LABOUR PRODUCTIVITY OF THE COTTON TEXTILE INDUSTRY IN FIVE LATIN-AMERICAN COUNTRIES

UNITED NATIONS

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LETTER OF TRANSMITTAL

Santiago
16 April 1951

Dear Mr. Secretary-General,

I have pleasure in transmitting herewith the report on labour productivity in the cotton textile industries of five Latin-American countries. This is the first attempt which has been made in Latin America to assess industrial productivity, to compare it with the standards based on the experience of highly industrialized countries, and to analyse the factors which bear upon it.

A number of interesting conclusions have been drawn at the close of this report, which also contains certain practical recommendations; the implementation of these by governments may well provide opportunities for the rendering of technical assistance by the United Nations.

It is evident that there is a wide margin for potential improvement in the productivity of the textile industry in Latin America and that a large proportion of this improvement could be effected by introducing new working methods, even if much of the existing equipment had to continue to be used. It is clear also that modernization of this equipment would lead to greater increases of productivity comparable to the rate of progress of the more highly industrialized countries.

A programme designed to increase productivity in the textile industry should be an integral part of a general plan of economic development, in order to avoid the disturbances which might result from partial measures which would give rise to a manpower surplus. This surplus should be absorbed in other economic fields to the extent that this could not be done through an increase in the activity of the industry itself, resulting from the expansion of the market following a reduction of costs and prices. It is therefore not an isolated problem but rather the manifestation of the general problem of economic development in the Latin-American countries and of the need to make substantial capital investments in order to establish new activities, increase those which already exist, and accelerate the rate of economic development.

The study has been made by the staff members of the ECLA secretariat who visited cotton mills in several Latin-American countries. Full co-operation was received from technical experts in the different countries. The International Bank for Reconstruction and Development provided financial assistance in carrying out the study.

Yours sincerely,

Raúl Prebisch
Executive Secretary
Economic Commission for Latin America

Hon. Trygve Lie
Secretary-General
United Nations
New York

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Chapter I

PRODUCTIVITY OF TEXTILE LABOUR IN THE GROUP OF COUNTRIES VISITED

I. Introduction

1. The Economic Commission for Latin America undertook the study of the cotton spinning and weaving industry of some Latin-American countries with a view to determining the factors influencing labour productivity in this industry. It was also desired to ascertain the extent of certain problems which have prevented the technical development of this industry from following a course similar to that of more advanced textile industries. Moreover, it was believed that an analysis of the results of the investigation could give rise to recommendations for the improvement of conditions in the mills.

2. Limitations, both of time and of material resources, have made it necessary to restrict the study to five countries—Brazil, Chile, Ecuador, Mexico and Peru—the textile industries of which offer substantial contrasts in size, modernity, markets and geographical location. The inclusion of other industries of considerable interest, such as those of Argentina and Colombia, would have improved the sample and added to the variety of aspects which could be focused in this sector of Latin America's economy.

3. The measurement of labour productivity and the analysis of the factors which affect it were chosen rather than any other study of the industry, because it is believed that the level of productivity is the best indication of internal operating conditions in the mills. In contrast to cost of production, though closely related with it, productivity is universal in character, not being affected by differences in the prices of raw materials, machinery and labour, nor distorted by the rates of foreign exchange and of interest on investment. Moreover, it can be easily measured, in a direct manner, in the mills and can be published without fear of revealing data which the manufacturers might consider confidential.

4. The whole task was carried out by members of the Commission's staff, assisted by technicians in the countries visited. In order to establish norms for comparison, that is, standard productivities, the services of a firm of American consulting engineers[1] were enlisted, in addition to the co-operation of several Latin-American manufacturers.

5. We do not presume to have attained the high degree of perfection desirable in this type of research, either in the methodology or in the scope of the work itself, but it is hoped that the importance of the results will stimulate the systematic adoption of measurements of this nature and the development of better methods of analysis.

II. Summary of the methodology adopted[2]

6. The study of each country was made by visiting a number of mills which differed in size, degree of modernity, characteristics of production, and geographical location. These units were selected with a view to obtaining sample groups, the composition of which would be as representative as possible of the country's industry, within the limitations imposed by the time available for the investigation.

7. In each of these mills, labour productivity was measured, process by process, for the greatest possible number of products. The final results in kilogrammes per man-hour were obtained by mathematically combining the measurements made in the processes. These were expressed separately, for spinning and weaving, by means of curves, the ordinates of which represent the productivity and the abscissae correspond to the specifications of the product.[3]

8. Furthermore, data were obtained regarding all the factors which might affect productivity, such as the distribution of labour, the quality of cotton, the condition of the machinery, humidity, the methods of control adopted, the organization of the processes, the speed of the equipment, the stoppage frequency for machinery, or breakage frequency of yarn, and the quality of the intermediary and final products.

9. In order to express the total productivity of a country's industry, average curves were plotted from individual mill data, separating the results obtained in modern industry from those of the older mills.[4]

10. In the subsequent analyses and comparisons, it was decided to use units of labour consumption (man-hours per kilogramme)[5] instead of their reciprocals, the units of productivity (kilogrammes per man-hour), because the former are more easily handled and can be added together directly.

11. The problem of comparing labour consumption for the different types of products, that is to say, both for

[1] Lockwood Greene Engineers Inc., of New York.

[2] Chapter VII contains a more detailed description of the methods employed.

[3] The English system of yarn count was used for yarn specifications; this is the number of groups of 840 yards contained in one pound of yarn. For fabrics, the relation selected was that between the density of the fabric, in picks plus warp ends per unit of area and the weight of the cloth per unit of area. In practice the formula shown below was used, that is, the method of assessment employed by the Mexican customs authorities in evaluating fabrics. The result has been named "the count of the fabric".

$$\left\{\frac{\text{warp ends}}{\text{sq. inch}} + \frac{\text{picks}}{\text{sq. inch}}\right\} \times \text{width of the fabric in inches} \times \frac{\text{yards}}{\text{lb.}}$$

[4] In the chapters dealing with individual countries, there are separate graphs for each mill, together with average productivity curves. The criteria adopted for the classification of mills as either old or modern is explained in chapter VII.

[5] In practice, man-hours per 100 kilogrammes of yarn or fabric were used.

fine and coarse yarns, and for fine and ