The result was as follows:

$280\,100 \times 1\,535\ (0.055 + 0.067) = 52.6$ million soles at 1955 prices.

Flat looms and textile-finishing equipment

The input for 1965 was worked out on the assumption that (a) there will be 9 620 looms in that year (see table 191); (b) that the industry will grow at the decennial rate of 70 per cent or 5.5 per cent a year (see table 186); (c) that equipment will depreciate at the rate of 6.66 per cent annually; (d) that the cost per loom (including all the machinery for preparing and finishing fabrics) will be 67 500 soles. The result was as follows:

$9\,620 \times 67\,500\ (0.055 + 0.067) = 79.0$ million soles at 1955 prices.

Machine-tools for the metal transforming industry

For an increase in productive capacity of 1 298 million soles (table 233, excluding repair of vehicles), an investment of 272 million is required in machine-tools (table 234); for the total production of the metal transforming industry in 1965, except repair of vehicles, as indicated in tables 228 and 223, which is equivalent to 1 771 million soles, it is assumed that there will be a total investment of 372 million in machine-tools. Assuming also that the demand for machine tools up to 1965 will grow at the decennial rate of 150 per cent or 9.5 per cent a year—parallel with the demand for products of the metal transforming industry (table 228)—and that depreciation will amount to 6.7 per cent annually, the 1965 input would be:

$372\ (0.095 + 0.067) = 60$ million soles at 1955 prices.

Method III

The estimates based on other countries' experience (see mainly *External disequilibrium in the economic development of Latin America: the case of Mexico, op. cit.*) or on industrialists' experience are as follows: for *gramophones, radios and television sets* as well as for *telephonic and telegraphic equipment*, an elasticity of 2.1 (the Mexican figure) was taken and applied to the decennial increase in total Peruvian consumption or expenditure (59 per cent). The resulting rate of expansion in demand was 98 per cent over 10 years. For *refrigerators*, the Mexican elasticity figure of 1.9 was taken (decennial rate of 94 per cent). In the case of *passenger cars and station-wagons*, the authors of the study were reluctant to take the rate obtaining in the past on the grounds that it seemed too high for the future (see chapter VIII section XI, footnote 18). The decennial rate of 171 per cent was therefore chosen instead of 189 per cent. Finally, on the basis of other countries' experience and the conditions of the Peruvian market, rates of growth were estimated for the demand for *gas cylinders, goods depending on the increase of transport in general, motorcycles, bicycles and the groups described as "other simple manufactures", "other non-electrical machinery and equipment" "other electrical machinery and equipment" and "other transport equipment"*.

cesses involved, both these factors tending to reduce the domestic production percentage. This study also takes into account two other factors which incorporate into the estimate an element corresponding to an industrial policy favouring the development of those industries which may help to improve the over-all industrial situation. One of these factors is what is here referred to as the "organicity" of the industry concerned. This term is adopted as a means of indicating a concatenation of circumstances in certain industries, which renders these latter essential or necessary for the development of other industries or other economic activities, inasmuch as they will either help to broaden the market for the products of such activities, or will tend to promote the manufacture of items indispensable for their development, or will serve as a link between other industries so as to complete an internal industrial integration process. The second factor is the question of whether the industry concerned will be employing domestic raw materials or not, a circumstance which obviously must be taken into account for reasons very similar to those adduced in connection with the "organicity" of industry.

A qualifying symbol—"A", "B", "C"— is assigned to the relative importance of each of the characteristics used as criteria, and indicates the degree of desirability of each industry with respect to the attribute under consideration. Thus, for example, in relation to the use of domestic raw material, "A" implies a high percentage; with regard to diversity of products or complexity of manufacture, the same grading means that little or no such diversity or complexity exists. Table 229 shows the grading of the various characteristics which were adopted as criteria in determining the proportion of demand likely to be satisfied by domestic industry in 1965. The figures noted may possibly seem over-optimistic in many cases; results closely approaching them may, however, reasonably be considered attainable if an appropriate industrial development policy is pursued.

If the domestic production percentages selected for 1965 are applied to demand as estimated for that year, the aggregate result is a 281-per cent expansion in the production of existing industry, which is equivalent to the addition of 1 100 million soles to the 400 million produced in 1955 (see again table 223). In other words, the proportion of demand satisfied by domestic industry would rise from 43 to 65 per cent in the period under consideration.

Chapter V, section XVII gives an account of many of the features of existing industry which would help to determine the proposed expansions. Some of these latter will take the form of actual increases in the output of articles currently manufactured, as in the case of tinplate containers, bedsteads, cooking-stoves, aluminium structural parts, barrels, casks and steel springs. In most lines of production, however, despite allusions to an "existing" industry, the most important development will have to take place in connexion with new manufactures. This applies to hardware and ironmongery, machinery for land clearing and cultivation, mining machinery and apparatus and electric control mechanisms. A third and very important instance is that of the progress which would be achieved if the proportion of domestic parts in relation to those of foreign origin were increased in any given product. The most illustrative case in point is the production of lorries, where the advance noted in table 223, small as it seems in terms of domestic production percentages, proves to be considerable when measured in millions of soles added to the 1955 production figure.

(b) *New industries*

The process of determining domestic production possibilities is much more complex in the case of new industries, especially when the aim is to take into account factors favourable or unfavourable to the national interest, in addition to those on which industrialists usually base their decisions as to the soundness of a project from the point of view of profits. In the first place, all manufactures obviously requiring a scale of production too large for the Peruvian market were eliminated from the list. Examples are internal combustion engines, passenger-cars, aircraft and their spare parts, X-ray apparatus, typewriters and calculating-machines, textile machinery and tractors. Recourse was then had to a series of criteria over and above those used in the case of existing industry, which included the two elements or factors that are always of indisputable importance, namely, the quantum of imports and the rate of growth of demand.

Among the most important of the new criteria was that afforded by the value added to the metal, expressed both as a percentage of the total value and in relation to the investment required for production. It was calculated fairly roughly, as the difference between the price per kilogramme of the imported article and an estimate of the price per kilogramme of the metals that would have to be imported for its manufacture.[40] It was thought preferable to use the value added to the metal, rather than the value added by manpower, which is that habitually utilized in appraisals of this type, firstly because the latter figure, to judge from statistical data for highly industrialized countries, differs little from one item to another, within the range of products of the metal transforming industry; and, secondly, because the value added to the metal gives a clear indication of what the country would gain by manufacturing the article concerned, even if imported raw materials were used.

Supplementary criteria were afforded by figures for requirements of machinery and equipment in general and of cutting machinery and tools in particular. The former were calculated as the percentage relationship

[40] In the case of components which Peru could not in any circumstances produce and would have to import in the form of manufactured goods—for example, bearings—the estimated value of the "metal" included the price of the components concerned.

Table 228

PERU: SUMMARY OF DEMAND PROJECTIONS AND DEVELOPMENT HYPOTHESES FOR THE METAL TRANSFORMING INDUSTRIES

(Values in millions of soles at 1955 prices; decennial rates of growth in percentages)

Item		Data for 1955					Hypothesis for 1965									
		Raw materials and intermediate products	Exports	Consumption	Investment	Total	Raw materials and intermediate products		Exports		Consumption		Investment		Total	
							Value	Rate	Value	Rate	Value	Rate	Value	Rate	Value	Rate
Manufacturing industry	D	197.6	—	407.2	2 400.7	3 005.5	467.9	137	—	—	988.0	143	6 061.9	152	7 517.8	150
	P	56.2	—	115.3	227.9	399.4	244.8	337	—	—	446.3	287	1 411.9	520	2 103.0	427
	I	141.4	—	291.9	2 172.8	2 606.1	223.1	58	—	—	541.7	86	4 650.0	114	5 414.8	108
	P/D	(28)	—	(28)	(9)	(13)	(52)		—		(45)		(23)		(28)	
Simple metallic manufactures	D	184.2	—	120.4	525.8	830.4	433.3	135	—	—	237.4	97	1 227.0	133	1 897.7	129
	P	56.2	—	70.0	86.0	212.2	244.8	336	—	—	174.9	150	360.1	319	779.8	267
	I	128.0	—	50.4	439.8	618.2	188.5	47	—	—	62.5	24	866.9	97	1 117.9	81
	P/D	(31)	—	(58)	(16)	(26)	(56)		—		(74)		(29)		(41)	
Non-electrical machinery and equipment (except for transport)	D	9.6	—	58.9	976.4	1 044.9	24.8	158	—	—	114.7	95	2 305.7	136	2 445.2	134
	P	—	—	0.2	23.7	23.9	—	—	—	—	56.0	27 900	411.9	1 638	467.9	1 858
	I	9.6	—	58.7	952.7	1 021.0	24.8	158	—	—	58.7	—	1 893.8	99	1 977.3	94
	P/D	(0)	—	(0)	(2)	(2)	(0)		—		(49)		(18)		(19)	
Electrical machines, instruments, apparatus and accessories	D	3.8	—	57.9	329.6	391.3	9.8	158	—	—	146.1	152	929.6	182	1 085.5	177
	P	—	—	17.7	15.3	33.0	—	—	—	—	85.6	384	241.2	1 476	326.8	890
	I	3.8	—	40.2	314.3	358.3	9.8	158	—	—	60.5	50	688.4	119	758.7	112
	P/D	(0)	—	(31)	(5)	(8)	(0)		—		(59)		(26)		(30)	
Transport equipment	D	—	—	170.0	568.9	738.9	—	—	—	—	489.8	188	1 599.6	181	2 089.4	183
	P	—	—	27.4	102.9	130.3	—	—	—	—	129.8	374	398.7	287	528.7	306
	I	—	—	142.6	466.0	608.6	—	—	—	—	360.0	152	1 200.9	158	1 560.9	156
	P/D	—	—	(16)	(18)	(18)	—	—	—		(26)		(25)		(25)	
Artisan production	D	70.7	0.3	77.9	234.1	383.0	101.6	44	—	—	163.3	110	159.1	— 32	424.0	11
	P	70.7	0.3	77.9	234.1	383.0	101.6	44	—	—	163.3	110	159.1	— 32	424.0	11
	I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	P/D	(100)	(100)	(100)	(100)	(100)	(100)		—		(100)		(100)		(100)	
Total	D	268.3	0.3	485.1	2 634.8	3 388.5	569.5	112	—	—	1 151.3	137	6 221.0	136	7 941.8	134
	P	126.9	0.3	193.2	462.0	782.4	346.4	173	—	—	609.6	216	1 571.0	240	2 527.0	223
	I	141.4	—	291.9	2 172.8	2 606.1	223.1	58	—	—	541.7	86	4 650.0	114	5 414.8	108
	P/D	(47)	(100)	(40)	(18)	(23)	(61)		—		(53)		(25)		(32)	

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.
Symbols: D: Demand; P: Production; I: Imports; P/D: Percentage relationship between production and demand.

Table 229

PERU: ESTIMATED EXPANSION POSSIBILITIES IN EXISTING METAL TRANSFORMING INDUSTRIES EXPRESSED AS PERCENTAGES OF DOMESTIC PRODUCTION IN 1965 [a]

United Nations classification	Item	Criteria [b]					Percentage of domestic production	
		Demand in 1955 (Millions of soles)	Organicity of the industry [c]	Diversity of products	Complexity of manufacture	Domestic raw materials [d]	1955	Possible for 1965
35	*Simple metallic manufactures*							
352	Containers of tinplate	55.0	A	A	A	B	79	82
	Metal caps	16.4	A	A	A	B	25	82
353	Table and kitchen cutlery	12.0	C	C	B	B	34	50
354	Taps and similar articles for sanitary installations	8.0	C	B	A	A	35	80
	Stoves, water-heaters, radiators and other non-electric heating appliances	17.0	B	B	B	A	42	42
355	Structural units of steel tubing and light steel shapes (including door and window-frames and lamp-posts	18.7	B	B	A	A	99	100
	Structural units of tubing and light shapes of aluminium (including door and window-frames)	4.9	C	B	A	C	100	100
	Structural units of heavy shapes	32.0	B	B	A	C	32	50
	Steel furniture	22.1	C	C	B	B	27	60
	Silos, tanks, vats, etc.	11.6	B	B	A	B	14	80
	Bedsteads	16.8	C	A	A	A	89	95
	Welded tubes and their fittings	67.9	A	B	A	A	27	80
356	Aluminium cooking utensils and tableware	16.2	C	C	B	C	77	77
	Other domestic metal utensils (including those of cast iron and steel sheet)	18.4	C	C	B	A	17	50
357	Lighting fixtures such as fluorescent lighting shades, chandeliers, brackets, lamps, etc.	3.1	C	C	C	B	48	65
358	Coarse and fine wire netting of iron and steel	4.0	A	A	A	A	60	100
	Nails, tacks, staples	12.2	A	A	A	A	29	100
359	Barrels, casks, drums, buckets, etc.	15.2	A	A	A	A	88	100
	Soft metal tubes for ointments and creams	3.9	C	A	A	B	90	90
	Safes and vault accessories	2.2	C	B	B	B	45	50
	Steel springs	8.1	A	A	A	A	59	100
	Other simple metallic manufactures of domestic origin	28.2 [e]	—	—	—	—	100	100
36	*Non-electrical machinery and equipment*							
362	Machines for land preparation and cultivation	19.7	A	C	C	B	6	10
363	Mining machinery	97.9	A	B	C	B	4	60
365	Wood-working machines	8.1	A	C	C	B	25	24
366	Lifts for buildings and escalators	17.7	C	B	C	C	8	10
367	Weighing—machines and scales	8.8	B	B	B	B	16	50
369	Other machinery and equipment (non-electrical) of domestic manufacture	10.9 [e]	—	—	—	—	100	100
37	*Electrical machines, instruments, apparatus and accessories*							
371	Electrical control equipment and machinery	8.0	A	C	B	B	21	40
373	Electric wire and cables	42.0	A	A	A	A	10	90
379	Accumulators	20.5	A	A	A	B	43	100
	Other miscellaneous electrical products of domestic manufacture	17.7 [e]	—	—	—	—	100	100
38	*Transport equipment*							
381	Ship-building and repairing	6.7	A	B	B	B	45	53
383	Lorries	114.9	A	B	B	B	4	9
	Buses	19.0	A	B	C	B	8	2
384	Repair of motor vehicles	109.4	—	—	—	—	100	100
	Other transport equipment of domestic manufacture	11.7 [e]	—	—	—	—	100	100

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955* and Ministry of Finance and Trade, *Estadistica de Comercio Exterior 1955*.

a For the purposes of these calculations, any industry with a production valued at less than 1 million soles has been considered non-existent.

b The letters "A", "B" and "C" indicate the extent to which the industry meets the appropriate criterion. For example, under the heading "Domestic raw materials", "A" signifies a high percentage, while under "Diversity of products" or "Complexity of manufacture" it signifies a low diversity or complexity.

c Indicates the importance of its inter-relationship with other industries and activities, whether existing or planned.

d The letter "A" has been assigned in many cases where raw materials are not yet produced in Peru but where production is already planned or suggested in this report.

e These figures relate only to domestic production.

Table 230

PERU: ESTIMATED EXPANSION POSSIBILITIES IN NEW METAL TRANSFORMING INDUSTRIES [a] EXPRESSED AS PERCENTAGES OF DOMESTIC PRODUCTION IN 1965

United Nations classification	Item	Criteria [b]										Percentage of domestic production in 1965
		Imports in 1955 [c] (Millions of soles)	Growth of demand	Organicity of the industry [d]	Diversity of products	Complexity of manufacture	Domestic raw materials [e]	Value added to metal [f]	Value added to metal per sol invested [g]	Machinery and equipment needed [h]	Machinery and cutting tools needed [i]	
35	*Simple metallic manufactures*											
353	Table and kitchen cutlery	5.6	B	C	B	A	C	71	1.32	65	66	40
	Other cutting implements (axes and machetes)	1.9	C	C	B	A	C	59	1.44	65	53	60
	Agricultural hand tools	10.6	C	A	C	A	A	69	2.00	42	5	80
	Artisan hand tools	26.7	B	A	C	B	B	68	1.27	65	48	40
	Locks and padlocks	1.9	B	C	C	B	C	80	1.51	65	66	20
354	Sanitary articles of cast iron	9.0	B	C	D	A	A	82	1.49	66	53	80
355	Gas cylinders	2.4	A	A	A	A	A	74	2.18	77	5	100
357	Electric flashlights	3.5	C	C	A	A	B	—	—	—	—	75
358	Iron and steel wire	25.0	B	B	A	A	AJ	21	—	—	—	100 [j]
	Barbed wire	4.5	C	B	A	A	AJ	7	—	—	—	100 [j]
	Springs	2.8	B	B	A	A	C	47	0.89	65	0 [k]	90
	Steel cables	7.7	B	B	A	A	C	28	—	—	—	0
	Electrodes and rods for soldering	5.6	A	A	A	A	BJ	—	—	—	—	50 [j]
359	Nuts, screws, pulley-wheels, rivets	11.4	A	A	B	A	A	58	1.39	64	93	73
	Needles, pins, hairpins (except hypodermic and gramophone needles)	3.0	C	C	A	A	B	—	—	—	—	0
	Razors	1.5	B	C	A	A	A	—	—	—	—	80
36	*Non-electrical machinery (except for transport)*											
361	Boilers, economizers and related equipment	19.1	B	B	B	A	C	78	2.29	77	5	40
362	Machinery and equipment for processing agricultural commodities	39.2	C	A	C	—	—	—	—	—	—	10
363	Concrete mixers	3.2	A	A	B	B	A	—	—	—	—	60
365	Dressing and spinning machines (textiles)	20.9	B	A	C	C	B	83	1.06	71	53	0
	Flat looms	13.7	B	A	A	C	B	74	0.95	71	53	0
366	Pumps	44.0	B	A	B	B	B	83	1.52	71	77	60
	Compressors (including pneumatic tools)	56.6	A	A	B	B	B	84	1.51	71	77	35
	Freight and other lifts (except for buildings)	11.4	A	A	A	A	B	80	1.50	65	27	40
	Cranes and other equipment for lifting and handling weights	14.5	C	A	C	B	C	—	—	—	—	30
	Equipment for the transmission of mechanical energy	10.8	A	A	C	—	B	—	—	—	—	78
368	Washers and driers for domestic use, floor scrapers and polishers	12.9	B	C	C	—	B	76	2.44	55	52	0

See notes at end of table.

Table 230 *(Continued)*

PERU: ESTIMATED EXPANSION POSSIBILITIES IN NEW METAL TRANSFORMING INDUSTRIES [a] EXPRESSED AS PERCENTAGES OF DOMESTIC PRODUCTION IN 1965

United Nations classification	Item	Criteria [b]										Percentage of domestic production in 1965
		Imports in 1955 [c] (Millions of soles)	Growth of demand	Organicity of the industry [d]	Diversity of products	Complexity of manufacture	Domestic raw materials [e]	Value added to metal [f]	Value added to metal per sol invested [g]	Machinery and equipment needed [h]	Machinery and cutting tools needed [i]	
	Domestic sewing-machines	61.0	B	C	A	C	B	50	—	—	—	0
	Industrial and domestic electric refrigerators	39.7	B	B	A	B	B	78	2.85	52	52	60
	Industrial and domestic non-electric refrigerators	6.3	B	B	A	B	B	75	2.74	52	52	80
369	Valves, etc. (except those for sanitary installations)	21.2	A	A	C	C	A	—	—	—	—	34
37	*Electrical machines, instruments, apparatus and accessories*											
371	Electric motors, under 25 HP	8.8	A	A	A	A	A	61	3.05	37	76	70
	Transformers, under 100 kW	10.6	A	A	A	A	A	66	3.30	62	30	70
372	Electric stoves and ovens	8.5	B	B	B	B	A	84	1.54	66	44	60
	Electric utensils with resistances	5.2	B	C	C	A	A	84	1.54	55	52	40
	Electric manual tools	3.3	B	A	C	B	B	87	3.48	46	64	25
	Liquidizers, mixers and other domestic utensils with small motors	9.5	B	C	C	B	B	75	3.48	46	64	25
379	Dry batteries	7.5	C	C	A	A	C	—	—	—	—	80
38	*Transport equipment*											
382	Freight vans	6.3	C	A	B	B	B	63	3.10	54	35	0
	Rolling-stock parts	12.7	C	A	C	A	A	—	—	—	—	25
383	Spare parts for motor-vehicles (excluding tractors)	118.0	A	A	C	B	B	—	—	—	—	15
	Spare parts for tractors	40.0	A	A	C	B	A	—	—	—	—	25
	Unspecified spare parts	24.3		—	—	—	—	—	—	—	—	0
385	Bicycles	13.0	A	B	A	C	C	67	3.83	65	57	90

SOURCES AND NOTES:

a For the purposes of these calculations, any industry with a production valued at less than 1 million dollars has been considered non-existent.

b The letters "A", "B" and "C" indicate the extent to which the industry meets the appropriate criterion. For example, under the heading "Domestic raw materials", "A" signifies a high percentage, while under "Diversity of products" or "Complexity of manufacture" it signifies a low diversity or complexity.

c Averages of 1954, 1955 and 1956 obtained from the Ministry of Finance and Trade, *Estadística de Comercio Exterior*.

d Indicates the importance of its inter-relationship with other industries and activities, whether existing or planned.

e The letter "A" has been assigned in many cases where raw materials are not yet produced in Peru but where production is already planned or suggested in this report.

f The value added to the metal was estimated as roughly the difference in c.i.f. prices per kilogramme between the product and the metal from which it is made. The relationship is expressed as a percentage of the c.i.f. price.

g The values of the investments involved in this estimate are taken from Robert N. Grosse, *Capital Requirements for Expansion of Industrial Capacity*, Bureau of the Budget, U. S. Government, 1953.

h Percentage relationship between the investment in machinery and équipment and the total fixed assets. Taken from Robert N. Grosse, *op. cit.*

i As a rough substitute for an index of technical and manpower needs, the authors of this study used the probable relationship between the investment in lathes, drills, milling and planing machines on the one hand, and the total investment in machinery and equipment on the other. The calculations were based on the unpublished report of Harry Markowitz, *Process analysis of the Metal Working Industries*, The Rand Corporation 1953.

j There would be domestic manufacture only if Chimbote had to sell wire in 1965 or if new productive capacity for wire and rod were created in the Lima-Callao zone.

k In this case the cutting tools are completely automatic and hence do not require skilled techniques or manpower.

between investment in machinery and total investment;[41] this was used to provide an approximate indication of the capital intensity needed for production. In default of indices showing the intensity of technique required, that is, of skilled manpower, use was made—again as a rough indicator—of the relationship between the investment needed for lathes, drills, millers, and planes, and total investment in machinery and equipment.[42]

All these criteria—plus a certain unavoidable element of subjectivity—came into play in the final determination of the percentage of domestic production considered possible by 1965. Thus, for example, in the case of gas cylinders domestic production might perhaps reach 100 per cent, since the diversity of products is slight in relation to the low degree of complexity of this line of manufacture, and the activity is of some national interest since it helps to improve fuel distribution and uses domestic raw materials. Furthermore, the economic characteristics shown in table 230 suggest that in this branch of manufacture the value added is quite high and requirements in respect of technique, or skilled labour, are modest, although it calls for a relatively high proportion of machinery and equipment. To take another example, the artisan hand tools industry will be seen to combine average characteristics in almost all the respects considered, although on the other hand it has a large market at its disposal. The decision in this case was in favour of a relatively low percentage of domestic production (40 per cent), taking into account only those tools with a very broad market and a fairly narrow range of models, such as hammers, axes, screw-drivers, screw-keys, pliers and tools for carpentry. Pumps and compressors present great advantages for Peru because of their high index of "organicity" and very broad market, as against moderate indices for diversity of products, complexity of manufacture and use of domestic raw materials. Notwithstanding relatively substantial requirements of machinery and technique and not very high figures for value added, it was decided that at least 60 per cent of demand could be satisfied with domestic production in the case of pumps, and 35 per cent in that of compressors. The decision against the production of household sewing-machines in 1965, despite the fact that they command an extremely large market, is rather attributable to reasons of another kind; as they are being manufactured in rival plants in several Latin American countries and the value added to the metal is relatively low, it seems likely to suit Peru better to import them than to construct them in the future, especially if some of the common market plans which are at present being mooted in Latin American materialize.[43] Lastly, the production of electric motors and relatively low power transformers is felt to be desirable on almost all counts, since, as can be seen in table 230, all their characteristics constitute incentives. The limitation of the proportion of domestic production to 70 per cent is due to the fact that many of these components form part of machinery or equipment imported as integrated units. But even in these cases, given an appropriate customs protection policy, it might be possible for at least the commonest types of equipment to be completed with motors and transformers in Peru, and, consequently, the percentage of demand met by domestic production might be higher than that postulated.

The domestic production percentages thus selected are applied to demand for each line of manufacture, as shown in tables 224 to 227. Although no explanation is needed, it must be pointed out that the development targets set up are not over-ambitious, since in the most optimistic case—that of simple metal manufacture—only 15 per cent of domestic production is reached by 1965; the corresponding figure for non-electrical machinery is 12 per cent and for electrical machinery and transport equipment no more than 9 per cent. Nevertheless, this would suffice for new industry to produce an annual total of over 6 000 million soles by 1965.

3. *Raw material requirements*

Table 231 shows estimates of probable requirements of metals for use as raw material by the metal transforming industry in 1965. Although the figures may be considered merely approximate for each individual line of production or item produced, since they are based on very general estimates, the aggregate totals for the various types of raw materials give a fairly accurate idea of the probable structure of consumption of metal raw materials. A study of these totals shows that the development of the industry would depend upon a good supply of flat products and of bars, shapes and strip. This fact alone indicates that within the industrial development policy which Peru should pursue, special provision should be made for ensuring a low-priced, high-quality and reliable supply of rolled steel products, especially flats.

Another striking point is that 27 of the 72 branches of industry under consideration require castings, but in very small quantities as a rule. This observation corroborates the conclusion reached in section XV of the present chapter, to the effect that in a well-organized development process an attempt should be made to centralize casting in the smallest possible number of foundries serving the largest possible number of industries. Tubing and wire requirements are also relatively small, but not as widespread as the need for castings. Here too a centralization policy could be adopted, although it would be less urgently required because, above a specific and relatively low volume of

41 The data used were taken from Robert N. Grosse, *Capital Requirements for the Expansion of Industrial Capacity*, United States Government Bureau of the Budget, 1953.

42 The data used in the preparation of these indices were taken from the unpublished report by Harry Markowitz, *Process Analysis of the Metal Working Industries*, the Rand Corporation, 1953.

43 Elsewhere in the present report, however, reference is made to the possibility of manufacturing some sewing-machine parts in Peru, such as the wooden frame and certain castings.

Table

PERU: ESTIMATE OF METALLIC RAW MATERIALS NEE

United Nations classification	Item or product	Value of production in 1965 (Millions of soles)	Average cost of production (Soles/kg)	Volume of production (Tons)	Total input of metallic raw material (Tons)
35	*Simple metallic manufactures*				
352	Containers of tinplate and metal caps	116.5	7.70	15 050	15 850
353	Table and kitchen cutlery	4.4	34.40	128	141
	Other cutting implements (axes and machetes)	1.7	24.10	71	78
	Agricultural hand tools	12.6	11.07	1 140	1 140
	Artisan hand tools	21.6	23.60	916	1 000
	Locks and padlocks	0.7	100.00	7	11
	Ironware and other hardware	11.4	25.20	450	520
354	Sanitary articles of cast iron	14.1	7.80	1 800	1 800
	Taps and similar articles for sanitary installations	12.1	36.80	330	346
	Stoves, water-heaters, ovens, radiators and other non-electric heating appliances	14.2	19.55	726	800
355	Structural units of steel tubing and light steel shapes (including door- and window-frames and lamp-posts)	35.3	6.92	5 100	5 400
	Structural units of tubing and light shapes, of aluminium (including door- and window-frames)	9.3	5.05	1 850	1 930
	Structural units of heavy shapes	30.3	6.20	4 880	5 120
	Steel furniture	26.3	23.10	1 140	1 365
	Silos, tanks, vats, etc.	18.6	5.68	3 270	3 330
	Gas cylinders	11.2	11.40	983	1 080
	Bedsteads	31.6	17.40	1 820	2 140
	Welded tubes and their fittings	92.3	6.00	15 400	15 600
356	Aluminium cooking utensils and tableware	25.6	32.50	788	945
	Other domestic metal utensils (including those of cast iron and steel sheet)	18.2	10.55	1 730	1 810
	Electric flashlights	3.4	53.50	64	65
357	Lighting fixtures, such as fluorescent lighting shades, chandeliers, brackets, lamps, etc.	6.6	43.00	154	161
358	Iron and steel wire	37.2	3.20	11 600	11 900
	Coarse and fine wire netting of iron and steel	6.0	3.83	1 570	1 600
	Barbed wire	6.7	3.38	1 980	2 000
	Springs	5.0	6.64	754	760
	Nails, tacks, staples	18.2	4.02	4 520	4 550
	Electrodes and rods for soldering	9.0	6.65	1 350	1 370
359	Barrels, casks, drums, buckets, etc.	21.9	8.00	2 740	2 870
	Soft metal tubes for ointments and creams	6.4	14.00	457	457
	Nuts, screws, pulley-wheels, rivets, etc.	40.6	8.04	5 050	5 100
	Safes and vault accessories	2.2	16.00	137	140
	Steel springs	24.5	8.08	3 040	3 060
	Razors	1.5	9.10	165	173
	Other simple metallic manufactures	82.6	28.20	2 930	3 080
36	*Non-electric machinery and equipment (except for transport)*				
361	Boilers, economizers and related equipment	15.3	18.50	827	867
362	Machines for land preparation and cultivation	2.9	15.45	188	169
	Machinery and equipment for processing agricultural commodities	5.8	19.95	281	320
363	Concrete mixers	3.6	23.40	154	162
	Mining machinery	176.2	12.44	14 200	14 900
365	Wood-working machines	5.8	23.20	250	275
366	Pumps	44.9	31.00	1 450	1 600
	Compressors (including pneumatic tools)	59.4	59.30	1 000	1 150
	Lifts for buildings and escalators	3.4	25.90	131	158
	Freight and other lifts	13.7	22.50	610	730
	Cranes and other equipment for lifting and handling weights	7.4	29.40	252	277
	Equipment for the transmission of mechanical energy	20.1	28.20	715	890
367	Weighing-machines and scales	7.5	23.20	324	340
368	Industrial and domestic electric refrigerators	46.2	25.10	1 840	2 020
	Industrial and domestic non-electric refrigerators	9.8	20.10	488	535
369	Valves, etc. (except those for sanitary installations)	12.4	36.80	347	354
	Other non-electric machinery and equipment	33.5	34.50	970	1 120

See notes at end of table.

DED BY THE METAL TRANSFORMING INDUSTRY IN 1965

Ferrous raw materials of possible domestic manufacture											*Domestic non-ferrous metals*		*Imported metals*	
Foundry		*Flat products*		*Bars, shapes and narrow plates*		*Tubes*		*Wire*		*Total*				
Tons	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]
		15 850	100							12 431	100				
														141	100
														78	100
		570	100	570	50					1 140	100				
														1 000	100
														11	100
		260	50							260	50	130	25	130	25
1 800	100									1 800	100				
												346	100		
		640	80			80	10			720	90	80	10		
				3 780	70	1 620	30			5 400	100				
														1 930	100
		2 560	50	1 540	30					4 100	80			1 020	20
68	5	1 024	75	273	20					1 365	100				
		2 660	80	670	20					3 330	100				
		1 080	100							1 080	100				
21	1	364	17	428	20	1 156	54	171	8	2 140	100				
		15 600	100							15 600	100				
														945	100
725	40	905	50	180	10					1 810	100				
												32	50	33	50
		48	30	32	20					80	50	81	50		
				11 900	100					11 900	100				
								1 600	100	1 600	100				
								2 000	100	2 000	100				
														760	100
								4 550	100	4 550	100				
								1 370	100	1 370	100				
		2 870	100							2 870	100				
												457	100		
		255	5	4 845	95					5 100	100				
70	50	56	40							126	90			14	10
				3 060	100					3 060	100				
												173	100		
770	25	770	25	770	25					2 310	75	770	25		
		433	50							433	50			434	50
68	40	33	20	68	40					169	100				
64	20	128	40	112	35					304	95			16	5
32	20	114	70	16	10					162	100				
8 200	55	2 980	20	2 980	20					14 160	95			740	5
192	70									192	70			83	30
1 360	85									1 360	85	160	10	80	5
287	25	345	30	345	30					977	85			173	15
8	5	56	35							64	40			94	60
255	35	74	10	290	40			111	15	730	100				
28	10	69	25	138	50					235	85			42	15
623	70									623	70	178	20	89	10
238	70									238	70	68	20	34	10
		1 515	75	202	10					1 717	85			303	15
		400	75	54	10					454	85			81	15
35	10			35	10					70	20	284	80		
224	20	224	20	224	20					672	60	224	20	224	20

Table

PERU: ESTIMATE OF METALLIC RAW MATERIALS NEE

United Nations classification	Item or product	Value of production in 1965 (Millions of soles)	Average cost of production (Soles/kg)	Volume of production (Tons)	Total input of metallic raw material (Tons)
37	*Electrical machines, instruments, apparatus and accessories*				
371	Electric motors, under 25 HP	20.0	33.30	600	706
	Transformers, under 100 kW	24.1	31.50	765	895
	Electric control equipment and machinery	10.4	65.50	159	183
372	Electric stoves and ovens	10.1	18.80	540	592
	Electric utensils with resistances	4.1	25.00	164	180
	Electric manual tools	1.7	88.50	19	23
	Liquidizers, mixers and other domestic materials with small motors	4.7	48.70	10	12
373	Electric wire and cables	122.9	26.40	4 650	4 880
379	Accumulators	62.1	17.20	3 600	—
	Dry batteries	10.2	15.10	680	—
	Other miscellaneous electrical products	56.5	63.00	900	980
38	*Transport equipment*				
381	Ship-building and repairing	9.8	—	—	—
382	Rolling-stock parts	3.8	10.50	360	435
383	Lorries	32.0	15.00	2 140	320
	Buses	1.0	20.00	50	15
	Spare parts for motor-vehicles (except tractors)	53.6	39.60	1 350	675
	Spare parts for tractors	14.9	38.00	390	430
384	Repair of motor vehicles	331.5	—	—	—
385	Bicycles	46.8	24.20	1 940	2 870
389	Other transport equipment	35.1	15.00	2 340	1 170
	Total	2 103.0		138 446	137 925

a The percentage is based on the total input of metals.

DED BY THE METAL TRANSFORMING INDUSTRY IN 1965

Ferrous raw materials of possible domestic manufacture												*Domestic non-ferrous metals*		*Imported metals*	
Foundry		*Flat products*		*Bars, shapes and narrow plates*		*Tubes*		*Wire*		*Total*					
Tons	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]	*Tons*	*Percentage* [a]
367	52	234	33	42	6					643	91	42	6	21	3
134	15	716	80							850	95	45	5		
18	10			18	10					36	20	147	80		
		533	90							533	90	59	10		
		162	90							162	90			18	10
		7	30							7	30	14	60	2	10
		4	30							4	30	7	60	1	10
												4 880	100		
		490	50							490	50	490	50		
305	70			130	30					435	100				
		225	70	95	30					320	100				
		6	40	8	55	1	5			15	100				
304	45	101	15							405	60			270	40
258	60			172	40					430	100				
										2 612	91			258	9
		373	13	809	28	1 430	50								
292	25	292	25	292	25					876	75			294	25
16 746	12	55 026	40	34 078	25	4 287	3	9 802	7	119 939	87	8 567	6	9 319	7

production, no appreciable economies of scale can be effected in manufactures of this type.

In brief, raw material requirements would be in the neighbourhood of 138 000 tons yearly, 40 per cent of which would be flat rolled products; 25 per cent bars, shapes, and strips; 12 per cent castings; and smaller percentages, other types of products. Given satisfactory development of the iron and steel and non-ferrous metal industries, it would not be difficult for domestic industry to supply up to 93 per cent of the raw materials required by the metal transforming industry.

4. *Manpower requirements*

Possible manpower requirements in 1965 were roughly estimated on the basis of data for other countries and direct information (see table 232). As a global result, it was determined that 22 621 additional workers would be needed, over and above the 1955 labour force of 7 940. This implies an increment of 286 per cent in 1955-65, which, if related to that of 427 per cent assumed for the total production of the metal transforming industries, means a 36-per-cent increase in aggregate productivity. Table 232 shows the rates making up this increase; the highest—124 per cent—corresponds to the manufacture of non-electrical machinery and equipment (excluding means of transport), where a sharp upswing in productivity is expected because new industries are bound to be installed before 1965, especially those manufacturing pumps, compressors, mechanical energy transmission units and electric refrigerators, and these, once certain dimensions are reached, will rapidly raise the productivity of manpower. The estimated increase in productivity is less in the case of simple metal manufactures, because this sector already possesses large and quite efficient plants; even if other industries with satisfactory productivity characteristics are incorporated, spectacular improvements are hardly likely here. Electrical machinery, instruments, appliances, and accessories fall between the two preceding cases, because, although this line of production already has plants where productivity is very high, such as those manufacturing conductor wire, almost all the rest of the industry is at a rudimentary stage and its productivity is susceptible of improvement. As regards transport equipment, a distinction is drawn between repairs to vehicles, where mechanization and productivity cannot be greatly increased, and the rest of the industry, whose volume of production and degree of mechanization are at present insignificant, although there is plenty of room for an increase in its importance. It could not expand, however, on the same scale as the non-electrical machinery sector, because the industry will be mainly engaged in the assembly of vehicles and the manufacture of coachwork, activities which in the period under consideration will probably not have become highly mechanized and where, therefore, the possibilities of increasing productivity will be very limited.

In conclusion, it may be asserted that the development of the metal transforming industry will contribute more than that of any other branch of industry to the provision of employment. It would account by itself for approximately 22 per cent of the surplus manpower which, according to the projections, industry would have to absorb in 1965. Next in order of importance as creators of employment would come the foodstuffs industries, which would provide work for 18 per cent of the surplus in question, and the chemicals industry, which could absorb a further 11 per cent. Chapter IX supplements this section with a study of requirements in respect of technicians and skilled labour.

5. *Requirements of machinery, equipment and other fixed assets*

The expansion likely to take place in each branch of the metal transforming industry having been ascertained, these expansion figures must now be compared with existing capacity in order to determine the extent

Table 232

PERU: ESTIMATED MANPOWER REQUIRED IN 1965 BY THE METAL TRANSFORMING INDUSTRY

Sector	*Production estimated for 1965 (Millions of soles at 1955 prices)*	*Production per man/year thought possible in 1965 (Soles at 1955 prices)*	*Number of workers in 1965*	*Number of workers in 1955* [a]	*Additional workers in 1965*	*Implicit improvement in productivity* [b] *(Percentage)*
Simple metallic manufactures	779.8	82 000	9 500	3 980	5 520	53
Non-electrical machinery and equipment (except for transport)	467.9	49 000	9 600	1 096	8 504	124
Electrical machines, instruments, apparatus and accessories	326.8	86 000	3 800	635	3 165	65
Transport equipment (excluding repair of vehicles)	197.0	77 000	2 560	381	2 179	40
Repair of motor-vehicles	331.5	65 000	5 100	1 847	3 253	10
Total	*2 103.0*	*69 000*	*30 560*	*7 939*	*22 621*	*36*

a These figures are somewhat diferent from those in table 46 (chapter IV) because some items have been reclassified from one branch to another or from one manpower category to another.

b The improvement percentages have been obtained by comparing the production growth ratios (indicated in previous tables) with manpower growth ratios obtained from this table.

to which the means of production would have to be increased. The relevant calculations and results can be seen in table 233, whence it can be deduced that in order to achieve a total production of 2 103 million soles in 1965, approximately 1 465 million soles of production capacity would have to be added to the 625 million existing in 1955. The branches of production in which the greatest effort to increase or create capacity would be required would comprise, in declining order of importance, mining machinery, compressors, refrigerators, pumps, seamed tubing, nuts, wire and artisan hand tools.

The preparation of table 233 also afforded an opportunity for industries to be reclassified in groups corresponding, very broadly, to types of manufacturing procedure or of equipment used in the manufacturing process. Thus, for example, table and kitchen cutlery would belong in the same group as cutting and felling equipment and *machetes*; agricultural hand tools and artisan tools, although dissimilar in many respects, would form part of a single group because, very broadly speaking, the same type of procedure or equipment would be used in their manufacture. Analogous groups would be formed by products of a structural type, boilers and bent tubing products, drop forgings, etc. This new grouping was based on the classification used in the United States for input-output studies, because, as will be seen later, data from such studies are used for certain estimates connected with Peru. It was on this grouping that the determination of machine-tool and equipment requirements was based.

On the basis of the findings of research carried out in 1953 [44] by The Rand Corporation of California, an attempt was made to determine, although very roughly, the quantity of machine tools, internal transport equipment, and other fixed assets which would be required in order to enable the metal transforming industry to achieve the expansion contemplated in this study (see table 234). It must be noted at the outset that owing to the drawbacks inherent in the association of several more or less dissimilar activities in a small number of industrial groups, the result of these estimates must be taken only as indicative of the approximate magnitude of investment and equipment requirements, and as a basis for a possible study of the guiding principles which should govern a rational development process in the metal transforming industry.

From a study of the data given in table 234 it may be concluded that the rational development of Peru's metal transforming industry would call for the centralization of activities which are necessary for many industries, but in scarcely any to an extent sufficient to justify purchase of the equipment required for such operations. The clearest case in point—which was also noted in connexion with raw materials—is that of casting, which appears in table 234 as necessary for almost all industries but on a relatively small scale in each. In the case of pressure casting the need for centralization is less urgent, since the plant required is not so complicated or so costly as for ordinary casting.

Another case in which it would manifestly be expedient to centralize operations is that of forging,[46] which is also needed for most industries, although intensively only in the manufacture of hand tools and machinery for mining and construction. Forging—and especially heavy forging—is an activity characteristic of industrialized environments, and cannot exist in countries whose metal transforming industry is barely in its initial stages, unless, thanks to a more rational development policy, it is established on a centralized basis so that it can serve at one and the same time a relatively large number of industries.

An instance similar to those just cited, although less important as regards the minimum investment required, is that of the manufacture of bearings, which, in the case of Peru—where construction of machinery would be only just beginning to develop, and, moreover, would be in the hands of different enterprises—it would be better to centralize, so that more specialized equipment could be utilized and operated for the longest shifts possible.

Although table 234 makes no reference to the manufacture of matrices and gauges for regulating the position of cutting tools, almost all the metal transforming industries need this type of activity, although not with suficient intensity to warrant, from the economic standpoint, the installation of specialized machine-tools, such as high-precision and pantographic millers. Furthermore, highly skilled manpower is also needed, and is difficult to obtain even in countries at an advanced stage of development. In default of reliable establishments in which the requirements of the various industries can be centralized, the industries themselves make shift to carry out the operation, with no very satisfactory results as regards quality and above all operational costs.

Hence the general conclusion may be reached that as the development of Peru's metal transforming industry is still in its initial stages, advantage might be taken of this very fact to channel it, by means of a policy of incentives, towards a structure free from the defects that generally characterize the metal transforming industries of other countries in process of development. The centralization of certain functions would have the advantage of enabling industry to reach almost at once a level of technique which other countries have taken years to attain.

The final estimate of investment requirements for the development of the metal transforming industry suggests that by 1965 about 580 million soles will be needed, of which 272 million would corespond to machine-tools, 15 million to internal transport equipment, 20 million to construction and the rest to other unspecified ancillary equipment and fixed assets.

[44] Unpublished report by Harry Markowitz, *Process Analysis of the Metal Working Industries*, op. cit.

[45] Casting and heavy forging really pertain to the basic metals rather than to the metal transforming industry; they are included in table 234 to facilitate presentation.

Table 233

PERU: PRODUCTS OF THE METAL TRANSFORMING INDUSTRY GROUPED TOGETHER ACCORDING TO SIMILARITY OF MANUFACTURING PROCESS AND ESTIMATED EXPANSION REQUIRED IN PRODUCTIVE CAPACITY BY 1965

(Values in millions of soles at 1955 prices)

United Nations classification	Item or product	Production in 1965	Capacity in 1965	Expansion required in the items	Grouping	United Nations classification	E.M. classification [a]	Expansion required in the groups
35	*Simple metallic manufactures*							
352	Containers of tinplate	87.0	87.4	—	Containers and caps of tinplate	352	93	—
	Metal caps	29.5	30.0	—				
353	Table and kitchen cutlery	4.4	—	4.4	Cutlery (excluding crockery)	353 [a]	94	6.1
	Other cutting implements (axes and machetes)	1.7	—	1.7				
	Agricultural hand tools	12.6	—	12.6	Hand tools	353 [b]	95	34.2
	Artisan hand tools	21.6	—	21.6				
	Locks and padlocks	0.7	—	0.7	Ironware	353 [c]	96	8.0
	Ironware and other hardware	11.4	4.1	7.3				
354	Sanitary articles of cast iron	14.1	—	14.1	Sanitary and tiled ware	354 [a]	97	23.4
	Taps and similar articles for sanitary installations	12.1	2.8	9.3				
	Stoves, water-heaters, ovens, radiators and other non-electric heating appliances	14.2	14.4	—	Non-electrical stoves, ovens and heaters	354 [b]	98	—
355	Structural units of steel tubing and light steel shapes (including door- and window-frames and lamp-posts)	35.3	18.5	16.8	Structural metal products	355 [a]	99	51.2
	Structural units of tubing and light shapes, of aluminium (including door- and window-frames)	9.3	9.8	—				
	Structural units of heavy shapes	30.3	10.2	20.1				
	Steel furniture	26.3	12.0	14.3				
	Silos, tanks, vats, etc.	18.6	1.6	17.0	Boiler making equipment and bent tubing products	355 [b]	100	73.3
	Gas cylinders	11.2	—	11.2				
	Bedsteads	31.6	30.0	1.6				
	Welded tubes and their fittings	92.3	48.8	43.5				
356	Aluminium cooking utensils and tableware	25.6	18.6	7.0	Stamped, inlaid or pressed articles	356	101	25.4
	Other domestic utensils and tableware (including those of cast iron and steel sheet)	18.2	3.2	15.0				
	Electric flashlights	3.4	—	3.4				
357	Lighting fixtures, such as fluorescent lighting shades, chandeliers, brackets, lamps, etc.)	6.6	1.5	5.1	Lamps and other lighting fixtures	357	103	5.1
358	Iron and steel wire	37.2	—	37.2	Wire and wire products	358	104	70.3
	Coarse and fine wire netting of iron and steel	6.0	4.8	1.2				
	Barbed wire	6.7	—	6.7				
	Springs	5.0	—	5.0				
	Nails, tacks, staples	18.2	7.0	11.2				
	Electrodes of ordinary iron and steel	9.0	—	9.0				
359	Barrels, casks, drums, buckets, etc.	21.9	26.6	—	Metal barrels, drums, etc.	359 [a]	105	—
	Soft metal tubes for ointments and creams	6.4	7.0	—	Soft tubes for ointments and creams	359 [b]	106	—
	Nuts, screws, pulley-wheels, rivets, etc.	40.6	—	40.6	Nuts, bolts and other small automatically-turned products	359 [c]	109	40.6
	Razors	1.5	—	1.5				
	Safes and vault accessories	2.2	2.0	0.2	Miscellaneous products, mainly of sheet	359 [d]	107	1.7
	Steel springs	24.5	9.6	14.9	Steel springs	359 [e]	108	14.9
	Other simple metallic manufactures	82.6	28.2	54.4	Other simple metallic manufactures	359 [f]	107	54.4

See notes at end of table.

Table 233 *(Continued)*

PERU: PRODUCTS OF THE METAL TRANSFORMING INDUSTRY GROUPED TOGETHER ACCORDING TO SIMILARITY OF MANUFACTURING PROCESS AND ESTIMATED EXPANSION REQUIRED IN PRODUCTIVE CAPACITY BY 1965

(Values in millions of soles at 1955 prices)

United Nations classification	*Item or product*	*Production in 1965*	*Capacity in 1965*	*Expansion required in the items*	*Grouping*	*United Nations classification*	*E.M. classification* [a]	*Expansion required in the groups*
36	*Non-electrical machinery and equipment (except for transport)*							
361	Boilers, economizers and related equipment	15.3	—	15.3	Boilers, economizers and related equipment	361	100	15.3
362	Machines for land preparation and cultivation	2.9	1.2	1.7	Agricultural machinery	362 [a]	113	1.7
	Machinery and equipment for processing agricultural commodities	5.8	—	5.8	Machinery for specific industries	362 [b]	118	5.8
363	Concrete mixers	3.6	—	3.6	Machinery for mining and construction	363	114	173.9
	Mining machinery	176.2	5.9	170.3				
365	Wood-working machines	5.8	2.0	3.8	Industrial machinery in general	365	123	3.8
366	Pumps	44.9	—	44.9	Pumps and compressors	366 [a]	119	104.3
	Compressors (including pneumatic tools)	59.4	—	59.4				
	Lifts for buildings and escalators	3.4	2.8	0.6	Elevators and transporters	366 [b]	120	21.7
	Freight and other lifts	13.7	—	13.7				
	Cranes and other equipment for lifting and handling weights	7.4	—	7.4				
	Equipment for the transmission of chemical energy	20.1	—	20.1	Equipment for the transmission of mechanical power	366 [c]	122	20.1
367	Weighing-machines and scales	7.5	2.8	4.7	Weighing-machines and scales	367	107	4.7
368	Industrial and domestic electric refrigerators	46.2	—	46.2	Refrigeration equipment	368	125	56.0
	Industrial and domestic non-electric refrigerators	9.8	—	9.8				
369	Valves, etc., except for sanitary installations	12.4	—	12.4	Valves and fittings	369 [a]	126	12.4
	Other non-electric machinery and equipment	33.5	12.9	20.6	Other non-electric machinery and equipment	369 [b]	123	20.6
37	*Electrical machines, instruments, apparatus and accessories*							
371	Electric motors, under 25 HP	20.0	—	20.0	Motors and generators	371 [a]	131	20.0
	Transformers, under 100 kW	24.1	—	24.1	Transformers	371 [b]	132	24.1
	Electric control equipment and machinery	10.4	3.4	7.0	Electric control apparatus	371 [c]	133	7.0
372	Electric stoves and ovens	10.1	—	10.1	Electrical appliances for domestic use	372	135	20.6
	Electric utensils with resistances	4.1	—	4.1				
	Electric manual tools	1.7	—	1.7				
	Liquidizers, mixers and other domestic utensils with small motors	4.7	—	4.7				
373	Electric wire and cables	122.9	8.4	114.5	Electric wire and cables	373	136	114.5
379	Accumulators	62.1	17.6	44.5	Accumulators	379 [a]	142	44.5
	Dry batteries	10.2	—	10.2	Dry batteries	379 [b]	143	10.2
	Other miscellaneous electrical products	56.5	17.7	38.8	General products of mechanical workshops	379 [c]	128	38.8
38	*Transport equipment*							
381	Ship-building and repairing	9.8	6.0	3.8	Shipping	381	149	3.8
382	Rolling-stock parts	3.8	—	3.8	Railway equipment	382	151	3.8
383	Lorries	32.0	9.4	22.6		383 [a]	145	76.2
	Buses	1.0	3.0	—				
	Spare parts for motor-vehicles (except tractors)	53.6	—	53.6				
	Spare parts for tractors	14.9	—	14.9	Spare parts for tractors	383 [b]	112	14.9
384	Repair of motor-vehicles	331.5	164.1	167.4	Repair of motor-vehicles	384	128	167.4
385	Bicycles	46.8	—	46.8	Motorcycles and bicycles	385	152	46.8
389	Other transport equipment	35.1	11.7	23.4	Other transport equipment	389	128	23.4
	Totales	2 103.0	625.2	1 464.9				

[a] Emergency model classification used for the Inter-Industry Economic Research Programme in the United States.

Table

PERU: ESTIMATE OF THE MACHINERY, EQUIPMENT
SION OF THE METAL TRANS
(Values in thousands of

Equipment and machines / Industrial groups [a]			*Cutlery (Excluding crockery)*	*Hand tools*	*Ironware*	*Sanitary and tiled ware*	*Structural metal products*
			353 a (94)	353 b (95)	353 c (96)	354 a (97)	355 a (99)
1		Foundry — ferrous	3.1	68.4	40.0	468.0	128.0
2	a)	Foundry — non-ferrous	6.1		8.0	117.0	
	b)	Die casting			96.0		
3	a)	Forging — regular	244.0	1 197.0	64.0		
	b)	Forging — large					
4	a)	Boring — regular				234.0	
	b)	Boring — large					
	c)	Jig boring regular					
5	a)	Drilling — regular	18.3	68.4	12.0	117.0	307.2
	b)	Drilling — large					
6	a)	Gear cutting — regular					
	b)	Gear cutting — large					
7		Grinding	549.0	752.4	120.0	81.9	
8	a)	Engine and turret lathes — regular		855.0	280.0	1 170.0	51.2
	b)	Engine and turret lathes — large					
9		Automatic chucking and screw machines		326.2	240.0	702.0	
10	a)	Milling — regular	134.2	1 197.0	400.0	117.0	
	b)	Milling — large					
11		Planing					102.4
12		Shaping		85.5			
13		Broaching		410.4	128.0	187.2	
14	a)	Bending and forming — small	244.0	1 197.0	240.0	936.0	4 915.2
	b)	Bending and forming — large					4 915.2
15		Heat treatment and industrial ovens	12.2	102.6	124.0	46.8	25.6
16		Surface finishing	6.1	34.2	8.0	93.6	15.4
17	a)	Welding — gas					
	b)	Welding — electric	6.1	68.4	8.0	46.8	230.4
	c)	Welding — resistance	12.2	102.6	24.0	70.2	25.6
18		Pipe bending and cutting				93.6	
19		Honing and lapping	12.2	68.4			
20		Cut-off machines	2.4	17.1	0.8	4.7	51.2
21		Riveting					128.0
22		Special equipment					
		Total — machines	1 249.9	6 550.6	1 692.8	4 485.8	10 895.4
23		Hoists	6.1	34.2	8.0	23.4	102.4
24	a)	Cranes and conveyers — regular	30.1	171.0	40.0	163.8	358.4
	b)	Cranes and conveyers — large					51.2
25		Industrial and trucks	42.7	239.4	56.0	163.8	153.6
		Total — internal transport equipment	78.9	444.6	104.0	351.0	665.6
26		Auxiliary equipment and unspecified fixed assets	1 020.4	6 137.6	1 196.0	4 226.0	128.0
27		Construction	1 143.8	6 412.5	1 500.0	4 387.5	5 789.0
		Total fixed assets	3 493.0	19 545.3	4 492.8	13 450.3	17 478.0

See notes at end of table.

234

AND OTHER FIXED ASSETS REQUIRED FOR THE EXPAN-
FORMING INDUSTRY UP TO 1965
soles at 1955 prices)

Boiler-making equipment and bent tubing products 355 b (100)	*Stamped, inlaid or pressed articles* 356 (101)	*Lamps and other lighting fixtures* 357 (103)	*Wire and wire products* 358 (104)	*Nuts, bolts and other small automatically turned products* 359 e (109)	*Miscellaneous products mainly of sheet* 359 d (107)	*Steel springs* 359 e (108)	*Other simple metallic manufactures* 359 f (107)
73.3		15.3		20.3	23.8		771.4
		1.0			1.7		55.1
		25.5					
				162.4	11.9		385.7
73.3					1.7		55.1
366.5	63.5	40.8			5.1		165.3
366.0							
				406.0	3.4		110.2
36.7	203.2	81.6		203.0	32.3		1 046.9
		122.4		6 049.4	28.9		936.7
					42.5		1 377.5
36.7							
		5.1			1.7		55.1
2 199.0	2 921.0	810.9			234.6		7 603.8
11 068.3	1 905.0						
73.3	50.8	5.1		81.2	3.4		110.2
73.3	20.3	2.0		40.6	3.4		110.2
586.4	15.2	5.1			6.0		192.9
14.7	152.4	30.6		20.3	6.0		192.9
659.7							
				4.1	0.9		27.6
73.3		2.6			0.3		11.0
			22 576.0			4 857.0	
15 701.0	*5 331.4*	*1 148.0*	*22 576.0*	*6 987.3*	*407.6*	*4 857.0*	*13 207.6*
110.0	25.4	5.1		8.1			
513.1	177.8	35.7		284.2	11.9		385.7
146.6	50.8				0.9		27.6
513.1	127.0	35.7		284.2	11.9		385.7
1 282.8	*381.0*	*76.5*	—	*576.5*	*24.7*	—	*799.0*
2 798.8	221.4	592.6	1 700.0	3 386.1	157.2	504.3	6 072.4
5 790.7	2 872.4	956.3	13 250.1	6 106.2	318.8	2 586.4	10 200.0
25 573.3	*8 806.2*	*2 773.4*	*37 526.1*	*17 056.1*	*908.3*	*7 947.7*	*30 279.0*

Table

PERU: ESTIMATE OF THE MACHINERY, EQUIPMENT
SION OF THE METAL TRANS
(*Values in thousands of*

Equipment and machines \ Industrial groups [a]			Boilers economizers and related equipment 361 (100)	Agricultural machinery 362 a (113)	Machinery for specific industries 362 b (118)	Machinery for mining construction 363 (114)	Industrial machinery in general 365 (123)
1		Foundry — ferrous	15.3	23.8	81.2	2 260.7	57.0
2	a)	Foundry — non-ferrous		0.9	17.4	87.0	0.8
	b)	Die casting					
3	a)	Forging — regular		10.2	26.1	521.7	1.9
	b)	Forging — large				1 217.3	
4	a)	Boring — regular	15.3	1.7	40.6	1 912.9	
	b)	Boring — large			11.6	1 565.1	
	c)	Jig boring — regular			17.4	521.7	
5	a)	Drilling — regular	76.5	6.0	34.8	173.9	11.4
	b)	Drilling — large	76.5	20.4	63.8	608.7	38.0
6	a)	Gear cutting — regular		10.2	29.0	782.6	
	b)	Gear cutting — large				695.6	
7		Grinding			127.6	1 739.0	5.7
8	a)	Engine and turret lathes — regular	7.7	93.5	174.0	2 608.5	152.0
	b)	Engine and turret lathes — large		8.5		4 695.3	38.0
9		Automatic chucking and screw machines		42.5	75.4	1 391.2	38.0
10	a)	Milling — regular	7.7	35.7	156.6	1 391.2	76.0
	b)	Milling — large				2 782.4	
11		Planing			92.8		
12		Shaping		8.5	46.4	434.8	
13		Broaching			23.2	608.7	
14	a)	Bending and forming — small	459.0	51.0	168.2	1 912.9	121.6
	b)	Bending and forming — large	2 310.3		284.2	2 608.5	399.0
15		Heat treatment and industrial ovens	15.3	1.7	40.6	52.2	3.8
16		Surface finishing	15.3	1.0	17.4	211.7	7.6
17	a)	Welding — gas		0.2	0.6		
	b)	Welding — electric	122.4	6.8	40.6	782.6	30.4
	c)	Welding resistance	3.1	1.7	5.8	87.0	7.6
18		Pipe bending and cutting	137.7		2.3	34.8	3.4
19		Honing and lapping			5.8	121.7	
20		Cut-off machines		1.0	5.8	69.6	1.9
21		Riveting	15.3	0.3	5.8	52.2	5.7
22		Special equipment					
		Total — machines	*3 277.4*	*325.6*	*1 595.0*	*31 841.5*	*999.8*
23		Hoists	23.0	3.4	8.7	347.8	5.7
24	a)	Cranes and conveyers — regular	107.1	8.5	58.0	869.5	38.0
	b)	Cranes and conveyers — large	30.6	0.3	2.9	173.9	1.9
25		Industrial and trucks	107.1	13.6	34.8	869.5	22.8
		Total — internal transport equipment	*267.8*	*25.8*	*104.4*	*2 260.7*	*68.4*
26		Auxiliary equipment and unspecified fixed assets	524.9	157.8	1 672.1	17 528.8	451.9
27		Construction	1 195.2	422.1	1 291.7	32 467.1	601.9
		Total fixed assets	*5 265.3*	*931.3*	*4 663.2*	*84 098.1*	*2 122.0*

See notes at end of table.

AND OTHER FIXED ASSETS REQUIRED FOR THE EXPAN-
FORMING INDUSTRY UP TO 1965
soles at 1955 prices)

Pumps and compressors 366 a *(119)*	*Elevators and transporters* 366 b *(120)*	*Equipment for the transmission of mechanical power* 366 e *(122)*	*Weighing-machines and scales* 367 *(107)*	*Refrigeration equipment* 368 *(125)*	*Valves and fittings* 369 a *(126)*	*Other non-electric machinery and equipment* 369 b *(123)*	*Motors and generators* 371 a *(131)*
2 086.0	65.1	241.2	65.8	112.0	148.8	309.0	60.0
104.3	10.9	20.1	4.7	5.6	99.2	4.1	10.0
				39.2	24.8		4.0
260.8	21.7	50.3	32.9	84.0	12.4	10.3	60.0
5 215.0	217.0	44.2	4.7	560.0	558.0		600.0
417.2							
2 086.0				168.0			
156.5	54.3	50.3	14.1	168.0	74.4	61.8	80.0
938.7		160.8		112.0		206.0	
469.4	130.2	904.5		84.0	24.8		160.0
		180.9					
3 546.2	173.6	683.4	9.4	560.0	272.8	30.9	300.0
4 172.0	759.5	763.8	89.3	1 736.0	1 252.4	824.0	540.0
						206.0	380.0
1 355.9	108.5	743.7	79.9	336.0	1 388.8	206.0	600.0
2 711.8	434.0	502.5	117.5	1 400.0	124.0	412.0	300.0
				84.0			
365.1		70.4		112.0			
417.2	130.2	50.3	4.7	84.0	136.4		100.0
1 043.0	759.5	201.0	648.6	1 960.0		659.2	460.0
	2 170.0			896.0		2 163.0	
208.6	65.1	40.2	9.4	56.0	62.0	20.6	12.0
104.3	32.6	20.1	9.4	56.0	43.4	41.2	30.0
312.9	43.4	120.6	16.5	56.0	12.4	164.8	100.0
73.0	65.1	20.1	16.5	196.0		41.2	
52.2				16.8	2.5	18.5	
319.9		50.3		84.0	86.8		4.0
156.5	21.7	8.0	2.4	16.8	6.2	10.3	6.0
	13.0		0.9	16.8		30.9	
26 572.5	*5 275.4*	*4 926.7*	*1 126.7*	*8 999.2*	*4 330.1*	*5 419.8*	*3 806.0*
156.5	32.6	30.2		84.0	18.6	30.9	30.0
1 043.0	65.1	160.8	32.9	252.0	74.4	206.0	80.0
104.3	21.7		2.4	22.4		10.3	20.0
625.8	130.2	120.6	32.9	280.0	74.4	123.6	100.0
1 929.6	*249.6*	*311.6*	*68.2*	*638.4*	*167.4*	*370.8*	*230.0*
14 542.6	2 925.0	311.6	538.4	240.8	2 735.4	2 449.4	134.0
16 521.1	3 437.3	1 957.5	881.3	5 695.2	4 132.9	3 263.0	1 510.0
59 565.8	*11 887.3*	*7 507.4*	*2 614.6*	*15 573.6*	*11 365.8*	*11 503.0*	*5 680.0*

Table

PERU: ESTIMATE OF THE MACHINERY, EQUIPMENT
SION OF THE METAL TRANS
(Values in thousands

Equipment and machines \ Industrial groups [a]			Transformers 371 b (132)	Electrical control apparatus 371 c (133)	Electrical appliances for domestic use 372 (135)	Electric wire and cables 373 (136)
1		Foundry — ferrous	216.9	1.4	61.8	
2	a)	Foundry — non-ferrous			4.1	
	b)	Die casting		1.4	82.4	
3	a)	Forging — regular			20.6	
	b)	Forging — large				
4	a)	Boring — regular			123.6	
	b)	Boring — large				
	c)	Jig boring — regular			20.6	
5	a)	Drilling — regular	192.8	56.0	30.9	
	b)	Drilling — large				
6	a)	Gear cutting — regular			41.2	
	b)	Gear cutting — large				
7		Grinding	24.1		206.0	
8	a)	Engine and turret lathes — regular	361.5	140.0	267.8	
	b)	Engine and turret lathes — large				
9		Automatic chucking and screw machines		210.0	721.0	
10	a)	Milling — regular	433.8		288.4	
	b)	Milling — large				
11		Planing				
12		Shaping	192.8			
13		Broaching			20.6	
14	a)	Bending and forming — small	1 807.5	560.0	309.0	
	b)	Bending and forming — large			721.0	
15		Heat treatment and industrial ovens	72.3	1.4	61.8	
16		Surface finishing	36.2		20.6	
17	a)	Welding — gas				
	b)	Welding — electric	96.4	3.5	4.1	
	c)	Welding — resistance	2.4	2.8	82.4	
18		Pipe bending and cutting	72.3			
19		Honing and lapping				
20		Cut-off machines	36.2		4.1	
21		Riveting		2.1	4.1	
22		Special equipment	241.0			22 389.0
		Total — machines	3 786.2	978.6	3 096.1	22 389.0
23		Hoists	14.5	4.2	10.3	
24	a)	Cranes and conveyers — regular	144.6	42.0	164.8	
	b)	Cranes and conveyers — large	12.1			
25		Industrial trucks	108.5	31.5	103.0	
		Total — internal transport equipment	279.7	77.7	278.1	—
26		Auxiliary equipment and unspecified fixed assets	215.0	32.0	315.3	1 680.0
27		Construction	2 495.1	320.7	2 830.4	16 750.3
		Total fixed assets	6 780.0	1 409.0	6 519.9	40 819.3

Sources: The investment values for each type of machinery and equipment per monetary unit of production used to calculate the figures in this table were obtained from the unpublished report by Harry Markowitz, *Process Analysis of the Metal Working Industries*, The Rand Corporation, 1953. The estimates of total investment and that in other fixed assets were based on coefficients supplied by Robert N. Grosse, *Capital Requirements for the Expansion of Industrial Capacity*, Bureau of the Budget, U.S. Government, 1953.

AND OTHER FIXED ASSETS REQUIRED FOR THE EXPAN-
FORMING INDUSTRY UP TO 1965
of soles at 1955 prices)

General products of mechanical work-shops 379 c (128)	*Shipping* 381 (149)	*Railway equipment* 382 (151)	*Motor vehicles* 383 a (145)	*Spare parts for tractors* 383 b (112)	*Motorcycles and bicycles* 385 (152)	*Other transport equipment* 389 (128)	*Total*
27.2	22.8	11.4	152.4	119.2	70.2	16.4	7 837.2
	11.4	1.9	38.1	7.5			616.9
			76.2		70.2		419.7
		22.8	609.6	67.1			3 877.4
	7.6	106.4		44.7			1 376.0
504.4	34.2	30.4	914.4	193.7	468.0	304.2	12 106.4
	87.4	15.2					2 096.5
310.4			228.6			187.2	3 539.9
116.4	9.5	15.2	114.3	44.7	327.6	70.2	3 103.7
232.8	9.5	3.8	76.2	67.1		140.4	3 121.2
582.0	17.1	0.8	838.2	178.8	468.0	351.0	5 071.8
465.6	17.1	1.9				280.8	1 641.9
698.4	17.1	22.8	1 600.2	52.2	234.0	421.2	12 747.5
2 328.0	60.8	34.2	914.4	253.3	1 638.0	1 404.0	24 534.6
582.0	133.0	38.0				351.0	6 431.8
2 328.0		34.2	2 667.0	163.9	936.0	1 404.0	23 235.6
1 862.4	45.6	57.0	1 066.8	208.6	702.0	1 123.2	16 761.7
698.4	87.4	11.4				421.2	4 000.8
	72.2	11.4		119.2			482.0
155.2	11.4	9.5	152.4	29.8		93.6	1 767.4
77.6		3.0	381.0	29.8	468.0	46.8	3 369.0
465.6	53.2	72.2	1 371.6	521.5	3 276.0	280.8	38 462.9
	174.8	269.8	3 048.0	715.2			33 648.3
194.0	22.8	3.8	228.6	14.9	46.8	117.0	1 886.1
23.3	3.4	3.4	53.3	10.4	46.8	14.0	1 118.5
			7.6				8.4
194.0	22.8		76.2	52.2	93.6	117.0	3 634.5
19.4	1.9		304.8	29.8	9.4	11.7	1 633.2
	9.5	3.8			46.8		1 153.9
58.2			266.7			35.1	1 113.1
7.8	1.9		15.2	3.0	46.8	4.7	534.7
	5.7	3.8	38.1	3.0			412.9
			228.6				50 291.6
11 931.1	940.1	788.1	15 468.5	2 929.6	8 948.2	7 195.5	272.037.1
58.2	5.7	3.8	228.6	29.8	14.0	35.1	1 498.3
232.8	22.8	9.5	304.8	89.4	93.6	140.4	6 411.7
	45.6	30.4	76.2	7.5			839.6
232.8	34.2	7.6	381.0	119.2	93.6	140.4	5 800.2
523.8	108.3	51.3	990.6	245.9	201.2	315.9	14 549.8
8 823.1	440.4	282.3	586.8	1 270.6	465.0	5 321.2	91 785.2
12 932.0	1 645.8	187.0	13 373.1	3 479.2	4 185.6	7 799.2	200 692.4
34 210.0	3 134.6	1 308.7	30 419.0	7 925.3	13 800.0	20 631.8	579 064.5

a The classification figures not in brackets correspond to the *International Standard Industrial Classification of all Economic Activities* (United Nations Statistical Papers, series M, No. 4), adapted to the needs of this study. Those in brackets pertain to the emergency model classification used in the United States.

Chapter IX

AGGREGATE ELECTRIC ENERGY, LABOUR AND FINANCING REQUIREMENTS IN COMPARISON WITH THE COUNTRY'S CAPACITY TO SATISFY THEM

In the previous chapter a development hypothesis was made for productive capacity in every branch of manufacturing industry, in order to ascertain whether the industry as a whole could respond to the needs of a specific rate of economic development in future without exceeding the limits imposed by the hypothetical capacity to import. Prior to this, an estimate had been made of aggregate demand for raw materials and intermediate products, in which account was taken of inter-industrial relationships and of the links between industry and other sectors of the economy.

At this juncture, an attempt should be made to determine total requirements for the salient factors in such a development process, namely, unskilled and skilled labour, technical experts, electric energy and capital for financing machinery and equipment requirements, and to compare the scale of these requirements with the country's capacity to satisfy them. These are the two objectives of the present chapter.

I. ELECTRIC ENERGY

When a development hypothesis was formulated for each branch of industry in the preceding chapter, it was decided to estimate the respective electric energy requirements at a later stage in order to prepare aggregate figures for comparison with the country's possibilities of meeting them through the development contemplated in current plans for expanding generating capacity. Except with respect to the estimate of energy required by industry, this section has been based on the data contained in the *Plan de Electrificación Nacional* prepared by *Electricité de France* for the Peruvian Government.

1. *Background information on the electric energy supply in Peru*

On 1 January 1956, the Peruvian electric energy distribution system comprised a large number of isolated grids which had a very low power level, with two exceptions: the concession networks for Lima and for the *Compañía Minera Cerro de Pasco*, which represented 47 and 16 per cent of the country's total guaranteed power respectively.

Installed capacity on that data was estimated at 430 000 kW of which 386 000 were permanently available. This power was distributed as indicated in table 235.

Studies, surveys and estimates made by *Electricité de France* place the average use of installed capacity at about 4 500 hours anually, which would raise the country's total consumption of electric energy in 1957 to 1 900 million kWh.

Table 235

PERU: INSTALLED CAPACITY FOR GENERATING ELECTRIC POWER IN 1956 [a]

(Kilowatts)

	Total	*Public services*	*Private services*
Total	*430 000*	*189 200*	*240 800*
Hydraulic	240 800	124 700	116 100
Thermal-steam	73 100	21 500	51 600
Thermal-diesel	116 100	43 000	73 100

SOURCE: *Electricité de France, Plan de Electrificación Nacional, Informe General.*

a According to the statistics supplied by the *Servicios Eléctricos del Perú*, installed power fluctuated as follows:

1934	101 762 kW
1940	219 746 ,,
1952	320 948 ,,
1954	390 531 ,,

In other words, the annual average rate of expansion was 7 per cent between 1934 and 1956 and 8 per cent between 1952 and 1956.

Generally speaking, the production, transport and distribution of electric energy lagged behind demand, particularly with respect to the public utilities which —except for those serving Greater Lima—had to be content in the last few years with fulfilling their minimum legal or contractual requirements since they were unable to obtain a reasonable adjustment of their rates. As a result, many industrial consumers were forced to install their own generating equipment, even though it was more economical for them to use a gen-

eral grid. This step although not in the country's interests was favourable by the low price of petroleum derivatives.

To sum up, Peru's electric energy network consisted of the following services on 1 January 1956:

(*a*) In Lima, there was a public utility amply equipped to meet demand; autonomous means of production represented approximately 28 per cent of installed capacity in the supplier zone

(*b*) In the mining area of central Peru, surrounding the axis of the Cerro de Pasco-Oroya and Oroya-Valle del Alto Rímac, there was an important service belonging to the *Compañía Minera Cerro de Pasco* which existed almost entirely to meet the enterprise's own needs.

(*c*) In the sugar-growing valleys of Lambayeque, La Libertad and the north of the department of Lima, there were some fairly large plants operating in complete isolation.

(*d*) Throughout the rest of the country, there were a large number of private plants and public utilities with power reserves that were often very low or even non-existent.

2. *Development programme for electric energy generating capacity*

This programme envisages a fairly gradual increase of generating capacity in different parts of the country (see table 236) which, by 1965, would have added a total of 913 000 kW to the 430 000 existing in 1956. The major expansions would take place in the central mining region (318 000 kW), the Lima area (197 000 kW) and the Chimbote-Trujillo area (159 000 kW), although on the whole any increment would be equitably distributed, throughout the country.

It is estimated that 80 per cent of the increment in installed capacity would correspond to hydro-electric

Table 236

PERU: PROJECTED INCREASE IN INSTALLED CAPACITY FOR GENERATING ELECTRIC POWER

(Thousands of kilowatts)

	1956	*1957*	*1958*	*1959*	*1960*	*1961*	*1962*	*1963*	*1964*	*1965*	*Total increase*
Lima [a]	—	—	26.0	—	72.0	—	—	99.0	—	—	197.0
Huacho-Pativilca [b]	—	0.6	—	0.9	24.0	—	—	—	—	24.0	63.0
Pisco-Ica y Mala [c]	—	1.5	0.3	3.1	0.6	0.3	25.0	—	0.3	—	31.1
Central mining area [d]	—	56.0	—	3.3	22.8	14.0	6.4	215.0	—	—	317.5
Chimbote-Trujillo [e]	—	4.1	50.4	1.8	7.9	1.8	3.3	1.8	1.8	86.8	158.9
Chiclayo-Piura Talara y Tumbes [f]	—	—	0.9	4.6	2.1	0.9	0.8	1.1	3.3	2.1	15.8
Moquegua-Tacna [g]	—	0.6	—	—	22.2	0.5	0.1	—	—	36.0	49.4
Cuzco [h]	—	1.0	0.9	4.0	—	—	28.3	—	—	—	34.2
Arequipa [i]	—	—	2.8	—	—	5.0	—	—	—	—	7.8
Iquitos [j]	—	0.7	—	—	0.7	—	—	1.5	—	—	2.9
Chachapoyas [k]	—	—	—	—	—	0.1	—	—	—	—	0.1
Huaraz [l]	—	—	0.2	—	5.0	—	—	—	—	—	5.2
Abancay [m]	—	0.2	—	—	0.2	—	—	—	—	—	0.4
Ayacucho [n]	—	—	—	0.3	—	—	—	—	—	—	0.3
Cajamarca [o]	—	—	0.4	—	0.2	—	—	0.2	—	—	0.8
Huancavelica [p]	—	—	0.2	—	—	—	—	—	—	—	0.2
Huánuco [q]	—	—	—	0.2	—	—	—	—	—	—	0.2
Huancayo [r]	—	1.0	—	—	—	1.7	—	—	—	—	2.7
Puerto Maldonado [s]	—	—	0.1	—	—	0.1	—	—	—	0.1	0.3
Puno [t]	—	0.2	—	1.3	—	—	—	—	—	—	1.5
Moyobamba [u]	—	—	—	0.5	—	—	—	—	—	—	0.5
Other installations [v]	—	2.8	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.6	22.8
Total	—	69.2	83.8	23.9	159.8	26.7	66.5	321.5	8.6	152.6	912.6

SOURCE: *Electricité de France, Plan de Electrificación Nacional, Informe General.*

a Includes the second stage of the Callahuanca project, which will be completed in 1958; the Huampaní hydroelectric plant of 17 000 kW and a thermal plant of 50 000 kW in Callao for 1960; and the first stage of the Huinco project for 1963.

b Includes 2 diesel groups each of 300 kW for 1957; 3 groups for 1959; the first stage of the Cahua hydroelectric plant on the river Pativilca, for 1960, and the second stage for 1965.

c Includes diesel groups up to 1961; the first stage of the Platanal hydroelectric plant on the river Cañete for 1962; and a diesel group for 1964.

d Includes the first stage of the hydroelectric plant on the river Paucartambo for 1957; the small plant at San Mateo for 1959; the Tamboraque plant for 1960; the second stage of the Paucartambo project for 1961; the Chiriz-Chichu plant for 1962; and the first stage of Mantaco project for 1963.

e Includes diesel groups in Trujillo and the three stages of the hydroelectric plant in the Cañón del Pato.

f Includes thermal groups (steam) at Chiclayo, diesel groups in Tumbes and Piura, and turbo-generators on the sugar farms.

g Thermo-electric groups.

h Includes a diesel plant for 1957; the modification of the Corimarca hydroelectric plant for 1958; a thermal plant using steam for 1959; and the first stage of the Machu-Pichu hydroelectric plant for 1962.

i Includes the harnessing of the Frailes dam for hydroelectric power in 1958 and the first stage of the Charcani IV hydroelectric plant, on the river Chili, for 1961.

j Diesel groups in each of the years indicated.

k Consists of a small hydroelectric plant to be completed in 1961.

l Includes a small diesel plant for 1957 and an offshoot of the Cañón del Pato project for 1960.

m Hydroelectric project to be carried out in two stages between 1957 and 1960.

n Refers to the Vinchos hydroelectric plant on the Canchis river.

o Includes completion of the first hydroelectric plant on the Chonta river in 1957 and the installations of two diesel groups between 1960 and 1963.

p Recovery project for the Sta. Bárbara plant on the Sacsamarca river.

q Refers to a project on the river Huallaga, between Colpas and Huánuco, the first stage of which will be completed for 1959.

r Refers to a thermal plant for 1957 based on diesel motors and another hydroelectric plant which will be located between the villages of Manutaro and San Lorenzo and will be completed in 1959.

s Diesel motors.

t Includes diesel groups for 1957 and the first stage of the Maravillas hydroelectric plant for 1959.

u Plant for harnessing the waterfall on the river Jera; it will be built in two stages the first of which will be completed in 1959.

v Includes the aggregate of many individually small groups both diesel and hydraulic.

Table 237

PERU: ESTIMATE OF ELECTRIC POWER CONSUMED BY INDUSTRY IN 1965

(Millions of kilowatt-hours)

Sector	*Consumption in 1956*	*Rate of increase in industrial production between 1956 and 1965* [a] *(Percentage)*	*Coefficient of increase in electricity consumption through modernization of installations (1956 to 1965)*	*Consumption in 1965*	*Growth of consumption between 1956 and 1965*	*Annual rate of growth of consumption (Percentage)*
Petroleum refining	24.2	39	1.00	33.6	39	44
Sugar processing	112.2	44	1.11	179.5	60	69
Non-ferrous metallurgy	88.7	85	1.08	177.0	100	116
Other industries	331.2 [b]	83	1.22	739.9	123	144
Total	556.3	73	1.17	1 130.0	103	120

SOURCE: Data for 1955: Industries and Electricity Department, *Estadistica de los Servicios Eléctricos del Perú, Boletin No. 4, Ejercicio 1956; Empresas Eléctricas Asociadas de Lima.*

a Calculated on the basis of the decennial rates given in chapter VIII.

b This figure is broken down as follows:

Greater Lima area:	
(a) Supplied by *Empresas Eléctricas Asociadas*	196.6
(b) Generated by industrial enterprises themselves	91.4
Rest of the country	43.2

plants, 16 per cent to steam power stations and 4 per cent to diesel power stations, so that the probable distribution of generating capacity in 1965, by type of plant, would be as follows:

Hydro-electric capacity	968 800 kW
Steam capacity	218 700 kW
Diesel capacity	152 500 kW
Total	1 340 000 kW

3. *Hypothesis of the growth of electric energy demand and its comparison with projected capacity up to 1965*

Total electric energy consumption was estimated to increase at an annual rate of 13.3 per cent between 1956 and 1963 and of 9.3 per cent between 1964 and 1975. The former rate would result from the effort that the country would have to make to close the current gap in supplies, after which the second rate is assumed to prevail as the growth of demand becomes stabilized. The rates were determined by taking into account all the regional development programmes as well as those for independent centres producing their own energy.

According to the foregoing data, demand in 1965 would probably amount to 5 500 million kWh and could be satisfied only if capacity were expanded by some 910 000 kW, which is less than the figure of 913 000 kW projected in the nation-wide electrification programme.

Industrial demand for electric energy in 1965 can be estimated on the basis of registered consumption in 1956 and of the rates of growth for manufacturing production corresponding to the hypotheses formulated in chapter VIII. But as it is thought that any rise in productivity will have to be largely combined with more mechanization, which implies greater energy consumption per unit of production, various coefficients representing increased electricity consumption as a result of plant modernization and ranging from 1.0 in the case of petroleum refining to 1.22 in the case of most industries, have been included in the demand estimates in table 237.

To sum up, industrial electric energy demand would rise from 556 million kWh in 1956 to 1 130 million in 1965, corresponding to a decennial growth rate of 120 per cent inferior to those of aggregate demand and installed capacity, and based on the assumption that

Table 238

PERU: SUMMARY OF DEMAND PROJECTIONS AND GENERATING CAPACITY FOR ELECTRIC POWER UP TO 1965

	1956	*1965*	*Growth between 1956 and 1965 (Percentage)*	*Decennial rate of growth* [a] *(Percentage)*
Demand (millions of kWh)				
By industry	556	1 130	103	119
By the population and other activities	1 344	4 300	220	274
Total	1 900	5 430	186	225
Generating capacity (kW)	430	1 343	212	554

SOURCE: Total data: *Electricité de France, Plan de Electrificación Nacional, Informe General.*

a Calculated for use in projections from 1955 onwards.

the development of the manufacturing industry as projected would not be hampered by difficulties in obtaining energy. It should be noted, however, that electrification programmes have tended to decentralize energy production in order to use water resources which are rather far from existing industrialization centres. For this reason, development plans for the industry should explore the possibility and advantages of establishing new plants outside the Lima-Callao area.

Projections of electric energy demand and generating capacity are summarized in table 238.

4. *Investment required to develop electric energy generating capacity and distribution*

Such investment would amount to about 5 070 million soles for generating plant and high-tension cables, and some 1 230 million more for low-tension distribution grids.[1] Total investment up to 1965 would therefore be 6 300 million soles at 1955 prices.

[1] In order to determine the total sum of investment from 1956 to 1965, the following factors were taken into account:

(a) The value of new grids is 10 000 soles per kW and of grid reinforcements, 5 000 soles;

(b) The cumulative rate of growth of distribution is 11 per cent annually;

(c) Forty-five per cent of the power distributed is for public use;

(d) Twenty per cent of the energy in public use is distributed at high tension; and

(e) Sixty per cent of the expansion of power in public use, at low tension, represents a reinforcement of existing grids.

As explained earlier, many manufacturing firms have had to produce their own energy and even a certain amount for public use. As this has meant (and will mean) heavy investment, which is added to the sum of the enterprises' fixed assets instead of being accounted for separately, it must be borne in mind, when making an aggregate estimate of investment in manufacturing industry up to 1965, that at least 480 million soles of the 5 070 million estimated for investment in generation and high-tension distribution, would correspond to the proportion of the private generating plant that the industry uses for its own consumption.

II. LABOUR AND TECHNICIANS

1. *The labour force that could be absorbed by industry*

The first labour problem to emerge, after development of the different branches of industry was projected in the previous chapters, is to ascertain whether industry as a whole will be capable of providing employment for the 100 000 persons, which, according to chapter III, will have to be absorbed into the manufacturing sector by 1965. Generally speaking, the reply is in the affirmative since by that year the aggregate increment in employment would be virtually 100 000 workers, in spite of the relatively high increases assumed in productivity. The recapitulation in table 239 shows that a total of 206 600 persons would be employed in manufacturing—96 700 more than in 1955—with an average productivity that would probably be 25 times greater than in the latter year.

2. *Skilled labour requirements*

Consideration should next be given to the country's possibilities of supplying the skilled labour required by industrial development. As shown in table 240, the proportion of skilled workers in the total labour force was only 21.7 in 1955, which was deemed insufficient,[2] and which, according to the factory surveys carried out, seems in actual fact to represent persons of only moderate skill, particularly in the made-up goods, furniture, printing and china industries. From the summary, it appears that these workers would have to become more skilful by 1965 and that their proportion of the labour force as a whole would increase to 31.8 per cent.

In order to reach the proposed target, the skilled labour supply, which was registered at 23 800 persons in 1955, would have to increase to 65 700 by 1965. As this net addition of 41 900 workers could only be obtained if more people were trained to cover replacements of existing personnel and even of the additional labour force, it may be inferred (see table 241) that Peru would have to train 50 250 workers in its own institutes and industry before 1965.

A cursory examination shows that the country's manpower-training capacity consists at present of 44 centres from which some 950 workers graduate annually. There are also 33 industrial training school for women, which can accept 2 000 pupils a year. These schools concentrate on teaching cutting and dressmaking, but for the home rather than for industrial purposes. If 20 per cent of the pupils from these schools and all the workers from the training centres go into industry, the total skilled labour force available in 1965 would be only 13 500 persons[3] as against the 50 250 required. It should be remembered that although in-service training in industry also exists, it is not the most economical method and cannot be undertaken unless there are enough skilled workers to teach the non-skilled. Generally speaking, this is seldom the case in view of the shortage of well-trained personnel.

The problem is clearly very serious and is sufficient in itself to slow down Peru's industrial and economic

[2] In the United States, highly specialized labour represents 43 per cent of the personnel employed in manufacturing industry, excluding employees.

[3] In an independent study mentioned in chapter IV, footnote 6, a much lower figure is given which indicates that the deficit of skilled labour will be an even more serious problem in future.

Table 239

PERU: LABOUR REQUIREMENTS FOR MANUFACTURING INDUSTRY IN 1965

Branch or item	*Workers employed in 1955* [a]	*Decennial rate of growth of production* [b]	*Assumed or implicit improvement in labour productivity (Percentage)*	*Workers needed for 1965*	*Increase in number of workers from 1955-1965*	
					Number	*(Percentage)*
Foodstuffs [c]	38 120	80	21	56 700	18 580	49
Beverages [d]	5 757	109	23	9 747	3 990	69
Tobacco	689	66	66	689	—	—
Yarns and flat fabrics [e]	16 634	102	—	16 634	—	—
Other textiles	4 124	59	15	5 700	1 576	38
Leather footwear	2 775	100	15	4 840	2 065	75
Made-up textiles	3 875	330	30	12 800	8 925	230
Timber	2 488	197	40	5 300	2 812	113
Furniture and fixtures	1 546	239	50	3 500	1 954	126
Paper and pulp	1 750	172	51	3 150	1 400	80
Printing and publishing	2 417	144	25	4 720	2 303	95
Leather and leather goods	1 969	106	40	2 900	931	47
Tyres	331	200	10	900	569	172
Other rubber industries [f]	299	354	20	1 130	831	278
Chemicals [g]	4 754	322	28	15 604	10 850	228
Petroleum and coal derivatives	801	52	38	881	80	10
Non-metallic mineral products	6 753	149	18	14 200	7 447	110
Iron and steel [h]	556	—	—	2 700	2 144	386
Non-ferrous metallurgy [i]	3 250	225	10	9 700	6 450	198
Metal transforming [j]	7 939	427	37	30 560	22 621	285
Other industries [k]	3 058	74	25	4 250	1 192	39
Total	109 885	137	25	206 605	96 720	88

SOURCE: Data for 1955: Ministry of Development and Public Works, *Estadistica Industrial 1955*.

a Although based on official data, some of these figures have been modified as a result of items and staff categories being re-classified.

b Figures taken from the corresponding sections of chapter VIII.

c For product break-down see table 183.

d For product break-down see table 185.

e See table 192. In theory, this item would require only 6 250 workers in 1965. As no solution to the problem of absorbing excess staff is foreseen, it was felt preferable to *maintain* the 1955 figure for 1965.

f Includes workers engaged in making vulcanized footwear.

g For product break-down see table 210.

h Rates of growth and improvement of productivity are omitted because in 1955 production related only to casting and was negligible.

i For product break-down see table 221.

j For sectorial break-down see table 232.

k An improvement in productivity equal to the average for the industry was assumed.

Table 240

PERU: SKILLED LABOUR REQUIREMENTS IN 1965

Branch or item	*Workers employed in 1955*			*Workers needed for 1965*		
	Total	*Skilled workers*		*Total*	*Skilled workers*	
		Number	*Percentage of total*		*Percentage of total*	*Number*
Foodstuffs	38 120	3 780	9.9	56 700	12.6	7 140
Beverages	5 757	790	13.7	9 747	19.7	1 920
Tobacco	689	100	14.5	689	30.0	207
Yarns and flat fabrics	16 634	4 800	28.8	16 634	40.0	6 650
Other textiles	4 124	1 240	30.2	5 700	45.0	2 570
Leather footwear	2 775	1 150	41.4	4 840	42.0	2 030
Made-up textiles	3 875	2 860	73.6	12 800	88.0	10 900
Timber	2 488	500	20.1	5 300	25.0	1 325
Furniture and fixtures	1 546	780	50.5	3 500	55.0	1 925
Paper and pulp	1 750	350	20.0	3 150	30.0	945
Printing and publishing	2 417	1 200	49.6	4 720	55.0	2 600
Leather and leather goods	1 969	400	20.3	2 900	35.0	1 015
Rubber industries	630	440	69.8	2 030	75.0	1 520
Chemicals	4 754	720	15.0	15 604	26.6	4 150
Petroleum and coal derivatives	801	260	32.5	881	39.0	343
Non-metallic mineral products	6 753	920	36.2	14 200	51.0	7 250
Iron and steel	556	220	39.5	2 700	30.0	810
Non-ferrous metallurgy	3 250	660	20.3	9 700	22.0	2 130
Simple metallic manufactures	3 980	835	21.0	9 500	28.3	2 680
Non-electrical machinery and equipment (except for transport)	1 096	312	28.5	9 600	23.7	2 270
Electrical machinery and equipment	635	300	47.2	3 800	39.0	1 485
Transport equipment	2 228	868	38.9	7 660	41.6	3 180
Other industries	3 058	300	9.8	4 250	15.0	638
Total	109 885	23 785	21.7	206 605	31.8	65 683

SOURCE: Data for 1955 (with slight modifications): Ministry of Development and Public Works, *Estadistica Industrial 1955*.

Table 241

PERU: TRAINING REQUIREMENTS FOR SKILLED WORKERS DURING THE PERIOD 1955-1965

(Number of persons and percentage decennial rates)

Branch or item	For replacement of skilled workers employed in 1955			For expansion of industry				Total skilled workers to be trained in 1955-1965
	Already employed	Replacement		Net addition	Replacement		Net addition plus replacement	
		Rate	Number		Average rate	Number		
Foodstuffs	3 780	32	1 215	3 360	7	235	3 595	4 810
Beverages	790	23	158	1 130	5	57	1 187	1 345
Tobacco	100	20	20	107	5	5	112	132
Yarns and flat fabrics	4 800	30	1 440	1 850	10	185	2 035	3 475
Other textiles	1 240	30	372	1 330	10	133	1 463	1 835
Leather footwear	1 150	25	287	880	6	53	933	1 220
Made-up textiles	2 860	15	430	8 040	3	241	8 281	8 711
Timber	500	30	150	825	7	58	883	1 033
Furniture and fixtures	780	30	234	1 145	7	80	1 225	1 459
Paper and pulp	350	30	105	595	7	42	637	742
Printing and publishing	1 200	15	180	1 400	3	42	1 442	1 622
Leather and leather goods	400	40	160	615	10	62	677	837
Rubber industries	440	20	88	1 080	5	54	1 134	1 222
Chemicals	720	23	162	3 430	6	206	3 636	3 798
Petroleum and coal derivatives	260	32	84	83	8	7	90	174
Non-metallic mineral products	920	29	266	6 330	7	443	6 773	7 039
Iron and steel	220	30	66	590	10	59	649	715
Non-ferrous metallurgy	660	45	297	1 470	10	147	1 617	1 914
Simple metallic manufactures	835	16	130	1 845	2	37	1 882	2 012
Non-electrical machinery and equipment (except for transport)	312	10	31	1 958	2	39	1 997	2 028
Electrical machinery and equipment	300	10	30	1 185	3	36	1 221	1 251
Transport equipment	868	15	128	2 312	2	46	2 358	2 486
Other industries	300	15	45	338	3	10	348	393
Total	*23 785*	*26*	*6 078*	*41 898*	*5*	*2 277*	*44 175*	*50 253*

SOURCE: Data for 1955 (with slight modifications): Ministry of Development and Public Works, *Estadistica Industrial 1955*.

progress unless it is dealt with effectively through the establishment of training centres in different parts of the country and the formulation of programmes which give priority to training for such activities as the metal transforming industries that are now suffering from a deficit but are highly important to the future development of Peruvian production. At the same time, the labour supply in, for instance, the textile industries, which now have a surplus, would be eased.

3. *Engineers and technicians required*

According to statistics, the Peruvian industry had 2 800 professionals and technicians in 1955, which represented 2.5 per cent of workers, professionals and experts as a whole. The analogous proportions given in table 242 for each branch of industry are, with a few exceptions, low in comparison with those which Peruvian industry should really have. On an average, they would be approximately 3.20 per cent by 1965, with more or less equivalent increases in most branches, except for the chemical industry, which needs an unusually large increment, and for some other activities, in which there might even be relative decreases. If industrial production does develop in the way that has been assumed in this study, it would require 6 840 professional and technical experts by 1965, in other words, about 4 040 more than in 1955.

In order to satisfy these requirements, some 4 950 engineers and experts would have to be trained between 1955 and 1965. This figure includes replacements for the personnel in 1955 as well as for the additional persons employed during the period in question (see table 243).

It may be estimated very roughly that the five universities in Peru [4] would be able to train about 3 000 engineers between 1955 and 1965; from this much the same conclusion may be reached as in the case of skilled labour, namely, that unless an extraordinary effort is made to increase the capacity of technical institutes or to organize the training of a large number of technicians abroad on a systematic basis the lack of engineers and technicians will be a formidable obstacle to Peru's industrial development.

To sum up, it is clear that the investment with the best economic yield for the country in future will be the establishment of training centres for skilled labour and technical institutes for professional training. Without an expansion of the present training capacity, it will be impossible to have a vigorous industrial development.

[4] The National Engineering University of Lima, for the technical specialities of chemistry, mechanics, electricity, metallurgy and petroleum, and the Universities of San Marcos at Lima, and of Trujillo, Cuzco and Arequipa, for chemistry. In 1959, the National University of Huamanga, in the department of Ayacucho, will be reopened, and the emphasis in its teaching placed on technical subjects.

Table 242

PERU: PROFESSIONAL AND TECHNICAL STAFF REQUIRED IN 1965

Branch or item	Employed in 1955			Needed in 1965		
	Total professional, technical and unskilled staff	Professional and technical staff		Total professional, technical and unskilled staff	Professional and technical staff	
		Number	Percentage of total		Percentage of total	Number
Foodstuffs	38 679	559	1.45	57 621	1.60	921
Beverages	5 934	177	2.98	10 088	3.38	341
Tobacco	719	30	4.17	745	7.46	56
Yarns and flat fabrics	16 634	465	2.80	17 130	2.90	496
Other textiles	4 230	106	2.50	5 870	2.90	170
Leather footwear	2 820	65	2.30	4 961	2.43	121
Made-up textiles	3 953	78	1.97	13 182	2.90	382
Timber	2 548	60	2.35	5 458	2.90	158
Furniture and fixtures	1 588	42	2.64	3 622	3.38	122
Paper and pulp	1 832	82	4.47	3 307	4.75	157
Printing and publishing	2 466	49	1.99	4 837	2.42	117
Leather and leather goods	2 031	62	3.05	3 015	3.83	115
Rubber industries	651	21	3.32	2 101	3.40	71
Chemicals	4 982	228	4.58	16 694	6.53	1 090
Petroleum and coal derivatives	826	25	3.02	919	4.10	38
Non-metallic mineral products	6 884	131	1.90	14 526	2.25	326
Iron and steel	571	15	2.62	2 781	2.92	81
Non-ferrous metallurgy	3 398	148	4.36	10 000	2.99	300
Simple metallic manufactures	4 155	175	4.21	9 906	4.10	406
Non-electric machinery and equipment	1 133	37	3.26	10 176	5.66	576
Electrical machinery and equipment	691	56	8.10	4 041	5.97	241
Transport equipment	2 338	110	4.70	8 110	5.55	450
Other industries	3 629	86	2.37	4 359	2.50	109
Total	*112 692*	*2 807*	*2.50*	*213 449*	*3.20*	*6 844*

SOURCE: Data for 1955 (with slight modifications): Ministry of Development and Public Works, *Estadística Industrial 1955*.

Table 243

PERU: TRAINING REQUIREMENTS FOR PROFESSIONAL AND TECHNICAL STAFF DURING THE PERIOD 1955-1965

(Number of persons and percentage decennial rates)

Branch or item	For replacement of professional and technical staff employed in 1955			For expansion of industry				Total professional and technical staff to be trained in 1955-1965
	Already employed	Replacement		Net addition	Replacement		Net addition plus replacement	
		Rate	Number		Average rate	Number		
Foodstuffs	559	28	157	362	7	25	387	544
Beverages	177	20	35	164	5	8	172	207
Tobacco	30	20	6	26	5	1	27	33
Yarns and flat fabrics	465	30	140	31	10	3	34	174
Other textiles	106	30	32	64	10	6	70	102
Leather footwear	65	25	16	56	6	3	59	75
Made-up textiles	78	15	12	304	3	9	313	325
Timber	60	30	18	98	7	7	105	123
Furniture and fixtures	42	30	13	80	7	6	86	99
Paper and pulp	82	30	25	75	7	5	80	105
Printing and publishing	49	15	7	68	3	2	70	77
Leather and leather goods	62	40	25	53	10	5	58	83
Rubber industries	21	20	4	50	5	2	52	56
Chemicals	228	18	41	862	6	52	914	955
Petroleum and coal derivatives	25	36	9	13	8	1	14	23
Non-metallic mineral products	131	23	30	195	8	16	211	241
Iron and steel	15	30	4	66	10	7	73	77
Non-ferrous metallurgy	148	45	67	152	10	15	167	234
Simple metallic manufactures	175	16	28	231	2	5	236	264
Non-electrical machinery and equipment (except for transport)	37	5	2	539	2	11	550	552
Electrical machinery and equipment	56	10	6	185	3	6	191	197
Transport equipment	110	15	16	340	2	7	347	363
Other industries	86	15	13	23	3	1	24	37
Total	*2 807*	*25*	*706*	*4 037*	*5*	*203*	*4 240*	*4 946*

SOURCE: Data for 1955 (with slight modifications): Ministry of Development and Public Works, *Estadística Industrial 1955*.

The various sections of the preceding chapter contained estimates of the capacity that would have to be added in manufacturing industry in order to attain the production targets proposed for 1965, and of the investment that such additions would represent. The latter is summed up in table 244, from which it can be seen that total investment requirements would be equivalent to some 9 440 million soles (at 1955 prices). It should be noted that this amount would correspond solely to the value of the fixed assets that would have to be incorporated in manufacturing industry proper —that is, to Peru's net investment effort in this sector—but that it would not include the various extra outlays, custom duties, etc., in connexion with imports of machinery and equipment, so that aggregate investment in industry itself would necessarily be somewhat higher. Furthermore, to the above mentioned sum would have to be added about 140 million soles corresponding to the modest capital formation needed by artisan industry, in the shape of tools, sewing-machines, building materials, and so forth, as well as about 480 million that industry would spend in the generation of electric energy for its own consumption,[5] which would mean that for the industrial sector as a whole investment would total approximately 10 060 million soles (at 1955 prices).

Table 244

PERU: INVESTMENT REQUIREMENTS FOR THE EXPANSION OF THE PRODUCTIVE CAPACITY OF MANUFACTURING INDUSTRY
(Millions of soles at 1955 prices)

Item or branch	*Investment necessary* [a]
Foodstuffs	1 092
Beverages	280
Tobacco	30
Yarns and flat fabrics	675
Leather footwear	20
Made-up textiles	140
Timber	100
Furniture and fixtures	20
Paper and pulp	275
Printing and publishing	32
Leather and leather goods	30
Tyres	175
Other rubber industries	20
Chemicals	1 868
Petroleum and coal derivatives	220
Non-metallic mineral products	514
Iron and steel	122
Non-ferrous metallurgy	2 700
Metal transforming	579
Other industries	550 [b]
Total	9 442

a See corresponding sections of chapter VIII.
b Calculated on the basis of the average investment per unit of production for the whole industry.

5 Strictly speaking, this sum ought to be taken into consideration in the services sector, but, as was shown in chapter VIII, section XIII, and section I of this chapter, it is difficult to separate data on production of electric energy generated and consumed by factories from manufacturing statistical data proper.

The figure just cited might be estimated as being made up by 80 per cent of imported machinery and 20 per cent for local construction and installations. If a further 20 per cent were added to the former so as to cover expenditure in connexion with the imports concerned, including customs duties, the inference would be that total investment would amount to 11 670 million soles (see table 245).

Table 245

PERU: TOTAL INVESTMENT NEEDS FOR MANUFACTURING INDUSTRY UP TO 1965
(Millions of soles at 1955 prices)

Investment in manufacturing industry excluding customs duties and charges on imported machinery	9 440
Investment in artisan production	140
Investment in generation of electric power by the manufacturing industry for its own consumption	480
Customs duties and charges at a rate of 20 per cent of the value of the imported machinery	1 610
Total investment with normal utilization of plant capacity	11 670
Total investment with 80 per cent of normal utilization of installed capacity	14 600

Consideration should also be given to another important aspect. As will be recalled, the under-utilization of installed capacity, which reaches such a pitch that in most factories a single shift is worked when two or three ought to be, is mentioned in several parts of the present study as one of the most serious deficiencies of existing industry. In estimates of expansion of production capacity it was not considered desirable to establish the utilization of all equipment for three shifts daily as the normal rule, since this was deemed impracticable—and not always necessary—at any rate during the period covered by these projections, mainly because of the shortage of technical personnel to direct operations. What was set up as a maximum, and even an "ideal", target was the working of two shifts in industries where the importance of machinery is relatively slight, such as the foodstuffs, made-up textile goods, footwear and even some of the metal transforming industries, and the ultimate establishment of three shifts, as a normal rule, in all such activities as are essentially mechanized or entail a continuous production process.

Thus, the figure of 11 670 million soles represents maximum or "ideal" conditions, which it is thought could be attained if a great effort were made in industry, if the shortage of technicians and skilled workers was at least partially remedied, and if, by means of an appropriate policy, a large number of industrialists were encouraged to advance beyond the "post-artisan" stage, during which, having converted their former artisan workshops into factories, they are still unwilling to delegate authority and continue to act as sole supervisors.

A more realistic figure would be obtained if it were

assumed that by 1965 industry would be working at 80 per cent of the capacity termed maximum or "ideal". This would mean that the factories hypothetically considered as working three shifts would probably do so, in view of the powerful economic incentives that would act as inducements but some of those which it was thought would manage two shifts would be content with working one only. In these circumstances, the additional investment needed would rise to about 14 600 million soles. The sum of the net investment thus obtained and the fixed capital of 14 940 million soles existing in 1955[6] would give a total stock of fixed capital in 1965 equivalent to about 29 540 million soles, a figure slightly lower than the estimate formulated in chapter III on the basis of the assumption that during 1955-65 the product-capital ratio in industry would remain constant (and equivalent to 0.41).

In turn, average depreciation of a stock of capital amounting to 29 540 million soles, at an annual rate of 4 per cent, and the growth of the gross product of industry at a rate of 6.5 per cent per annum,[7] would imply that by 1965 industry would require annual gross investment in the neighbourhood of 3 100 million soles (at 1955 prices). This might involve Peru in a fairly intensive effort, but would certainly not exceed its financing potentialities. In fact, such investment in industry would represent 23.1 per cent of gross investment for the whole economy, a relationship which, compared with the 19 per cent registered for 1955, indicates not too excessive a relative displacement of resources from other sectors to that of industry. This displacement is fully justifiable in the light of the changes in favour of industrial activities which would take place by 1965 in the composition of the gross product (see table 34). Moreover, serious financing difficulties would be unlikely to arise, in so far as the changes in capital market organization and mechanisms and in credit policy with respect to manufacturing industry, mentioned in chapter VI, effectively materialized, since the result would be that means of financing were channelled towards industry much more efficaciously than in the past.

[6] To the capital of 12 940 million soles pertaining to industry with the exclusion of metal and petroleum refining (see table 10), have been added 2 000 million, representing an approximate estimate of investment in the latter activities.

[7] During 1955-65, the annual rate of growth of the gross product of industry would be 7 per cent, since the sector would be passing through a phase of recovery from its relatively backward state. It may be assumed that by 1965 there would be less difference between the rates of growth of the economy as a whole on the one hand, and manufacturing industry on the other.

ANNEXES

Annex I

SOURCES AND METHODS OF CALCULATION USED IN DETERMINING THE GROSS PRODUCT AND OTHER MACROECONOMIC MAGNITUDES

I. ESTIMATES OF THE GROSS PRODUCT IN 1955 AND ITS EVOLUTION IN 1945-55

So far as the present study of industrial development is concerned, the estimates of the gross product are designed to serve a threefold purpose: firstly, to ascertain the position of manufacturing industry within the economy as a whole during the last year for which full data are available, in this case 1955; secondly, to trace the development of this industry during the ten preceding years and the structural changes that became apparent in the economy in the course of that period; and thirdly, to draw certain tentative conclusions therefrom as to the possible future growth of the economy in general and the industrial sector in particular.

In the preparation of these estimates, use was made of the very exhaustive data published regularly by the *Banco Central de Reserva* in its *Renta Nacional del Perú* series. These publications, in which the bulk of the relevant statistical material available in Peru is systematically assembled constituted the main basis for the estimates presented here. The ECLA study group also benefited from the personal collaboration of the Chief of the Department of Economic Research of the *Banco Central de Reserva*, who devoted much of his time to clarifying certain theoretical and methodological points which arose in the course of the work. In the last analysis, the ECLA estimates do not differ substantially from those of the *Banco Central*. The minor discrepancies observable derive mainly from the fact that a new series on active population in the various sectors was used in the present study. A revised estimate of the active population was considered preferable because the published series assumes the structure of employment to remain the same as in 1940, the year of the last census, a supposition which, in view of the growth noted since then in the Peruvian economy, it is difficult to accept. Even so, the new estimates undoubtedly contain a considerable margin of error and must be revised in the light of the results of the next census.

The "gross product" to which reference is made corresponds to the concept of the "gross geographical product" used by ECLA in its studies,[1] and is equivalent to the "total value added" or "gross national product" in *La Renta Nacional del Perú*. The detailed calculations for each sector will be presented below, under the following three heads: active population; gross product in 1955; and gross product from 1945 to 1955. Population data take precedence over the estimate of the gross product because in many cases they provide the basis for the calculation. The level of the gross product by sectors once established for 1955, the series for the preceding years were computed by means of indices which in many cases were specially prepared for the purpose. The result is a gross product series (at constant 1955 prices) which reflects, within the limitations of the statistical material available the growth of the Peruvian economy during the decade 1945-55. Once again it must be noted that many calculations are based on indirect estimates, and their statistical foundations are relatively shaky. The figures presented must therefore be interpreted not literally but as general guides to orders of magnitude, both absolute and relative. The study and criticism of these estimates may perhaps spur on the future improvement of statistical data in Peru and consequently lead to the reduction of a wider margin of error than is found in the corresponding material in more highly developed countries.

[1] See "Special note on the concepts and methods used by ECLA in its analyses of economic development", in the United Nations publication, *Economic Bulletin for Latin America*, Vol. 1, No. 2 (Santiago, Chile, September, 1956), pp. 29-35.

1. *Agriculture*

(a) *Active population*

The active population employed in agriculture in 1955 was estimated on the basis of the break-down of the population by urban and rural sectors as presented in Part One of this study. When the rural population had been established, relationship between it and the agricultural population was estimated to be the same as that registered in the 1940 census; the figure thus obtained for the latter was 2 176 000 persons.

(b) *Gross product in 1955*

The statistics published by the *Banco Central de Reserva* in *La Renta Nacional del Perú* served as the basis for the calculation of the gross value of crop, livestock, poultry and fish production. Estimates of inputs of raw materials and other costs to be deducted were based on special research. The next step was to obtain the sum of the value added, or gross product, thus calculated, plus the value added in cotton gins, which was included in this rather than in the industrial sector in conformity with the international classification of industry. The corresponding calculations are assembled in table 1 and show a gross product of 9 693 million soles.

Table 1

PERU: ESTIMATE OF GROSS PRODUCT OF AGRICULTURAL SECTOR, 1955

(Millions of soles)

Gross value of production:		
Crops		9 057.5
Livestock, poultry and fish		2 105.1
Cotton-ginning		729.3
		11 891.9
Less:		
Materials used in production	1 149.9	
Fodder crops	396.0	
Cotton for ginning	653.0	2 198.9
Value added (gross product of agricultural sector)		9 693.0

SOURCES: Production: *Banco Central de Reserva, La Renta Nacional del Perú.*

(c) *Evolution of the gross product in 1945-55*

For 1945-55 an agricultural production index was constructed on the basis of data published by the Ministry of Agriculture, the National Agrarian Society (*Sociedad Nacional Agraria*), the *Banco Central de Reserva* and other official sources. The composition of this index is shown in detail in table 2. The index was applied to the value of the gross product in 1955 in order to calculate the gross product (at 1955 prices) for all the other years in the period.

Table 2

PERU: INDICES OF AGRICULTURAL PRODUCTION, 1945-55
(Base 1955 = 100 [a])

Year	Commodities			Grand total	Commodities for	
	Crops	Livestock	Other		Domestic consumption	Export
1945 . .	69.5	72.1	31.7	68.1	74.3	62.6
1946 . .	71.9	67.7	40.2	69.7	76.7	61.8
1947 . .	72.1	67.8	41.6	70.0	79.7	57.2
1948 . .	77.1	66.4	41.1	73.7	84.9	59.2
1949 . .	84.6	59.3	49.6	78.9	90.1	64.1
1950 . .	86.6	69.3	58.3	82.5	94.6	65.4
1951 . .	91.4	74.1	64.5	87.5	98.5	72.1
1952 . .	93.0	78.0	68.3	89.4	95.9	81.3
1953 . .	98.0	91.9	74.2	95.9	101.7	89.0
1954 . .	101.0	98.7	91.1	99.9	101.1	99.2
1955 . .	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Calculations based on official statistics.
[a] Original base year 1954 = 100.
Weighting of partial indices:

Crops	80.2		
Livestock	15.6	Domestic consumption	63.3
Other	4.2	Exports	36.7
	100.0		100.0

2. *Mining*

(a) *Active population*

The number of persons employed in mining is given in several official sources. According to the *Banco Central de Reserva*, this sector provided employment for 62 800 persons in 1955.

(b) *Gross product in 1955*

In the calculation of the gross product of this sector, certain classification adjustments were affected as a result of which transforming activities, in respect of both petroleum and metal ores, were excluded from the "Mining" sector and included under "Industry", in accordance with the practice adopted in the International Standard Industrial Classification. This means that the gross product of the mining sector falls below the figures previously published in Peru. One of the most complex problems arising in connexion with these calculations was that relating to the valuation of the output of metal ores. Finally, it was considered best to value them in accordance with the export prices published by the Customs Department (*Superintendencia General de Aduanas*) in its *Estadística del Comercio Exterior*. These estimates place the sector's gross product, or value added, at 2 199 million soles in 1955 (see table 3).

(c) *Evolution of the gross product in 1945-55*

The real growth of the gross product of the mining sector was calculated using a production index for ores and concentrates, shown in table 4. This index was applied directly to the

Table 3

PERU: ESTIMATE OF GROSS PRODUCT OF EXTRACTIVE INDUSTRIES, 1955
(Millions of soles)

Gross value of production:		
Extraction of mineral products (excluding petroleum)		1 798
Crude petroleum		826
		2 624
Less:		
Materials used in production:		
Extraction of ores	277	
Extraction of petroleum	148	425
Value added (gross product) in extractive industries		2 199

SOURCE: Calculations based on official statistics.

1955 gross product to obtain gross product values for the other years in the period.

3. *Industry*

(a) *Active population*

The active population in the transforming industry was estimated to stand at 616 000 persons in 1955. This figure was based on the number of persons employed in this activity in 1940, according to the census for that year and on the subsequent growth of the urban centres. It has already been shown in the present study that a more rapid increase was registered among the urban than among the rural population. For the purposes of the calculations, it was further assumed that the rate of growth of the population employed in non-agricultural activities, including industry, must have been similar to that of the urban population.

According to the tabulations for 1955, prepared by the Ministry of Development and Public Works, Department of Industries and Electricity, in that year registered industry employed a total of 120 666 persons. The number of persons employed in the unregistered sector would then amount to about 495 000, calculated as the difference between the total active population in manufacturing industry and the number employed in the registered sector.

Table 4

PERU: QUANTUM INDICES OF PRODUCTION OF ORES AND CONCENTRATES, 1945-56
(Base: 1953 = 100)

1945	67.2
1946	59.2
1947	57.7
1948	57.7
1949	68.6
1950	74.8
1951	84.4
1952	89.4
1953	100.0
1954	109.9
1955	108.7
1956	116.7

SOURCE: Calculations based on official statistics. The index represents the evolution of the quantum of production of the main ores and concentrates, valued in dollars in accordance with prices published in United States Bureau of Mines, *Minerals Yearbook*, and United States Department of Commerce, *Commodity Imports*. The index was constructed according to the Paasche formula, i.e. with variable weighting for each year. (See *Economic Survey of Latin America*, 1956, (E/CN.12/427/Rev.1) United Nations publication (Sales No.: 1957 II.G.1), Part Two, Chapter III: "Mining".)

(b) *Gross product in 1955*

For the computation of the 1955 gross product, the very detailed tabulations regularly prepared by the Ministry of Development and Public Works, Department of Industries and Electricity were available. Using this data it was possible to establish a fairly accurate estimate for the registered sector. The contribution of the unregistered sector, on the other hand, which is not covered by the surveys referred to, had to be assessed on the basis of indirect criteria.

The chief of these was the comparison of total utilization of specific raw materials (domestically-produced or imported) with available data on registered industry's consumption of them. The raw material availabilities remaining were then taken as inputs in unregistered industry. The combination of these with the ratio between inputs and gross product in the registered sector (due allowance being made for differences in productivity) enabled the gross product of the unregistered sector to be estimated.

The contribution of each of these sectors to the gross product of industry is shown in table 5. It should be pointed out that the data on registered industry supplied by the Department of Industries and Electricity were adjusted to include petroleum refining and the smelting of metal ores, which were excluded from the mining sector.

Table 5

PERU: ESTIMATE OF GROSS PRODUCT OF MANUFACTURING INDUSTRY, 1955
(Millions of soles)

Manufacturing industry	*Production*	*Inputs*	*Value added (Gross product)*
Registered	10 037	6 639	3 397
Unregistered	6 000	3 846	2 154
Total	*16 037*	*10 485*	*5 551*

SOURCES: Registered industry: Ministry of Development and Public Works, Department of Industries and Electricity (adjusted figures).

(c) *Evolution of the gross product in 1945-55*

In order to ascertain the evolution of manufacturing industry during the decade 1945-55, a detailed index of the quantum of production by main branches of activity was prepared. The construction of this special index is described in annex II. It was applied to the 1955 figure as a means of calculating the value added, or gross product, for all years in the period under study. The gross product series thus obtained reflects, in accordance with the index utilized, changes in the quantum of industrial production during this period, expressed in terms of soles at 1955 prices. A yardstick is hereby provided for measuring manufacturing industry's real contribution to the economy as a whole, but the index and the resulting series do not necessarily reflect variations in the real income received by the factors of production employed in the industrial sector; and the same is true of the sectors previously dealt with. The two concepts will differ in so far as changes may have taken place in the relative price of industrial goods as compared with those of goods produced by other sectors.

4. *Construction*

(a) *Active population*

In 1940, according to the census taken in that year, 45 659 persons were employed in construction activities. On the assumption that employment in this field increased at least at the same rate as the active population in industry as a whole, the total in 1955 would seem to have been 84 000 persons. Of this number, 16 676 persons belonged to the registered construction industry i.e. those firms on whose data the publications of the *Banco Central de Reserva* are based, and which constitute a sufficiently representative sample to justify certain conclusions with respect to the sector as a whole.

(b) *Gross product in 1955*

The gross product of the registered sector, published in *La Renta Nacional del Perú*, reached 393 million soles in 1955. Of this sum, 34 per cent represented salaries and wages and 66 per cent profits, depreciation and other outlays. *Per capita* remunerations in this group amounted to almost 8 000 soles during the year referred to, within the sector comprising the 16 676 construction workers employed by established firms and able to count on relatively steady work. For the 67 324 construction workers in the unregistered group, annual earnings were estimated at only 4 000 soles, as both the absolute level of wages and the time during which work is available compare unfavourably with conditions in the registered group. Thus, total remunerations amounted to 403 million soles. If the ratio between this figure and the total product is taken to be the same as in the registered sector, a gross product value of 1 180 million soles is obtained for 1955.

In order to calculate investment, the value of total production in the construction industry was also computed. The above-

Table 6

PERU: ESTIMATE OF QUANTUM INDEX OF CONSTRUCTION ACTIVITIES, 1945-55
(Production values in thousands of soles at 1955 prices)

Year	*Cement*	*Common clay*	*Plaster of Paris*	*Sawn timber*	*Lime for building*	*Quarry stone and crushed stone*	*Imported building materials* [a]	*Total*	*Index (1955=100)*
1945	74 439	2 179	5 282	29 370	342	592	135 546	247 750	34.8
1946	73 262	2 479	5 098	48 393	336	662	168 216	298 446	41.9
1947	71 840	2 849	4 922	57 291	309	794	165 911	303 916	42.7
1948	79 352	3 373	5 762	75 264	364	987	172 910	338 012	47.5
1949	81 220	4 635	4 534	76 388	558	704	167 535	335 574	47.1
1950	93 094	5 072	3 979	78 689	1 117	823	191 266	374 040	52.5
1951	103 507	5 861	4 919	70 392	765	1 218	315 665	502 327	70.6
1952	104 323	7 042	4 187	102 206	660	1 617	334 094	554 129	77.8
1953	126 245	8 407	5 552	105 947	779	2 154	470 472	719 556	101.1
1954	135 629	7 879	4 592	117 920	785	2 086	366 844	635 735	89.3
1955	153 055	9 167	6 294	112 024	544	2 284	428 576	711 944	100.0

SOURCE: Calculations based on official data.
a *Import series at current prices deflated by a relevant price index, with 1953 as the original base year. For 1945-47 a rather different price index was used, with 1937 as its original base year, and coupled to the former.*

mentioned gross product value, or value added, of 1 180 million soles was taken as a point of departure, together with the value of the building materials produced in Peru—672 million soles, according to *La Renta Nacional del Perú*. The sum of these, plus a further 428 million soles for imported building materials, finally gave 2 280 million soles as the gross value of production.

(c) *Evolution of the gross product in 1945-55*

To work out the gross product values for the years 1945-55 a quantum index of production was prepared and then applied to the value of the gross product in 1955. A series in constant values—that is, in real terms—for the evolution of construction during the years in question was thus obtained. These, like the indices for other sectors, measure the quantum of construction for each year, not necessarily the real income of the factors of production employed. The construction index was based on the production statistics relating to the most important domestically-produced commodities for which quantitative data were available—and which constitute a sufficiently representative sample—plus imports of building materials. The weighting assigned to each of these items corresponded to its value in 1955. The estimated indices and the resulting gross product series are given in tables 6 and 7.

Table 7

PERU: EVOLUTION OF GROSS PRODUCT IN CONSTRUCTION ACTIVITIES, 1945-55

Year	*Construction index (1955=100)*	*Gross product at 1955 prices (Millions of soles)*
1945	34.8	411
1946	41.9	494
1947	42.7	504
1948	47.5	560
1949	47.1	556
1950	52.5	619
1951	70.6	833
1952	77.8	918
1953	101.1	1 193
1954	89.3	1 054
1955	100.0	1 180

SOURCE: Calculations based on official statistics.

5. *Transport*

(a) *Active population*

The 1940 census shows that during that year 51 079 persons were employed in transport activities. A break-down of this total by the main branches of the sector shows that 7 463 persons worked in rail transport, 18 822 in lorry transport and 24 794 in other branches (taxis, buses, sea, air and animal transport). The estimate for 1955 was prepared on the basis of these data and on the assumption that increments in the active population concerned were functions of certain indicators of the evolution of these activities. Thus, in the case of railway transport, it was assumed that the personnel employed increased in direct ratio to the combined movement of the goods and passengers carried; in that of lorries, it was the variations in the number of units in circulation that were taken as indicative of the changes in employment. Lastly, for the remaining types of transport, a growth rate identical with that of the urban (or non-agricultural) active population was applied (see table 8).

(b) *Gross product in 1955*

Since the data for this sector published by the *Banco Central de Reserva* represent only a sample of total activities, it

Table 8

PERU: ACTIVE POPULATION EMPLOYED IN TRANSPORT SECTOR, 1955

Active population	*1940 census*	*1955*
Railway transport	7 463	11 418
Road transport	18 882	87 232
Other	24 734	37 687
Total	51 079	136 337

was felt preferable to base estimates of the gross product of transport on the number of persons employed. However, the figure for salaries and wages shown in the sample referred to (and included under the head of "Services" in *La Renta Nacional del Perú*) was taken into account, a *per capita* income equivalent to the average earnings of employees and workers in the registered transport enterprises being assigned to the whole sector. This average stood at about 13 530 soles in 1955. According to information obtained from persons connected with this activity, salaries and wages in the unregistered group (comprising small-scale independent entrepreneurs and their employees) were probably lower than in the registered group; on the other hand, the income of the self-employed—taxi-drivers, for example—would considerably exceed the figure given. All in all, it was estimated that a mean level between the two types of income would be close to that mentioned above. A reserve of some 400 million soles for depreciation of equipment was added to the income in question, and as this totalled 1 843 million soles, the total gross product of the sector was thus 2 243 million soles.

(c) *Evolution of the gross product in 1945-55*

The estimate of the gross product for 1945-55 was based esentially on a weighted index intended to reflect real variations in the different activities constituting this sector. This index, applied to the value of the gross product in 1955, gave the values, at constant prices, of the gross product in the other years of the period under consideration. It was compounded of various partial indices, corresponding to the most important and representative groups within the transport sector. For railways, an index of the volume of freight handled and another of the number of passengers carried were utilized and weighted by the value involved in each case in the year 1955. The index for lorries was constituted by the number of units in circulation in each year, weighted by the gross product of this group in 1955. Where other means of transport were concerned, the growth of the urban active population was taken as an indicator, and the weighting corresponded to the gross product generated by these activities, calculated residually by subtraction of the

Table 9

PERU: ESTIMATE OF GROSS PRODUCT OF TRANSPORT SECTOR, 1945-55
(Millions of soles at 1955 prices)

Year	*Quantum index (1955=100)*	*Gross product*
1945	41.6	933
1946	44.9	1 007
1947	49.7	1 115
1948	50.1	1 121
1949	54.0	1 212
1950	64.3	1 442
1951	70.3	1 578
1952	74.2	1 665
1953	86.6	1 943
1954	91.0	2 041
1955	100.0	2 243

gross product originating in the railway and lorry groups from the total gross product. The total index thus arrived at, and the gross product for the period, are shown in table 9.

6. *Trade*

(a) *Active population*

On the basis of the estimate for the non-agricultural active population, the proportional magnitude of the trade sector within this group was assumed to be much the same as the census data showed it to have been in 1940. The total number of persons employed in trade activities in 1955 would thus seem to have been approximately 175 000, of whom 81 672, according to the *Banco Central de Reserva*, were working with registered firms, while the remaining 93 328 comprised individual dealers or establishments too small to appear in the registers on which the bank's data are based.

(b) *Gross product in 1955*

The data issued by the *Banco Central de Reserva* were utilized as a basis for estimating the gross product of the registered sector, but the figure for changes in inventories was adjusted so as to exclude the effect of price variations and express the changes in question in real terms (see table 10). With regard to the unregistered sector, it was ascertained from authorized sources that the *per capita* product was considerably smaller in this group than in the registered sector, in which the average earnings of employees were estimated to be in fact approximately equal to the *per capita* gross product in the unregistered sector. In other words, this would imply that the income of a small self-employed small dealer might be a little higher than that of an employee in the registered sector, but that the salaries of employees in the unregistered group were a good deal lower than those paid by the big commercial firms. The gross product of the unregistered group was estimated at 1 170 million soles, which, in conjunction with the registered sector's 2 349 million soles, gives a total product of 3 519 million soles for the trade sector.

Table 10

PERU: ESTIMATE OF GROSS PRODUCT OF TRADE SECTOR, 1955

Active population	*Number of persons*	
Total (estimated)	175 000	
Registered	81 672	
Unregistered	93 328	
		Values (Millions of soles)
Gross income of registered sector		11 995
Plus:		
Inventories at beginning of year	2 707	
Inventories adjusted by wholesale price increases	2 910	
Inventories at end of year	3 072	
Real increase in inventories	162	162
		12 157
Minus:		
Cost-price and other purchases		9 808
Value added (gross product) of registered sector		2 349
Gross product per active person (soles)	28 761	
Remuneration per active person (soles)	10 552	
Average salary (soles)	12 540	
Value added (gross product) of unregistered sector		1 170
Active persons	93 328	
Gross product per active person (soles)	12 540 [a]	
Total gross product of trade sector		3 519

[a] Equivalent to average wages in registered sector.

(c) *Evolution of the gross product in 1945-55*

A weighted index reflecting the quantum of the staple items marketed was prepared to facilitate the calculation of the real gross product during 1945-55. In other words, the indices for agricultural production, manufacturing output and imports were averaged, and the resulting combined index, reflecting movements in the trade sector, was applied to the 1955 gross product figure to obtain the corresponding values (at constant prices) for the other years of the period (see table 11).

Table 11

PERU: ESTIMATES OF GROSS PRODUCT OF TRADE SECTOR, 1945-55

Year	*Quantum index (1955=100)*	*Gross product (Millions of soles at 1955 prices)*
1945	58.7	2 066
1946	61.9	2 178
1947	64.4	2 266
1948	65.6	2 308
1949	71.5	2 516
1950	74.8	2 632
1951	85.1	2 995
1952	86.8	3 054
1953	92.8	3 266
1954	94.4	3 322
1955	100.0	3 519

SOURCE: Calculations based on official statistics.

7. *Finance*

(a) *Active population*

The statistics used were those published by the *Banco Central de Reserva* in *La Renta Nacional del Perú.*

(b) *Gross product in 1955*

The gross product figure for 1955 is that given in *La Renta Nacional del Perú.*

(c) *Evolution of the gross product in 1945-55*

The gross product at constant prices was calculated on the basis of the series at current prices published by the *Banco Central de Reserva,* the cost-of-living index being utilized as a deflator (see table 12). To check the evolution of bank services in real terms, the volume of credit granted by the commercial and saving banks was studied, and deflated by the same index; this procedure revealed a movement parallel to that of the gross product as estimated by the first method.

8. *Real estate*

(a) *Active population*

No estimate was made of the number of persons employed in this sector during 1955. It would be safe to say, that their

Table 12

PERU: ESTIMATE OF GROSS PRODUCT OF FINANCE SECTOR, 1945-55

Year	Gross product (Millions of soles at current prices)	Cost-of-living index [a] (1955=100)	Gross product (Millions of soles at 1955 prices)
1945	108	29.6	365
1946	123	32.4	380
1947	135	41.8	323
1948	150	54.8	274
1949	191	63.0	303
1950	254	70.5	360
1951	343	77.7	441
1952	416	83.1	501
1953	551	90.6	608
1954	625	95.5	654
1955	711	100.0	711

SOURCE: *Banco Central de Reserva, La Renta Nacional del Perú.*
a Original base period: 1934-36 = 100.

number within the total active population is very small and that many of those drawing income under this head are at the same time employed in other activities and consequently appear in the appropriate groups.

(b) *Gross product in 1955*

The gross product here is the figure for property income appearing in *La Renta Nacional del Perú* under the heading "Miscellaneous", minus the sum of 50 million soles for such outlays as interest, etc., and plus the item "Real estate" transferred from the "Services" sector, after deduction of the corresponding expenditure.

(c) *Evolution of the gross product in 1945-55*

To ascertain the movements of the gross product in real terms, that is, the changes in the real volume of services offered by this sector, variations both in the over-all level of prices and in relative prices being eliminated, an estimate was made of marketable real estate for each of the years under review. As shown in table 13, the method consisted in assembling all registrations of ownership or occupancy, in both urban and rural areas, from 1925 to 1945, which gave the number of

Table 13

PERU: ESTIMATE OF GROSS PRODUCT OF REAL ESTATE SECTOR, 1945-55

Year	Register of marketable real estate (Cumulative figure)	Index (1955=100)	Gross product (Millions of soles at 1955 prices)
1925-45	27 129	73	912
1946	28 612	77	962
1947	29 935	81	1 012
1948	31 162	84	1 049
1949	32 147	87	1 087
1950	32 711	88	1 099
1951	33 319	91	1 137
1952	34 053	92	1 149
1953	34 859	94	1 174
1954	36 065	97	1 212
1955	37 000 [a]	100	1 249

SOURCE: *Anuario Estadístico del Perú.*
a Estimate.

properties existing in the latter year. To this result were added the new registrations corresponding to each year up to 1955, from which an index of the changes in the number of properties from 1945 to 1955 and, by implication some idea of the volume of services rendered by this sector were derived. Here again there is no question of measuring income, as relative price changes may have caused major or minor variations in the receipts accruing from the services effectively supplied. The index was then applied to the gross product generated by this sector in 1955 to obtain the series for the preceding years.

9. *Miscellaneous services*

(a) *Active population*

Of the total active population providing services, estimated for 1955 at 435 000 persons, about 136 000 were absorbed by the transport and communications sector, which has been discussed separately. The remaining 317 000 were distributed approximately as follows: 5 000 independent professionals, 161 000 domestic servants, 34 000 in service registered by the *Banco Central de Reserva* and another 116 000 representing the many small unregistered services. The 1955 estimates of the total population in this sector and of its composition were based essentially on the 1940 census data, to which were applied the appropriate increases in relation to the increment in the non-agricultural active population.

(b) *Gross product in 1955*

The services sector was reclassified for the purposes of these calculations so as to include those professional services, which appear in the estimates of the *Banco Central de Reserva* under

Table 14

PERU: ESTIMATES OF GROSS PRODUCT OF SERVICES SECTORS, 1955

		Millions of soles
A. Registered services		
Gross income		2 394
Less:		
Transport		577
Real estate		171
		1 646
Less:		
Inputs		548
Gross product		*1 098*
Number of persons employed	34 453	
Per capita product (soles)	31 869	
Per capita remuneration (soles)	8 480	
B. Unregistered services		
Number of persons employed	116 315	
Per capita product (soles)	8 480	
Total gross product (millions of soles)		*986*
C. Summary		
Gross product:		
Registered services		1 098
Unregistered services		986
Professional services		152
Domestic services		290
Electric energy		663
Total		3 189

SOURCE: Registered services: *Banco Central de Reserva, La Renta Nacional del Perú* (figures adjusted by exclusion of transport and real estate).

heading "Miscellaneous", and exclude activities dealt with elsewhere in the present study (transport and real estate). Registered services thus adjusted, in respect both of the gross value of production and the personnel employed and of the inputs involved, generated a gross product of 1 098 million soles in 1955. The *per capita* gross product worked out at nearly 32 000 soles, and *per capita* earnings at some 8 480 soles. For the unregistered group of services, only fragmentary data were available, but they sufficed to indicate that the level of the *per capita* product was probably not much higher than that of salaries and wages in the registered sector. On this assumption, the gross product of this unregistered group can be estimated at 986 million soles (see table 14).

Income from the professions, according to the *Banco Central de Reserva* statistics, was 152 million soles in 1955. In the case of domestic service, an average *per capita* income of 1 800 soles was estimated, on the basis of direct assessments, and with due allowance for the considerable differences between wages in the larger and smaller urban centres. As a result, this group's total income was computed at 290 million soles. A further amount of 663 million soles was included as the estimated value added in electric energy production during 1955. The sum of the various groups covered by this sector gives a total gross product from services amounting to 3 189 million soles in 1955.

(c) *Evolution of the gross product in 1945-55*

In view of the shortage of data for this sector and the variety of activities that it comprises, the presentation of product or real income figures for the decade 1945-55 becomes a somewhat difficult matter. A preliminary indication, based on salaries and wages in the registered sector deflated by the cost-of-living index, shows that the real income of employees and workers in this group remained virtually stationary owing to the abundant supply of manpower for service activities created by internal population shifts. In these circumstances, real income in the unregistered group is sure not to have varied either to any extent worth mentioning. The gross product of the sector, therefore (excluding the generation of electricity), would seem to have risen only in direct ratio to the increase in the number of people it employed. It was possible to calculate the value added in electricity services (at constant 1955 prices) for all the years of the period on the basis of the published data relating to production in terms of kWh, which, expressed in the form of an index, were applied to the value added in 1955. The total gross product of the services sector is shown in table 15.

Table 15

PERU: EVOLUTION OF GROSS PRODUCT OF SERVICES SECTORS, 1945-55
(Millions of soles at 1955 prices)

Year	Population employed (1940=100)	Gross product excluding electricity	Electric energy (Value added)	Total gross product
1945	110.85	2 115	231	2 346
1946	113.02	2 156	252	2 408
1947	115.19	2 199	281	2 480
1948	117.36	2 239	314	2 553
1949	119.53	2 282	357	2 639
1950	121.70	2 323	365	2 688
1951	123.87	2 363	396	2 759
1952	126.04	2 406	439	2 845
1953	128.21	2 447	499	2 946
1954	130.38	2 487	576	3 063
1955	132.58	2 526	663	3 189

10. *Government*

(a) *Active population*

According to the statistics published by the *Banco Central de Reserva*, the number of persons employed in the Government sector during 1955 rose to 117 600, including such public administration personnel as civil servants, teachers in State schools, the armed forces, manual workers etc. The evolution of employment in this sector is shown in table 16 and reveals a gradual upward movement in the course of the decade except for 1946 when the total soared to 98 690 persons from 85 036 in the preceding year.

(b) *Gross product in 1955*

Figures for the Government sector were taken directly from the data presented by the *Banco Central de Reserva*, except that the item "Expenditure on material" was excluded, since these outlays constitute purchases from other sectors and should therefore be discounted in the calculation of the gross product or value added. The value added, equivalent in this case to personnel expediture was thus 2 514 million soles.

(c) *Evolution of the gross product in 1945-55*

The gross product for the period 1945-55, expressed in terms of constant 1955 prices, was estimated on the basis of existing statistics for the active population in this sector and the date on the *per capita* gross product in 1955. It was postulated that the *per capita* gross product, or, in other words the services rendered by each individual underwent no variation during the period. On this assumption, the increase in the total gross product would be a direct function of the number of persons employed (see table 16). But this does not imply that no change took place in income; on the contrary, data on salaries and wages suggest that in real terms—that is, if effects of price fluctuations are disregarded—they rose considerably during the decade under review.

Table 16

PERU: EVOLUTION OF GROSS PRODUCT OF GOVERNMENT SECTOR, 1945-55

Year	Public administration personnel, etc. (Number of active persons)	Gross product (Millions of soles at 1955 prices)
1945	85 036	1 818
1946	98 690	2 110
1947	101 224	2 164
1948	103 889	2 221
1949	106 339	2 273
1950	108 997	2 330
1951	110 472	2 362
1952	110 559	2 363
1953	112 704	2 409
1954	114 927	2 457
1955	117 603	2 514

SOURCE: *Banco Central de Reserva, La Renta Nacional del Perú.*

II. GROSS PRODUCT, GROSS INCOME AND AVAILABLE GOODS AND SERVICES

The concepts of gross product, gross income and available goods and services, as used in this study, are identical with those adopted in other CEPAL publications.[2] Gross income is

[2] See "Special note on the concepts and methods used by ECLA

equivalent to the gross product plus the terms-of-trade effect; available goods and services correspond to the arithmetical sum of the gross product plus or minus the surplus or deficit in the balance of payments on current account; and consumption represents the difference between total available goods and services and investment, which is calculated separately.

As the relevant tables have already been presented in the appropriate sections, nothing need be added here but some explanation regarding the methodology and procedures adopted in calculating the investment series. Investment was estimated on the basis of its main components, i.e., capital goods imports, domestic production of capital goods, costs of installing equipment and construction works. These components make up fixed investment, to which changes in inventories are added in order to assess total investment. The calculations relating to total investment in 1955 are given in table 17.

In order to express investment in the other years of the period 1945-55 in terms of currency units with constant purchasing power, a weighted index reflecting changes in volume during the period mentioned was constructed from a sub-index of the volume of construction activities and another of the quantum of imports of capital goods. The respective weightings were estimated on the basis of the 1955 value of each of these magnitudes. The application of this index to the value of fixed investment in 1955 provided the corresponding series for the years from 1945 onwards. Lastly, changes in inventories, reduced to real terms and expressed in 1955 prices, were combined with the foregoing figures to give total investment for the whole period (see table 18).

in its analyses of economic development", *loc. cit.*, where these concepts are explained in detail.

Table 17

PERU: ESTIMATE OF INVESTMENT, 1955
(Millions of soles)

A. *Imports of machinery and equipment*		3 160
For agriculture	301	
For industry and mining	1 352	
For transport and communications	454	
Additional charges for customs duties, internal transport and other expenses (50 per cent)	1 053	
B. *Domestic production of capital goods* [a]		394
C. *Installation of equipment, construction and other works*		2 283
Imports of building materials	428	
Domestic production of building materials	672	
Salaries and wages	403	
Other outlays (including profits)	780	
D. *Changes in inventories*		303
At current values	665	
Attributable to price increases	362	
Increment in real terms	303	
E. *Total investment*		6 140

SOURCE: Calculations based on official data.
a Including an additional 30 per cent for transport and other expenses.

Table 18

PERU: EVOLUTION OF INVESTMENT, 1945-55

Year	*Weighted index of imports of capital goods and construction activities (1955=100)*	*Fixed investment*	*Changes in inventories*	*Total investment*
		(Millions of soles at 1955 prices)		
1945	47.7	2 784	— 162	2 622
1946	66.2	3 864	1 184	5 048
1947	66.0	3 852	75	3 927
1948	58.9	3 438	— 253	3 185
1949	64.3	3 753	220	3 973
1950	65.3	3 812	37	3 849
1951	99.3	5 796	356	6 152
1952	96.0	5 604	413	6 017
1953	111.8	6 525	419	6 944
1954	89.9	5 247	91	5 338
1955	100.0	5 837	303	6 140

SOURCE: Calculations based on official data.

III. STOCK OF CAPITAL AND THE PRODUCT-CAPITAL RATIO

For want of systematic data on the stock of capital—defined in terms of depreciated capital at replacement cost—calculations had to be based on the few partial data available. Whatever the shortcomings of the estimates that it was ultimately possible to prepare, they are unquestionably preferable to mere book values, which in most instances represent the cost of purchase at different periods and ignore the revaluation of assets. For the three main sectors of the economy—agriculture, mining and industry—the stock of capital in 1955 was calculated, while in the case of services, gross product data were utilized to establish the capital invested in the sectors concerned, certain product-capital ratios being assumed by analogy with other Latin American countries whose economic structure is similar to Peru's.

The elements taken into account in calculating the depreciated capital of the agricultural sector comprised soil improvement, building (including housing), erection of fences, permanent plantations, and livestock and farm equipment. In the case of mining, published data were available, from which capital and reserves were seen to total 8 345 million soles. For industry a special calculation was made on the basis of imports of industrial machinery. The method consisted in essence in noting all imports of this type of machinery as from 1925, making allowance for gradual depreciation and thus obtaining the total stock of depreciated industrial capital in 1955. To this figure a coefficient for customs duties and installation outlays was applied, in order to find the price "at site" of the machinery imported. Finally, the value of land and buildings was added to this sum, giving the total fixed capital for 1955. Capital in the transport, energy and property income sectors

Table 19

PERU: ESTIMATES OF STOCK OF CAPITAL AND PRODUCT-CAPITAL RATIO, 1955

	Gross product	*Capital*	*Product-capital ratio*
	(Millions of soles)		
Agriculture	9 693	16 802	0.58
Mining [a]	2 427	8 345	0.29
Industry [b]	5 323	12 942	0.41
Transport	2 243	7 235	0.31
Energy	663	7 367	0.09
Real estate	1 249	10 408	0.12
Other activities	10 222	17 624	0.58
Total	32 048	80 723	0.40

a Including refining of petroleum and metal ores.
b Excluding refining of petroleum and metal ores.

and in other services was estimated on the basis of the 1955 gross product of each, with the help of the product-capital ratio noted in other Latin American countries. Accordingly, the total capital of the Peruvian economy in 1955 was estimated at 80 723 million soles (see table 19).

If the data on the stock of capital are taken together with the foregoing estimates of the gross product, the product-capital ratio can be established. This concept is essentially a measure of the productivity of capital. For the economy as a whole it was 0.40 (see again table 19), although considerable differences are observable from one sector to another.

On the basis of the 1955 figures, the stock of capital in the other years covered by the period 1945-1955 can now be estimated by the use of the investment data presented earlier. It is estimated that part of the total investment of 6 140 million dollars calculated for 1955 was used as a depreciation reserve, or, in other words, to keep the stock of capital intact, while the remainder—that is, net investment—constituted the increase in the stock of capital in relation to the preceding year. If the annual rate of depreciation is assumed to have been 4 per cent, which would mean that the average useful life of equipment was 25 years, a sum of 3 228 million soles was needed for the depreciation reserve in 1955. By subtraction, therefore, net investment was in the neighbourhood of 2 912 million soles. In 1954, capital must have been the same as in 1955 (80 723 million soles) less net investment in 1955, i.e., 77 811 million soles. These calculations are repeated for each of the other years in turn (see table 20). If the gross product in each year is related to the corresponding capital, the product-capital ratio for the whole period 1945-55 can be obtained (see again table 20).

Table 20

PERU: ESTIMATE OF CAPITAL AND PRODUCT-CAPITAL RATIO, 1945-55

Year	*Gross product* P_g (1)	*Increase in gross product* ΔP_g (2)	*Stock of capital* C_s (3)	*Product-capital ratio* $R_{p/c}$ (1) : (3) (4)	*Gross investment* I_g (5)	*Depreciation* (3) $\times \frac{D_4}{100}$ (6)	*Net investment* I_n (5)—(6) (7)
1945	19 698		57 658	0.34	2 622	2 306	316
1946	20 394	696	60 294	0.34	5 048	2 412	2 636
1947	20 973	579	61 751	0.34	3 927	2 470	1 457
1948	21 765	792	62 438	0.35	3 185	2 498	687
1949	23 308	1 543	63 857	0.37	3 973	2 554	1 419
1950	24 477	1 169	65 102	0.38	3 849	2 604	1 245
1951	26 422	1 945	68 513	0.39	6 152	2 741	3 411
1952	27 327	905	71 664	0.38	6 017	2 866	3 151
1953	29 629	2 302	75 585	0.39	6 944	3 023	3 921
1954	30 950	1 321	77 811	0.40	5 338	3 112	2 226
1955	32 048	1 098	80 723	0.40	6 140	3 228	2 912

Annex II

ESTIMATES OF THE QUANTUM OF INDUSTRIAL PRODUCTION FOR 1945-56

No official data are available in Peru to show how industrial production really evolved over any fairly considerable length of time. Much of this study is based on ECLA estimates which at least show the general lines followed by the quantum of production of manufacturing as a whole and of its principal branches. This work was done in collaboration with the Department of Mathematical Statistics and Research (*Departamento de Estadística Matemática e Investigaciones*) of the National Statistical Service (*Dirección Nacional de Estadística*) of Peru. The limited time at the group's disposal and the immediate requirements of the analysis made it advisable to confine the estimates in question to the period 1945-56. A detailed account of the methodological criteria and background data utilized is given below with various purposes in mind: to obtain an objective opinion regarding the relative validity, possible shortcomings and margins of error of the figures adopted; to incorporate any corrections or changes that may seem advisable; to present the data needed to bring the estimates up to date or extend them to earlier years; and, lastly, to encourage further research which might lead to more accurate and complete estimates.

Indices of the quantum of industrial production are usually based on an industrial census and on statistical series covering a fairly comprehensive and homogeneous sample of enterprise. In the present case, neither of these requisites was forthcoming; no industrial census has so far been taken in Peru, and statistical series display the same defects as in most Latin American countries.[1] Hence the only solution was to adopt indirect criteria, in lieu of better sources of basic information.

The problems raised are in essence twofold. One aspect relates to the variations in the quantum of production of specific industries, and the other to the weighting of these partial indices in order to estimate others for broader groups of manufacturing activity or for industry as a whole.

1 Paradoxical as it may seem, the gradual improvement of the compilation of basic data itself gives rise to additional difficulties in connexion with the construction of indices by traditional methods. For example, the fact that a progressively larger number of enterprises is registered makes it hard to estimate how much of the production increment indicated by the statistical series is attributable to the increase in the number of firms submitting reports and how far it is really due to an expansion of domestic production. According to the industrial statistics supplied by the Department of Industry and Electricity (*Dirección de Industrias y Electricidad*) of the Ministry of Development and Public Works (*Ministerio de Fomento y Obras Públicas*), 2 606 enterprises were registered in 1954 and 2 918 in 1955.

I. ESTIMATES OF QUANTUM OF PRODUCTION IN SPECIFIC INDUSTRIES

The first step in the preparation of these estimates consisted in selecting as homogeneous as possible a list of industries representative of all branches of manufacturing industry. Broadly speaking, this selection corresponds to the relevant groups of the United Nations International Standard Industrial Classification of all Economic Activities. For some of the branches of industry concerned, it was relatively easy to obtain reliable data on the effective volume of production, either because the goods are manufactured in a limited number of registered establishments or because the line of production in question is subject to indirect or specific taxes (as in the case of cigarettes, alcoholic beverages, etc.). Where this was so, direct use was made of the effective production statistics thus assembled. It was not the case, however, with the great majority of branches of industry, for which it was assumed in principle that their volume of production must have fluctuated in much the same way as the consumption of particular raw materials which normally constitute inputs directly proportional to total output.

Table 1

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTIONS OF MEAT INDUSTRIES (SLAUGHTERING, PREPARATION AND PRESERVING), 1945-56 [a]

(Volumes in tons; values in thousands of soles)

Year	*Beef*		*Mutton*		*Pork*		*Goat meat*		*Index (1954 = 100)*
	Volume	*Value*	*Volume*	*Value*	*Volume*	*Value*	*Volume*	*Value*	
1945	14 107	22 994	900	1 539	1 865	4 066	4	7	55.5
1946	11 334	19 608	723	1 150	1 041	2 603	17	23	43.1
1947	13 067	26 917	844	1 562	2 552	11 154	79	134	54.4
1948	8 967	20 175	758	1 402	3 402	17 012	5	9	43.1
1949	9 990	30 469	616	1 633	3 457	21 260	46	116	46.3
1950	17 498	83 116	1 896	9 953	3 119	18 717	381	1 905	75.1
1951	17 976	85 384	1 795	9 622	3 706	23 049	251	1 254	77.9
1952	17 438	83 879	1 691	9 720	3 965	27 758	188	963	76.4
1953	24 857	174 496	1 638	11 791	3 744	29 243	234	1 606	100.2
1954	24 060	194 882	2 150	11 768	3 919	31 353	329	2 516	100.0
1955	27 078	219 334	2 024	15 423	3 599	28 793	327	2 488	108.5
1956	24 810	212 128	1 992	15 860	4 042	39 172	395	3 109	102.6

SOURCE: National Statistical Service (*Dirección Nacional de Estadística*), *Anuarios Estadísticos* (*Statistical Yearbooks*).
a Animals slaughtered at the National Refrigerating Plant (*Frigorífico Nacional*).

In the selection of these raw materials, priority was given as far as possible to those of which the entire supply is imported, and for which more systematic and regular statistical records are therefore available.[2]

The criteria adopted in each case are given below.

1. *Slaughtering, preparation and preserving of meat*

The data on livestock slaughtered at the National Refrigerating Plant (*Frigorífico Nacional*) was used as the basis for estimating the index of the quantum of production in these activities. The basic series are shown in table 1, together with the final index, which was calculated by adding together the annual values for each type of livestock, at constant 1954 prices, to obtain the total value of slaughtering at the same year's prices.

2. *Manufacture of dairy products*

The quantum index of production in these industries was estimated on the basis of the volume of output in three specific lines: the processing of powdered, evaporated and condensed milk, etc., and the making of cheeses and butter. As in the preceding case, the method used was based on the annual amounts registered for each of these types of commodity, valued at constant 1954 prices. The final index was deduced from the annual sums of these three series of values (see table 2).

Table 2

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF DAIRY PRODUCTS, 1945-56

Year	*Milk (powdered, condensed, etc.)*	*Cheese*	*Butter*	*Index (1954=100)*
		(Tons)		
1945 . . .	3 650	6 400	1 600	61.8
1946 . . .	4 000	6 800	1 700	66.1
1947 . . .	5 900	7 300	1 800	75.8
1948 . . .	6 330	8 838	2 313	90.6
1949 . . .	6 760	9 200	2 300	93.7
1950 . . .	7 200	8 238	2 250	89.7
1951 . . .	7 640	7 778	1 775	83.5
1952 . . .	8 080	7 795	1 635	83.4
1953 . . .	8 520	8 640	2 376	97.3
1954 . . .	8 945	8 802	2 420	100.0
1955 . . .	11 126	8 805	2 430	107.1
1956 . . .	14 180	8 000	2 450	112.8
Price per kg in 1954 (soles) . .	6.0	9.5	21.0	

SOURCES: Milk products: estimates based on statistics supplied directly by enterprises. Butter and cheese: *Banco Central de Reserva, La Renta Nacional del Perú.*

3. *Canning industries*

Fish processing accounts for a high proportion of these activities; its quantum index is therefore based partly on the volume of production of tinned sea food. As data on the latter covered only the period 1952-56, its previous evolution had to be estimated on the basis of fluctuations in the consumption of tinplate, which was taken to be representative of the quantum of production in this branch of industry before 1952, especially as prefabricated containers were not then imported. The basic series and the relevant index are given in table 3.

Table 3

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF CANNING INDUSTRIES, 1945-56

Year	*Production of tinned fish (Thousands of crates of 48 half-lb tins)*	*Imports of tinplate (Tons)*	*Index (1954=100)*
1945		2 000	34.2
1946		2 006	34.2
1947		2 087	35.7
1948		2 213	37.8
1949		3 049	52.0
1950		3 176	54.3
1951		4 654	79.5
1952	1 090	4 843	82.6
1953	1 034	6 226 [a]	78.3
1954	1 320	8 776 [a]	100.0
1955	1 510	8 220 [a]	114.4
1956	1 600		121.2

SOURCES: Production: National Fisheries Association (*Sociedad Nacional de Pesquería*). Imports of tinplate: *Anuarios de Comercio Exterior.*
a Data not utilized in the construction of the index

4. *Manufacture of grain mill products*

This is one of the branches of industry for which it is very difficult to obtain complete data on the volume of production. As the most important of these activities is the milling of wheat, it was considered best to estimate the quantum of production on the basis of total consumption (production plus imports) of wheat in terms of grain. The basic figures and the corresponding index are shown in table 4.

Table 4

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF GRAIN MILL PRODUCTS, 1945-56

Year	*Wheat production*	*Wheat imports*	*Apparent consumption of wheat*	*Index (1954=100)*
		(Tons)		
1945 . . .	85 954	159 974	245 928	60.9
1946 . . .	90 649	110 178	200 827	49.7
1947 . . .	126 958	138 867	265 825	65.8
1948 . . .	136 773	144 273	281 046	69.6
1949 . . .	129 056	203 983	333 039	82.5
1950 . . .	143 807	242 601	386 408	95.7
1951 . . .	156 568	195 946	352 514	87.3
1952 . . .	162 110	232 952	395 062	97.9
1953 . . .	168 732	253 986	422 718	104.7
1954 . . .	162 502	240 719	403 221	100.0
1955 . . .	151 947	298 370	450 316	111.5
1956 . . .	123 308	285 202	408 510	101.3

SOURCES: Production: National Statistical Service, *Anuarios Estadísticos.* Imports: *Anuarios de Comercio Exterior.*

5. *Manufacture of bakery products*

The situation here was much the same as for the preceding industries. The quantum index was estimated on the basis of consumption of flour, in accordance with the basic series in table 5.

2 The method is similar to that employed in *Analyses and projections of economic development. Vol. III: The economic development of Colombia* (E/CN.12/365 Rev.1), United Nations publication (Sales No.: 1957.II.G.3). For the general characteristics and possible drawbacks of this method, see annex VIII of the above-mentioned study, "Note on sources and methods used in the construction of the quantum indices of industrial production", pp. 417 *et seq.*

Table 5

PERU: ESTIMATES OF QUANTUM INDEX MANUFACTURE OF BAKING PRODUCTS, 1945-56

Year	Flour production [a]	Flour imports	Apparent consumption of flour	Index (1954=100)
	(Tons)			
1945	177 068	12 053	189 121	62.7
1946	144 595	5 373	149 968	49.7
1947	191 394	6 153	197 547	65.5
1948	202 353	6 445	208 798	69.2
1949	239 788	11 538	251 326	83.3
1950	278 214	2 288	280 502	93.0
1951	253 810	6 915	260 725	86.4
1952	284 445	6 208	290 653	96.3
1953	304 360	3 976	308 336	102.2
1954	290 319	11 404	301 723	100.0
1955	324 228	5 417	329 645	109.3
1956	294 127	7 013	301 140	99.8

SOURCES: Imports: *Anuarios de Comercio Exterior.*
a Estimate based on apparent consumption of wheat—as shown in table 4—and an extraction coefficient of 75 per cent.

Table 6

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF SUGAR FACTORIES AND REFINERIES, 1945-56

Year	Sugar production (Tons)	Index (1954=100)
1945	423 110	66.6
1946	397 200	62.5
1947	431 970	67.9
1948	497 860	78.3
1949	493 075	77.6
1950	451 532	71.0
1951	489 873	77.1
1952	493 647	77.6
1953	626 373	98.5
1954	637 621	100.0
1955	677 526	106.5
1956	717 773	112.6

SOURCE: Production: National Statistical Service, *Anuarios Estadisticos.*

Table 7

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF COCOA, CHOCOLATE AND CONFECTIONERY, 1945-56

Year	Cacao production	Cacao imports	Apparent consumption of cacao	Index (1954 = 100)	
	(Tons)			Annual figure	Three-term average movable
1945	2 590	530	3 120	75.6	81.4
1946	2 854	1 063	3 919	94.9	97.8
1947	3 890	1 275	5 165	125.1	99.0
1948	3 220	43	3 263	79.1	100.8
1949	4 060	84	4 144	100.4	93.1
1950	4 080	136	4 216	102.1	107.9
1951	5 000	88	5 088	123.3	109.5
1952	4 300	37	4 337	105.1	108.8
1953	4 080	52	4 132	100.1	101.2
1954	4 080	47	4 127	100.0	100.0
1955	4 200	11	4 211	102.0	101.1
1956	4 260	7	4 267	103.4	102.2

SOURCES: Production: *Banco Central de Reserva, La Renta Nacional del Perú.* Imports: *Anuarios de Comercio Exterior.*

Table 8

PERU: ESTIMATES OF QUANTUM INDICES OF PRODUCTION OF WINE, SPIRITS AND BEER INDUSTRIES, 1945-56

Year	Production of wine		Production of spirits		Production of beer	
	Thousands of litres	Index (1954=100)	Thousands of litres	Index (1954=100)	Thousands of litres	Index (1954=100)
1945	10 926	144.7	734	62.3	34 956	37.9
1946	11 253	149.1	966	82.0	36 158	39.2
1947	11 967	158.5	1 096	93.0	35 448	38.4
1948	12 048	159.6	1 001	85.0	31 634	34.3
1949	11 566	153.2	1 103	93.6	33 386	36.2
1950	10 244	135.7	993	84.3	44 436	48.2
1951	10 308	136.5	1 147	97.3	55 556	60.2
1952	8 605	114.0	1 132	96.1	66 264	71.8
1953	7 531	99.6	1 133	96.1	80 968	87.8
1954	7 551	100.0	1 178	100.0	92 266	100.0
1955	10 858	143.8	1 161	98.5	98 002	106.2
1956	10 005	132.5	1 141	96.9	98 462	106.7

SOURCE: Basic data supplied by the Alcohol and Sugar Department, Deposit and Remittance Office (*Caja de Depósitos y Consignaciones*).

Table 9

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF THE SOFT DRINKS AND MINERAL WATERS INDUSTRIES, 1945-56

(Quantities in thousands of litres; values in thousands of soles)

A. *1952-56*

Year	Production		Values at 1954 prices			Index (1954=100)
	Mineral waters	Soft drinks	Mineral waters	Soft drinks	Total	
1952	9 256	45 083	12 588	82 052	94 640	93.6
1953	9 104	52 485	12 381	95 523	107 904	106.7
1954	8 386	49 271	11 405	89 673	101 078	100.0
1955	8 766	46 440	11 922	84 521	96 443	95.4
1956	8 074	43 880	10 981	79 862	90 843	89.9
Average price per litre in 1954	1.36	1.82				

B. *1945-51*

Year	Index (1954 = 100)		Average index [a]
	Production of mineral waters	Imports of concentrates for soft drinks	
1945	93.7	14.0	22.9
1946	99.1	22.6	31.0
1947	107.5	44.7	51.6
1948	114.9	43.5	51.4
1949	102.1	46.3	52.4
1950	97.3	53.9	58.7
1951	115.1	62.0	67.8

SOURCES: Production 1952-56: Alcohol and Sugar Department, Deposit and Remittance Office. Prices in 1954: Ministry of Development and Public Works, *Estadística Industrial, 1954*. Imports: *Anuarios de Comercio Exterior* (items 1 002 and 1 003).

a Average weighted by the corresponding 1954 values.

6. *Sugar factories and refineries*

As relatively precise data on total sugar processing in Peru are available, direct use was made of the series referring to the volume processed annually in order to compute the quantum index (see table 6).

7. *Manufacture of cocoa, chocolate and confectionery*

These estimates were based on apparent consumption of cacao (production plus imports), in view of the impossibility of obtaining reliable data on the effective volume of production directly. In order to neutralize to some extent the sharp annual fluctuations in the figures thus computed, a movable average of three terms of the resulting index was used (see table 7).

8. *Production of wine, spirits and beer*

In this case, direct data on the volume of production were available, since these beverages are subject to specific taxes on every unit produced. The amounts and indices in question are given in table 8.

9. *Production of soft drinks and mineral waters*

Direct data on the volume of production were available in respect of these activities only as from 1952. The quantum index for 1952-56 was therefore estimated on the basis of the appropriate series of values at 1954 prices (see table 9, part A). For 1945-51 the only information on output is for mineral waters. In the case of other soft drinks it was calculated that fluctuations in the volume of production must have been similar to those registered in imports of concentrates for their manufacture. The corresponding quantum index was therefore estimated as a weighted average of the indices resulting from these two series (see table 9, part B).

10. *Tobacco manufactures*

For this activity the index of the quantum of production was based directly on the series for the manufacture of cigarettes, on which reliable data can usually be obtained. The relevant figures are given in table 10.

11. *Manufacture of cotton textiles*

Estimates of the quantum of production in this activity were very difficult to obtain through direct output statistics, and

Table 10

PERU: ESTIMATES OF QUANTUM INDEX OF TOBACCO MANUFACTURES, 1945-56

Year	Manufacture of cigarettes (Millions of units)	Index (1954=100)
1945	1 439	60.0
1946	1 498	62.1
1947	1 712	71.0
1948	1 716	71.1
1949	2 008	83.3
1950	2 144	88.9
1951	2 081	86.3
1952	2 067	85.7
1953	2 270	94.1
1954	2 411	100.0
1955	2 596	107.7
1956	2 141	88.8

SOURCE: National Statistical Service, *Anuario Estadístico*.

Table 11

PERU: ESTIMATES OF QUANTUM INDEX OF COTTON TEXTILE MANUFACTURES, 1945–56

Year	Consumption of cotton		Imports of yarn	Total consumption of yarn	Index (1954 = 100)
	Raw	In terms of yarn			
	(Tons)				
1945 . . .	11 500	9 775	46	9 821	72.3
1946 . . .	11 114	9 447	96	9 543	70.3
1947 . . .	12 006	10 205	290	10 495	77.3
1948 . . .	13 683	11 631	87	11 718	86.3
1949 . . .	14 530	12 350	59	12 409	91.4
1950 . . .	12 429	10 565	75	10 640	78.4
1951 . . .	12 835	10 910	109	11 019	81.1
1952 . . .	12 121	10 303	109	10 412	76.7
1953 . . .	13 680	11 628	126	11 754	86.6
1954 . . .	15 914	13 527	53	13 580	100.0
1955 . . .	14 851	12 624	50	12 674	93.3
1956 . . .	14 836	12 611	57	12 668	93.3

SOURCES: Consumption of raw cotton: *Banco Central de Reserva, La Renta Nacional del Perú*. Imports of yarn: *Anuarios de Comercio Exterior* (items 1496 and 1400).

Table 12

PERU: ESTIMATES OF QUANTUM INDEX OF WOOLLEN TEXTILE MANUFACTURES, 1945-56

(Volumes in tons)

Year	Consumption of wool			Imports of yarn	Total consumption of yarn	Index (1954=100)
	Greasy	Imports of washed and waste	Total in terms of yarn			
1945	5 603	33	1 704.0	10	1 714.0	67.0
1946	7 786	181	2 462.5	31	2 493.5	97.5
1947	6 910	29	2 093.3	15	2 108.3	82.4
1948	7 749	31	2 346.4	54	2 400.4	93.9
1949	7 891	4	2 370.1	16	2 386.1	93.3
1950	6 141	12	1 850.7	29	1 879.7	73.5
1951	6 788	54	2 074.2	27	2 101.2	82.2
1952	8 679	23	2 619.8	45	2 664.8	104.2
1953	7 061	26	2 136.5	44	2 180.5	85.3
1954	8 362	29	2 528.9	27	2 555.9	100.0
1955	9 955	54	3 024.3	26	3 050.3	119.3
1956	8 397	61	2 561.8	36	2 597.8	101.6

SOURCES: Consumption of greasy wool: *Banco Central de Reserva, La Renta Nacional del Perú*. Imports of washed and waste: *Anuarios de Comercio Exterior* (items 1464 and 1470). Imports of yarn: *Anuarios de Comercio Exterior* (items 1493 to 1495).

Table 13

PERU: ESTIMATES OF QUANTUM INDEX OF ARTIFICIAL FIBRE TEXTILE MANUFACTURES, 1945-56

(Volumes in tons)

Year	Production	Imports	Consumption	Index (1954=100)
1945 . . .	—	39	39	1.6
1946 . . .	—	42	42	1.8
1947 . . .	198	47	245	10.3
1948 . . .	313	137	450	18.9
1949 . . .	564	193	757	31.8
1950 . . .	651	477	1 128	47.5
1951 . . .	611	968	1 579	66.4
1952 . . .	602	626	1 228	51.7
1953 . . .	629	826	1 455	61.2
1954 . . .	1 000	1 377	2 377	100.0
1955 . . .	1 198	1 532	2 730	114.8
1956 . . .	1 141	2 119	3 260	137.1

SOURCES: Production: direct information from the producer enterprises. Imports: *Anuarios de Comercio Exterior* (items 1461, 1462, 1491 and 1491-A).

were therefore based on cotton consumption (production minus exports), to which a small quantity of imported cotton yarn was added. To make the figures for raw cotton and yarn more strictly comparable, the former were expressed in terms of yarn, an approximate coefficient of 0.85 being applied (see table 11).

12. *Manufacture of woollen textiles*

The method of calculation was similar to that adopted in the case of the cotton textile industry. The quantum index thus reflected the fluctuations in consumption of domestically-produced wool and imports of woollen yarn, the former having been expressed in terms of yarn through the utilization of an average coefficient of 0.3 (see table 12).

13. *Manufacture of artificial fibre textiles*

These estimates were also based on yarn consumption (domestic production plus imports). The basic figures are presented in table 13. It should be noted that production of artificial fibre yarns is included later on as one of the sub-divisions of the chemicals industry so that the index referred to here relates exclusively to weaving.

14. *Manufacture of wearing apparel and made-up textile goods*

This is one of the manufacturing activities for which it was most difficult to estimate production in real terms. In the first place, there were so many small establishments that it was impossible to assess the quantum of production on the basis of the direct information supplied by a fairly limited number of enterprises, because it is very difficult to judge how representative they are of the whole. After various approximate indicators had been tried out, it was thought best to adopt, for purposes of a purely provisional estimate, the assumption that fluctuations in the quantum of production were probably similar to those in cumulative sewing-machine inventories. The practical procedure, therefore, consisted in computing cumulative imports of such machines as from 1935, valued at constant 1955 prices, and constructing the index on the basis of the cumulative total up to each of the years covered by the period 1945-56 (see table 14). Properly speaking, the estimate of cumulative imports ought to have been confined to industrial sewing-machines. But this was not done because the foreign trade yearbooks mention these machines separately only as from 1947.

Table 14

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF WEARING APPAREL AND MADE-UP TEXTILE GOODS, 1935-56

(Values in thousands of soles at constant 1955 prices)

Year	Imports of sewing-machines		Index (1954=100)
	Annual figure	Cumulative figure as from 1935	
1935	10 954		
1936	17 588		
1937	19 109		
1938	18 866		
1939	17 649		
1940	19 839		
1941	17 283		
1942	10 467		
1943	3 651		
1944	10 285		
1945	9 189	154 880	41.4
1946	12 658	167 538	44.8
1947	9 615	177 153	47.4
1948	1 765	184 819	49.5
1949	2 556	196 677	52.6
1950	3 225	207 008	55.4
1951	5 051	234 452	62.7
1952	3 286	269 193	72.0
1953	7 181	318 334	85.2
1954	5 477	373 736	100.0
1955	6 390	440 154	117.8
1956	9 555	531 920	142.3

SOURCE: For imports of sewing-machines: *Anuarios de Comercio Exterior.*

15. *Manufacture of footwear*

Here again no direct production statistics were available. The relevant estimates were therefore based on the series for total consumption of dressed hides, both domestically-produced and imported. In the last analysis, the quantum index was deduced as a weighted average of the leather industry production index and an index for the quantum of imports of similar goods. The relevant weightings were 90 per cent for the former and 10 per cent for the latter, this estimate having been based in turn on the raw materials of each type purchased by the sample of such establishments that submitted reports to the Department of Industry in 1954 (see table 15).

Table 15

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF FOOTWEAR, 1945-56

(1954 = 100)

Year	Quantum index of production of leather industry	Quantum index of imports of dressed hides [a]	Average index [b]
1945	55.5	30.8	53.0
1946	43.1	24.0	41.2
1947	54.4	12.1	50.2
1948	43.1	1.3	38.9
1949	46.3	17.9	43.5
1950	75.1	40.1	71.6
1951	77.9	50.4	75.1
1952	76.4	52.3	74.0
1953	100.2	100.8	100.3
1954	100.0	100.0	100.0
1955	108.5	108.7	108.6
1956	102.6	127.0	105.0

SOURCES: Production of leather industry: see table 1. Imports of dressed hides: *Anuarios de Comercio Exterior.*

a Index obtained by valuing annual imports at constant 1955 prices.

b With weightings of 90 and 10 per cent for production and imports, respectively.

16. *Wood manufactures*

In this instance the quantum index was based on the estimated annual production of timber (see table 16).

Table 16

PERU: ESTIMATES OF QUANTUM INDEX OF WOOD MANUFACTURES, 1945-56

(Quantities in thousands of cubic feet) [a]

Year	Timber production	Index (1954=100)
1945	14 675	29.6
1946	24 359	49.2
1947	29 758	60.1
1948	39 150	79.0
1949	39 553	79.9
1950	42 783	86.4
1951	43 520	87.9
1952	49 100	99.1
1953	46 545	94.1
1954	49 526	100.0
1955	55 684	112.4
1956	57 653	116.4

a Estimates of output of sawn timber in the producer areas.

Table 17

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF PAPER AND BOARD, 1945-56
(Tons)

Year	Production of paper and board						Value at 1954 prices (Thousands of soles)	Index (1954=100)
	Writing and printing paper	Kraft and wrapping paper	Toilet paper	Board and paperboard	Other types of paper and board	Total		
1945	2 623	5 839	89	3 843	1 034	13 428	41 363	65.2
1946	2 262	6 876	153	4 996	734	15 021	41 000	64.6
1947	1 901	7 427	217	6 148	922	16 615	41 743	65.7
1948	2 480	8 113	361	5 417	402	16 773	45 350	71.5
1949	2 728	8 901	541	6 547	443	19 160	51 241	80.6
1950	2 709	6 443	520	4 886	433	14 991	44 092	69.4
1951	2 930	10 299	500	8 128	420	22 277	57 077	89.9
1952	1 974	11 322	496	7 425	325	21 542	50 587	79.7
1953	2 561	12 219	756	7 663	678	23 877	60 120	94.6
1954	2 515	13 196	830	9 939	403	26 883	63 455	100.0
1955	2 908	14 689	1 091	9 088	688	28 464	71 233	112.1
1956	3 150	16 695	1 200	12 687	800	34 532	82 199	129.4
Average price in 1954 (soles per Kg)[a]	7.73	2.05	5.29	1.09	4.31			

SOURCES: Production: direct information from enterprises.
a Figures deduced from data on volume and value of production in 1954, as given by the Ministry of Development, Department of Industries and Electricity, *Estadística Industrial*. Prices relate to bond paper, kraft, toilet paper, ordinary board and paper for envelopes and cover-pages.

17. *Manufacture of paper and board*

As production is centralized in a few establishments, direct data were forthcoming on the volume of production of the various types of paper and board. The pertinent quantum index was computed by valuing this output at constant 1954 prices, as shown in table 17.

18. *Manufacture of articles of paper and board*

For these industries, in contrast to the preceding group, no direct statistical data on the annual volume of production were available. It was therefore decided to base the estimate of the quantum index concerned on total consumption of board (domestically-produced and imported) (see table 18).

19. *Printing, publishing and allied industries*

The best indication of the quantum of production of these industries was given by the evolution of consumption of newsprint and other types of writing and printing paper (see table 19).

20. *Manufacture of leather and leather products*

In view of the impossibility of obtaining direct production statistics for these products, total availabilities of the various types of leather were used as an indicator of the evolution of production in these industries, in real terms. As imports of hides are negligible, only domestic production was taken into account. Hence the relevant index is the same as that for slaughtering (see again table 1).

21. *Manufacture of rubber products*

The quantum index is based on annual figures for apparent consumption of raw rubber (see table 20). As in other cases, a

Table 18

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF ARTICLES OF PAPER AND BOARD, 1945-56

Year	Consumption of board (Tons)			Index (1954=100)
	Production	Imports	Apparent consumption	
1945	3 843	87	3 930	36.2
1946	4 996	89	5 085	46.9
1947	6 148	106	6 254	57.6
1948	5 417	127	5 544	51.1
1949	6 547	159	6 706	61.8
1950	4 886	158	5 044	46.5
1951	8 128	393	8 521	78.5
1952	7 425	294	7 719	71.1
1953	7 663	542	8 205	75.6
1954	9 939	914	10 853	100.0
1955	9 088	813	9 901	91.2
1956	12 687	1 138	13 825	127.4

SOURCES: Production: see table 17. Imports: *Anuarios de Comercio Exterior* (items 1251, 1253 and 1255).

Table 19

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTINO OF PRINTING, PUBLISHING AND ALLIED INDUSTRIES, 1945-56

Year	Consumption of printing paper (Tons)				Index (1954 = 100)
	Imports of newsprint	Imports of other types of printing paper	Production of other types of printing paper	Total	
1945	8 024	1 323	2 623	11 970	62.7
1946	11 008	1 657	2 262	14 927	78.2
1947	9 799	1 231	1 901	12 931	67.8
1948	5 786	1 078	2 480	9 344	49.0
1949	9 933	1 976	2 728	14 637	76.7
1950	8 256	1 877	2 709	12 842	67.3
1951	10 792	2 466	2 930	16 188	84.8
1952	10 452	2 232	1 974	14 658	76.8
1953	10 318	3 065	2 561	15 944	83.6
1954	13 258	3 308	2 515	19 081	100.0
1955	15 418	4 001	2 908	22 327	117.0
1956	18 408	3 466	3 150	25 024	131.1

SOURCES: Imports of newsprint and other types of printing paper: *Anuarios de Comercio Exterior*. Production: see table 17.

Table 20

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF RUBBER PRODUCTS, 1945-56

(Quantities in tons)

Year	Domestic consumption of rubber	Imports of rubber	Movable average	Total consumption	Index (1954 = 100)
1945	552	165	126	678	24.1
1946	1 016	47	146	1 162	41.3
1947	1 199	226	201	1 400	49.8
1948	1 293	330	278	1 571	55.9
1949	1 383	279	227	1 610	57.3
1950	1 573	71	254	1 827	65.0
1951	1 699	413	195	1 894	67.4
1952	1 768	102	173	1 941	69.0
1953	2 800	4	65	2 865	101.9
1954	2 765	89	46	2 811	100.0
1955	2 749	46	252	3 001	106.8
1956	2 589	620	429	3 018	107.4

SOURCES: Domestic consumption: information from the *Banco de Fomento Agropecuario del Perú*. Imports: *Anuarios de Comercio Exterior* (items 1073, 1074, 1076).

three-year movable average was used for imports, in order to moderate the possible influence of changes in inventories.

22. Manufacture of synthetic fibre

The quantum index was deduced from the annual volume of production estimated on the basis of direct information from enterprises (see table 21). It should be noted that production began in Peru only in 1947.

Table 21

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF SYNTHETIC FIBRE

Year	Production of synthetic filament (Tons)	Index (1954 = 100)
1945	...	...
1946	...	...
1947	198	19.8
1948	313	31.3
1949	564	56.4
1950	651	65.1
1951	611	61.1
1952	602	60.2
1953	629	62.8
1954	1 000	100.0
1955	1 198	119.7
1956	1 141	114.0

SOURCE: Direct information from the producer enterprises.

23. Production of oils and fats

The index for these industries represents a very rough estimate, based solely on production of cotton-seed (see table 22).

24. Manufacture of pharmaceutical preparations

It is very difficult to estimate the quantum index of production of pharmaceutical preparations, because the number of existing establishments is relatively large and also because the range of products manufactured is wide. Hence it was considered preferable to use an approximate estimate, based on the valuation at constant 1954 prices of a long list of imported raw materials, which probably constitute a major proportion of the

Table 22

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF OILS AND FATS, 1945-56

(Quantities in tons)

Year	Production of cotton-seed	Index (1954=100)
1945	117 479	63.6
1946	119 026	64.4
1947	106 704	57.8
1948	100 349	54.3
1949	113 063	61.2
1950	118 797	64.3
1951	127 469	69.0
1952	147 291	79.7
1953	145 937	79.0
1954	184 724	100.0
1955	166 777	90.3
1956	189 508	102.6

Table 23

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF PHARMACEUTICAL PREPARATIONS

A. MAIN RAW MATERIALS IMPORTED IN 1954

Tariff item	Volume (Kg)	Value (Thousands of soles)	Unit price (Soles)
570	48	1 141	23.77
571	411	16 449	40.02
572	228	10 069	44.16
573	949	16 981	17.89
574	973	18 352	18.86
581	1 831	191 611	10.46
682	20 401	177 440	8.70
682a	1 966	142 410	7.24
686	1 472	28 525	19.38
718	5 878	121 757	20.70
720	83	10 363	124.85
721	24 192	758 879	31.37
742	4 409	827 089	187.59
746	190	550 878	2 899.35
751	1 465	177 742	121.33
753	299	114 724	383.69
827	4 595	1 126 858	245.23
829	2 879	649 964	225.76
831	883	34 427	38.98
851	1 302	672 651	516.62
852	557	78 120	140.25
853	1 841	720 629	391.45
894	830	343 847	414.27
895	6 166	3 891 036	631.05

B. EVOLUTION OF IMPORTS OF RAW MATERIALS, 1945-56

Year	Annual figure	Movable average	Index (1954=100)
	(Values in thousands of soles at constant 1954 prices [a])		
1945	3 621 749	4 161 410	38.7
1946	5 240 732	4 849 761	45.1
1947	5 686 803	5 354 098	49.7
1948	5 134 760	6 202 271	57.6
1949	7 785 249	6 302 423	58.7
1950	5 987 261	8 376 499	77.8
1951	11 356 986	8 881 833	82.5
1952	9 301 252	10 132 435	94.2
1953	9 739 066	9 907 420	92.1
1954	10 681 942	10 760 848	100.0
1955	11 861 537	13 296 615	123.6
1956	17 346 366	15 518 089	144.2

SOURCE: *Anuarios de Comercio Exterior.*

a Total amounts for each year valued at the 1954 unit prices shown in part A of this table.

Table 24

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF SOAP AND CANDLE INDUSTRIES, 1945-56

A. MAIN RAW MATERIALS USED IN SOAP PRODUCTION

(Volumes in tons)

Year	Tallow			Cotton-seed oil [a]	Cotton waste	Palm and coconut oil	Colophony
	Imports	Production	Consumption				
1945	879	700	1 579	2 600	1 874	67	423
1946	1 029	701	1 730	2 627	1 904	115	737
1947	657	700	1 357	2 550	1 707	741	1 178
1948	3 835	580	4 415	—	1 606	230	557
1949	3 386	670	4 056	—	1 809	550	1 340
1950	4 771	988	5 759	—	1 901	168	1 415
1951	2 963	980	3 943	—	2 026	439	830
1952	5 974	1 000	6 974	—	2 491	395	958
1953	6 043	1 050	7 093	—	2 449	146	965
1954	5 067	1 040	6 107	—	2 867	322	788
1955	4 766	1 100	5 866	—	2 684	222	848
1956	5 824	1 240	7 064	—	2 940	223	1 115
Average price in 1954 (soles per Kg)			4.54	3.97	1.17	7.07	5.53

B. SOAP AND CANDLE PRODUCTION INDICES

Year	Soap		Candles			Average index [c] (1954=100)
	Raw materials [b] (Thousands of soles at 1954 prices)	Index (1954=100)	Imports of paraffin (Tons)	Movable average	Index (1954=100)	
1945	22 497	59.6	3 194	2 614 [d]	55.5	58.6
1946	25 400	67.3	1 880	2 626	55.8	64.2
1947	30 035	79.6	2 805	2 088	44.4	70.6
1948	26 629	70.6	1 580	2 883	61.2	68.1
1949	31 829	84.4	4 264	3 290	69.9	80.6
1950	37 383	99.1	4 027	3 413	72.5	92.0
1951	27 965	74.1	1 947	3 411	72.5	73.6
1952	42 667	113.1	4 260	3 457	73.4	102.6
1953	41 435	109.8	4 165	4 319	91.8	105.0
1954	37 715	100.0	4 532	4 707	100.0	100.0
1955	36 031	95.5	5 405	5 091	108.2	98.9
1956	43 253	114.7	5 336	5 359	113.8	114.5

SOURCES: Anuarios de Comercio Exterior.

a From 1947 onwards the use of cotton-seed oil in the manufacture of soap was prohibited.

b Sum of the amounts shown in part A valued at average 1954 prices.

c Weighted average, the weighting factors being 37 715 for soap and 13 530 for candles.

d Taking into account imports of 2 768 tons in 1944.

Table 25

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF PAINT INDUSTRIES, 1945-56

Year	Production of paint, 1948-53 (Thousands of gallons)	Imports of resin (Tons)	Estimate of total production (Thousands of gallons)	Index (1954=100)
1945			900	35.7
1946			950	37.7
1947			1 010	40.1
1948	1 263		1 263	50.1
1949	1 353		1 353	53.7
1950	1 423		1 423	56.4
1951	1 515		1 515	60.1
1952	1 603		1 603	63.6
1953	1 814	312.8	1 814	71.9
1954		433.8	2 521	100.0
1955		593.4	3 428	136.0
1956		822.6	4 752	188.5

SOURCES Production 1948-53: Ministry of Agriculture, Inter-American Food Production Co-operative Service (*Servicio Cooperativo Interamericano de Producción de Alimentos* (SCIPA)), *Análisis de Trabajos.*

Table 26

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF PETROLEUM AND COAL PRODUCTS, 1945-56

(Quantities in thousands of 42-gallon barrels)

Year	Crude petroleum handled by domestic refineries	Index (1954=100)
1945	13 503.5	92.7
1946	11 039.9	75.8
1947	10 723.7	73.6
1948	11 938.4	81.9
1949	12 325.9	84.6
1950	12 171.2	83.5
1951	13 516.7	92.8
1952	13 711.8	94.1
1953	13 912.6	95.5
1954	14 569.1	100.0
1955	14 817.3	101.7
1956	15 730.6	108.0

SOURCE: *Estadística Petrolera.*

Table 27

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF CEMENT, 1945-56

(Quantities in 170-kg barrels)

Year	*Cement production*	*Index (1954=100)*
1945	1 558 189	54.9
1946	1 533 539	54.0
1947	1 503 786	53.0
1948	1 661 020	58.5
1949	1 700 220	59.9
1950	1 948 806	68.6
1951	2 166 773	76.3
1952	2 183 860	76.9
1953	2 642 760	93.1
1954	2 839 201	100.0
1955	3 212 092	113.1
1956	3 246 686	114.4

SOURCE: National Statistical Service, *Anuarios Estadísticos.*

Table 28

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURE OF GLASS AND GLASS PRODUCTS, 1945-56

Year	*Index (1954=100)*
1945	22.0
1946	34.7
1947	50.9
1948	57.9
1949	53.3
1950	36.2
1951	54.5
1952	57.1
1953	83.5
1954	100.0
1955	102.1
1956	105.0

Table 29

PERU: ESTIMATES OF QUANTUM INDEX OF MANUFACTURES OF POTTERY, CHINA AND EARTHENWARE, 1945-56

(Quantities in thousands of tons: values in thousands of soles at constant 1954 prices)

Year	*Production of raw materials*			*Index (1954=100)*
	Clay	*Kaolin*	*Value*	
1945	50	1.2	26.5	28.9
1946	56	1.1	29.4	32.1
1947	73	1.5	38.9	42.5
1948	90	1.5	46.9	51.3
1949	107	0.9	55.2	60.3
1950	117	0.6	59.8	65.4
1951	135	0.5	68.6	75.0
1952	163	0.3	82.4	90.1
1953	168	0.2	84.3	92.1
1954	182	0.4	91.5	100.0
1955	212	0.4	106.5	116.4
1956	222	0.1	111.1	121.4
Average price in 1954 (soles)	0.50	1.29		

SOURCE: *Banco Central de Reserva, La Renta Nacional del Perú.*

Table 30

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF BASIC METAL INDUSTRIES, 1945-56

Year	*Index (1954=100)*
1945	77.3
1946	63.5
1947	58.5
1948	49.7
1949	65.9
1950	68.7
1951	80.4
1952	81.4
1953	92.8
1954	100.0
1955	115.1
1956	123.3

total raw materials used by these industries. Part A of table 23 shows the volume, value and unit price of such imports in 1954; part B gives the results obtained when the amounts registered for each of the remaining years are valued. For the final calculation, a movable average of three terms of the series for values at constant prices was employed, in order to smooth out the sharpest of the fluctuations presumably attributable to changes in raw material inventories.

25. *Manufacture of soap and candles*

Here again no direct information on the volume of production was available, so that the quantum index had to be based on approximate indications. For soap production, the series relating to consumption of a group of the most important raw materials were valued at constant 1954 prices (see table 24, parts A and B). In order to estimate the output of candles, the basic indicator selected was the figure for imports of paraffin wax, which is the most essential raw material, and is imported in its entirety, since petroleum with a paraffin base is not produced in Peru. To allow for possible changes in inventories, the final index was calculated on the basis of a three-term movable average for the imports in question (see again table 24, part B).

26. *Manufacture of paint*

The index for the manufacture of paint was based mainly on estimates of the effective annual volume of production. These, however, cover only the period 1948-53; for the years 1945-47 purely arbitrary estimates were adopted, while from 1953 onwards the changes registered in imports of special phenolic and synthetic resins for the preparation of paint and varnish were used as the basic criterion. Details of these calculations are given in table 25.

27. *Manufacture of products of petroleum and coal*

This index was based on the series for the volume of crude petroleum handled in domestic refineries (see table 26).

28. *Manufacture of cement*

For these industries, direct data on the annual volume of production were available, and the quantum index was therefore based on the series in question (see table 27).

29. *Manufacture of glass and glass products*

No direct data are obtainable on the effective volume of production of the glass industries, and the preparation of approximate estimates was a highly complicated matter. It was hoped that imports of sodium carbonate could be taken as a basis, but these showed very marked annual fluctuations. Some of the industrialists themselves thought that an approximate estimate could be prepared from a more careful study of the changes that might take place in inventories (see table 28). In order to bring this index up to date or extend it, the same criterion might be adopted. Yet certain more or less arbitrary adjustments would probably have to be made in order to allow for the frequent sharp changes in inventories of the imports concerned during the period under review.

30. *Manufacture of pottery, china and earthenware*

Difficulties similar to those encountered in the previous case attended the preparation of estimates of the quantum index for the manufacture of pottery, china and earthenware. In the last analysis it was considered best to base these estimates on the series for production of clay and Kaolin (see table 29). To obtain the sum of production of these two items, annual figures were valued at constant 1954 prices, and the final index was computed on the basis of the total value at prices for the same year.

31. *Basic metal industries*

Within this group of industries, the most important is the smelting of ores. Consequently, the relevant quantum index was based entirely on the available figures relating to the output of the foundries, their products being valued at world market prices. The final index obtained by this method is given in table 30.

32. *Metal transforming industries*

The case of these industries closely resembles that of the pharmaceutical industry, in the sense that not only a relatively large number of establishments but also a wide range of manu-

Table 31

PERU: ESTIMATES OF QUANTUM INDEX OF PRODUCTION OF METAL TRANSFORMING INDUSTRIES

A. MAIN RAW MATERIALS IMPORTED IN 1954

Tariff item	*Volume (Tons)*	*Value (Thousands of soles)*	*Unit price (Soles)*
2336	438	648	1.48
2337	86	334	3.88
2343	179	1 124	6.28
2345	31	380	12.19
2346	579	2 063	3.57
2353	368	2 571	6.99
2354	133	2 018	15.19
2357	289	1 208	4.17
2359	1 737	4 355	2.51
2363	8 579	40 652	11.36
2367	11 578	31 847	2.75
2368	220	1 071	4.88
2369	263	656	2.50
2377	657	3 118	4.75
2394	59	1 029	17.58
2395	15	258	17.10
2396	19	677	35.03
2397	6	121	19.34
2398	86	1 557	18.07
2399	26	121	4.73
2401	0.1	2	14.93
2402	190	5 300	27.96
2403	7	226	31.81
2405	17	265	15.81
2406	55	616	11.20
2409	548	7 787	14.20
2410	14	354	24.59
2413	3	88	31.45
2416	1	13	9.63
2429	52	2 346	45.06
2430	22	515	22.91
2432	20	673	34.27
2441	5	165	32.62

B. EVOLUTION OF RAW MATERIAL IMPORTS, 1945-56
(Values in thousands of soles at constant 1954 prices [a])

Year	*Annual figure*	*Movable average*	*Index (1954=100)*
1945	31 465	35 476	24.8
1946	43 500	44 491	31.1
1947	58 507	57 158	39.9
1948	69 471	69 507	48.5
1949	80 543	76 576	53.5
1950	79 714	91 078	63.6
1951	112 978	104 422	72.9
1952	120 575	126 067	88.0
1953	144 648	126 460	88.3
1954	114 157	143 184	100.0
1955	170 746	171 712	119.9
1956	230 232	210 403	146.9

SOURCE: *Anuarios de Comercio Exterior.*
a Sum of amounts for each year valued at 1954 unit prices shown in part A.

factures are registered. The yardstick used for estimating the quantum index of production was also very similar, and was based on the valuation of a long list of imported raw materials —representing a high proportion of those used by these industries—at constant 1954 prices. The volume, value and unit price of these imports are shown in table 31, part A, while part B gives the results obtained when the amounts registered for each of the other years were valued at these same 1954 unit prices. In view of possible annual variations in raw material inventories, it was felt preferable to compute the final index on the basis of a movable average of three terms of the above-mentioned series of values at constant prices.

II. WEIGHTING OF PARTIAL INDICES

When the quantum indices of production for specific industries had been estimated by the methods just set forth, a suitable weighting system still had to be devised whereby representative indices for broader groups of manufacturing activities could be computed, as well as an aggregate quantum index for the whole of the industrial sector.

The following was the procedure generally applied. The values added in each group and major group were used as weighting factors in calculating indices for the major groups and the overall 1954 index respectively. The background data required to determine these values added were taken from the tabulations in *Estadística Industrial* for that year prepared by the Industrial Statistics Section of the Industrial Division of the Ministry of Development and Public Works.

Table 32 sums up the results of the foregoing calculations and gives the indices for each group and for industrial production as a whole, to obtain which the appropriate values added were used for weighting purposes.

A brief account will now be given of the procedure adopted for the consolidation of partial indices in the form of indices for broader groups, together with the figures for the values added which constituted the weighting factors, all of which are expressed in thousands of soles.

1. *Food manufacturing*

In this group were included the slaughtering, preparation and preserving of the meat; the manufacture of dairy products; the canning industry; manufacture of grain mill and of baking products; sugar factories and refineries; and the manufacture of cocoa, chocolate and confectionery.

The following calculations give the weighting factors:

	Gross value of production	*Value of input of raw materials*	*Value added*	*Percentage composition*
Slaughtering, preparation and preserving of meat	17 091	7 484	9 607	1.7
Manufacture of dairy products	116 916	73 760	43 156	7.6
Canning industries	111 390	60 891	50 499	8.9
Manufacture of grain mill products	519 234	414 308	104 926	18.4
Manufacture of baking products	247 952	88 966	158 986	27.9
Sugar factories and refineries	246 991	74 459	172 532	30.3
Manufacture of cocoa, chocolate and confectionery	71 008	41 161	29 847	5.2
Total			569 563	*100.0*

2. *Beverage industries*

This group comprises production of wine, spirits, beer and soft drinks. Weightings for the four partial indices were obtained from the following calculations:

	Gross value of production	*Value of input of raw materials*	*Value added*	*Percentage composition*
Wine	16 904	10 674	6 230	2.6
Spirits	46 343	24 366	21 997	9.3
Beer	243 602	78 837	164 765	69.9
Soft drinks	77 150	34 379	42 770	18.2
Total			*235 742*	*100.0*

3. *Tobacco manufactures*

The tobacco industry constitutes one of the major groups which are not subdivided; consequently the index was taken directly into account as one of the determinants of the quantum index for industrial production in the aggregate.

4. *Manufacture of textiles*

Under this head were included the three partial indices for the cotton, woollen and artificial fibre textile industries. But weighting factors could not be based on the corresponding values added, since in 1954 the classification used in the Industrial Division's tabulations was not strictly comparable to that applied here, and consequently the raw materials for each of the three groups could not be separately considered. Weightings were therefore based only on the gross value of production. It is not felt that the distortion which this may produce will be very serious, since the activities concerned are similar and their proportions of value added probably do not differ very widely. The relevant figures are as follows:

	Gross value of production	*Percentage composition*
Cotton textiles and yarn	486 380	47.5
Woollen textiles and yarn	317 966	31.1
Artificial fibre textiles	218 605	21.4
Total	*1 022 951*	*100.0*

5. *Manufacture of footwear, other wearing apparel and made up textile goods*

The two group indices to which reference was previously made —for manufacture of footwear and manufacture of other wearing apparel and made-up textile goods—are included here. The weightings allocated to each were based on the following estimates:

	Gross value of production	*Value of input of raw materials*	*Value added*	*Percentage composition*
Footwear	143 830	75 910	67 920	55.2
Wearing apparel and made-up textile goods	145 242	90 056	55 186	44.8
Total			*123 106*	*100.0*

Table 32

PERU: ESTIMATES OF QUANTUM INDICES OF INDUSTRIAL PRODUCTION, BY MAJOR GROUPS AND GROUPS, 1945-56

(Base: 1954 = 100)

Major groups and groups	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*
Industrial production	*55.1*	*55.4*	*60.3*	*64.3*	*70.4*	*72.5*	*78.8*	*83.2*	*91.1*	*100.0*	*105.9*	*111.5*
1. *Food manufacturing*	*61.7*	*55.7*	*66.0*	*72.0*	*79.2*	*83.6*	*84.0*	*89.1*	*99.0*	*100.0*	*108.6*	*107.0*
1.1 Slaughtering, preparation and preserving of meat	55.5	43.1	54.4	43.1	46.3	75.1	77.9	76.4	100.2	100.0	108.5	102.6
1.2 Manufacture of dairy products	61.8	66.1	75.8	90.6	93.7	89.7	83.5	83.4	97.3	100.0	107.1	112.8
1.3 Canning industries	34.2	34.2	35.7	37.8	52.0	54.3	79.5	82.6	78.3	100.0	114.4	121.2
1.4 Manufacture of grain mill products	60.9	49.7	65.8	69.6	82.5	95.7	87.3	97.9	104.7	100.0	111.5	101.3
1.5 Manufacture of baking products	62.7	49.7	65.5	69.2	83.3	93.0	86.4	96.3	102.2	100.0	109.3	99.8
1.6 Sugar factories and refineries	66.6	62.5	67.9	78.3	77.6	71.0	77.1	77.6	98.5	100.0	106.5	112.6
1.7 Manufacture of cocoa, chocolate and confectionery	81.4	97.8	99.0	100.8	93.1	107.9	109.5	108.8	101.2	100.0	101.1	101.2
2. *Beverage industries*	*40.3*	*44.3*	*48.9*	*45.4*	*47.5*	*55.7*	*66.9*	*79.1*	*92.3*	*100.0*	*104.5*	*103.4*
2.1 Wine	144.7	149.1	158.5	159.6	153.2	135.7	136.5	114.0	99.6	100.0	143.8	132.5
2.2 Spirits	62.3	82.0	93.0	85.0	93.6	84.3	97.3	96.1	96.1	100.0	98.5	96.9
2.3 Beer	37.9	39.2	38.4	34.3	36.2	48.2	60.2	71.8	87.8	100.0	106.2	106.7
2.4 Soft drinks and mineral waters	22.9	31.0	51.6	51.4	52.4	58.7	67.8	93.6	106.7	100.0	95.4	89.9
3. *Tobacco manufactures*	*60.0*	*62.1*	*71.0*	*71.1*	*83.3*	*88.9*	*86.3*	*85.7*	*94.1*	*100.0*	*107.7*	*88.8*
4. *Manufacture of textiles*	*55.4*	*62.8*	*64.6*	*73.9*	*79.5*	*70.3*	*78.0*	*79.8*	*80.6*	*100.0*	*105.9*	*104.9*
4.1 Cotton	72.3	70.3	77.3	86.3	91.4	78.4	81.1	76.7	86.6	100.0	93.3	93.3
4.2 Wool	67.0	97.5	82.7	93.9	93.3	73.5	82.2	104.2	85.3	100.0	119.3	101.6
4.3 Artificial fibres	1.6	1.8	10.3	18.9	31.8	47.5	66.4	51.7	61.2	100.0	114.8	137.1
5. *Manufacture of footwear, other wearing apparel and made-up textile goods*	*47.8*	*42.8*	*48.9*	*43.7*	*47.6*	*64.3*	*69.6*	*73.1*	*93.6*	*100.0*	*112.7*	*121.7*
5.1 Footwear	53.0	41.2	50.2	38.9	43.5	71.6	75.1	74.0	100.3	100.0	108.6	105.0
5.2 Wearing apparel and made-up textile goods	41.4	44.8	47.4	49.5	52.6	55.4	62.7	72.0	85.2	100.0	117.8	142.3
6. *Wood manufactures*	*29.6*	*49.2*	*60.1*	*79.0*	*79.9*	*86.4*	*87.9*	*99.1*	*94.1*	*100.0*	*112.4*	*116.4*
7. *Manufacture of paper and paper products*	*49.0*	*54.7*	*61.2*	*60.1*	*70.0*	*56.6*	*83.5*	*74.8*	*84.0*	*100.0*	*100.4*	*128.3*
7.1 Manufacture of paper and board	65.2	64.6	65.7	71.5	80.6	69.4	89.9	79.7	94.6	100.0	112.1	129.4
7.2 Manufacture of articles of paper and board	36.2	46.9	57.6	51.1	61.8	46.5	78.5	71.1	75.6	100.0	91.2	127.4
8. *Printing, publishing and allied industries*	*62.7*	*78.2*	*67.8*	*49.0*	*76.7*	*67.3*	*84.8*	*76.8*	*83.6*	*100.0*	*117.0*	*131.1*
9. *Manufacture of leather and leather products*	*55.5*	*43.1*	*54.4*	*43.1*	*46.3*	*75.1*	*77.9*	*76.4*	*100.2*	*100.0*	*108.5*	*102.6*

Table 32 *(Continued)*

PERU: ESTIMATES OF QUANTUM INDICES OF INDUSTRIAL PRODUCTION, BY MAJOR GROUPS AND GROUPS, 1945-56

(Base: 1954 = 100)

	Major groups and groups	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*	*1952*	*1953*	*1954*	*1955*	*1956*
10.	*Manufacture of rubber products*	24.1	41.3	49.8	55.9	57.3	65.0	67.4	69.0	101.9	100.0	106.8	107.4
11.	*Manufacture of chemicals and chemical products*	47.9	51.4	53.4	55.9	63.1	73.3	73.0	86.1	86.4	100.0	108.3	125.3
11.1	Synthetic fibre	—	—	19.8	31.3	56.4	65.1	61.1	60.2	62.8	100.0	119.7	114.0
11.2	Oils and fats	63.6	64.4	57.8	54.3	61.2	64.3	69.0	79.7	79.0	100.0	90.3	102.6
11.3	Pharmaceutical preparations	38.7	45.1	49.7	57.6	58.7	77.8	82.5	94.2	92.1	100.0	123.6	144.2
11.4	Soap and candles	58.6	64.2	70.6	68.1	80.6	92.0	73.6	102.6	105.0	100.0	98.9	114.5
11.5	Paint	35.7	37.7	40.1	50.1	53.7	56.4	60.1	63.6	71.9	100.0	136.0	188.5
12.	*Manufacture of products of petroleum and coal*	92.7	75.8	73.6	81.9	84.6	83.5	92.8	94.1	95.5	100.0	101.7	108.0
13.	*Manufacture of non-metallic mineral products*	43.1	46.8	51.9	58.0	57.8	57.7	69.1	70.9	89.8	100.0	109.6	111.5
13.1	Cement	54.9	54.0	53.0	58.5	59.9	68.6	76.3	76.9	93.1	100.0	113.1	114.4
13.2	Glass	22.0	34.7	50.9	57.9	53.3	36.2	54.5	57.1	83.5	100.0	102.1	105.0
13.3	Pottery, china and earthenware	28.9	32.1	42.5	51.3	60.3	65.4	75.0	90.1	92.1	100.0	116.4	121.4
14.	*Engineering and basic metal industries*	40.4	40.7	45.4	48.8	57.2	65.1	75.1	86.1	89.7	100.0	118.5	139.9
14.1	Basic metal industries	77.3	63.5	58.5	49.7	65.9	68.7	80.4	81.4	92.8	100.0	115.1	123.3
14.2	Metal transforming industries	24.8	31.1	39.9	48.5	53.5	63.6	72.9	88.0	88.3	100.0	119.9	146.9

SOURCE: Basic data from the Ministry of Development and Public Works, Industrial Division (*Sub-dirección de Indastrias*), Industrial Statistics Section (*Sección Estadistica Industrial*), *Estadistica Industrial 1954*.

6. *Wood manufactures*

These constitute one of the major groups that are not sub-divided.

7. *Manufacture of paper and paper products*

The two partial indices for manufacture of paper and board and for manufacture of articles of paper and board were included under this head. Weighting factors for both indices were deduced from the following figures:

	Gross value of production	*Value of input of raw materials*	*Value added*	*Percentage composition*
Manufacture of paper and board	33 742	14 932	18 810	44.1
Manufacture of articles of paper and board	116 941	93 076	23 865	55.9
Total			42 675	*100.0*

8. *Printing, publishing and allied industries*

These were taken in the aggregate as a single major group not sub-divided.

9. *Manufacture of leather and leather products*

These also constitute one of the major groups; consequently, the relevant index was taken directly into account in the calculation of the quantum index for total industrial production.

10. *Manufacture of rubber products*

This too was considered as one major group.

11. *Manufacture of chemicals and chemical products*

In this group were included the partial indices for the manufacture of synthetic fibres, oils and fats, pharmaceutical preparations, soap and candles, and paint. For much the same reasons as were cited in respect of the textile industry, a satisfactory method of weighting the group indices could not be based on the respective values added. The weighting factors were therefore worked out from the gross value of production, although it must be acknowledged that in this instance the resulting distortions may be much greater than in the case of the textile industries. The relevant estimates are as follows:

	Gross value of production	*Percentage composition*
Synthetic fibre	40 687	7.5
Oils and fats	186 978	34.4
Pharmaceutical preparations	179 415	33.0
Soap and candles	98 596	18.2
Paint	37 193	6.9
Total	542 869	*100.0*

12. *Manufacture of products of petroleum and coal*

This was taken as a single major group.

13. *Manufacture of cement, pottery, china, earthenware, glass and other non-metallic mineral products*

This group comprises the three partial indices for the manufacture of cement, glass and glass products, and pottery, china and earthenware. The values added by means of which the respective weightings were established were based on the following calculations:

	Gross value of production	*Value of input of raw materials*	*Value added*	*Percentage composition*
Cement	112 148	6 127	106 021	63.4
Glass	73 537	17 996	55 541	33.2
Pottery, china and earthenware	7 197	1 480	5 717	3.4
Total			167 279	*100.0*

14. *Metal transforming and basic metal industries*

The partial indices for the basic metal industries and the metal transforming industries were included in this group. As in previous cases, weightings for each were based on the respective values added by production in 1954. For the basic metal industries, an estimate of the probable value added in foundries was applied, in view of the difficulties involved in using the figures presented in the tabulations serving this purpose in all other instances. For the metal transforming industries, on the other hand the same procedure was adopted as in previous cases, that is, the input of raw materials was discounted from the gross value of production. The figures ultimately utilized were as follows:

	Value added	*Percentage composition*
Basic metal industries	61 000	29.6
Metal transforming industries	145 303	70.4
Total	206 303	*100.0*

15. *Weightings for industry as a whole*

The quantum index for total industrial production was determined as an average of the indices for the 14 groups just enumerated, weighted by the respective values added. The latter are shown in detail in table 33, and were obtained from the same industrial tabulation used for the foregoing estimates. It

Table 33

PERU: ESTIMATES OF VALUE ADDED IN REGISTERED INDUSTRY, 1954

Branch of industry	*Value added (Thousands of soles)*	*Percentage composition*
Food manufacturing	660 149	23.2
Beverages	236 385	8.3
Tobacco	116 284	4.1
Textiles	561 371	19.7
Footwear, other wearing apparel and made-up textile goods	123 117	4.3
Wood products	48 629	1.7
Paper and paper products	42 675	1.5
Printing, publishing and allied industries	88 792	3.1
Leather and leather products	48 764	1.7
Rubber products	28 341	1.0
Chemicals and chemical products	205 866	7.2
Products of petroleum and coal	239 900	8.4
Non-metallic mineral products	246 161	8.6
Metal transforming and basic metal industries	206 303	7.2
Total	2 852 737	*100.0*

SOURCE: Basic statistics from Ministry of Development and Public Works, Industrial Division, *Estadística Industrial* 1954.

should be noted that in many cases the value added which appears in this table exceeds the sum of the group values added, as given in earlier paragraphs; the explanation is that in order to determine the weighting for each of these groups all the activities composing it were taken into account, including some for which partial quantum indices were not computed and which could not therefore be taken into consideration in the preceding calculations.

III. POSSIBLE DEFECTS OF THE WEIGHTING SYSTEM

A note must be added on the shortcomings to which such a weighting system may be subject, and the possible direction of the distortions it may cause in the quantum index for manufacturing output as a whole.

The basic reservation derives from the fact that the values added which were used as weighting factors were deduced from a sample of establishments and do not therefore cover the whole of Peru's manufacturing output. Comparison of the figure for total value added given in table 33 with that repeatedly mentioned in the course of this study for the gross product generated by the industrial sector will suffice to give a clearer idea of the amount of production excluded from these calculations.

This would not be a matter of major importance if it could feasibly be assumed that the proportion of registered industry is approximately the same in each of the major groups and groups. But this is not the case. Specific branches of industry where production is concentrated in a limited number of establishments—for example, tobacco, petroleum derivates, cement—are taken into account virtually in their entirety; but to others, where production is mainly on a small scale or is distributed among a large number of enterprises—the manufacture of footwear and wearing apparel and probably, to a considerable extent, the chemicals and metal transforming industries are cases in point—a value added which constitutes only a fraction of the total is assigned. Had it been possible to make allowance for these factors, the relative importance of each of the group indices within the total index would have been substantially modified; in so far as the partial indices showed different variations during the period under review, these changes in turn would have been reflected in somewhat different fluctuations of the quantum index for industrial production as a whole.

This difficulty was insuperable, given the statistical data currently available and particularly the lack of an industrial census. The Industrial Division seems to have compiled fuller industrial statistics for 1955 than for the preceding year; but the complete findings were not accessible soon enough for the pertinent corrections to be introduced here. In any event, it will probably be advisable to make these amendments if plans for the future continue to include the computation of an industrial production index in line with the general methodological principles set forth in the present study.

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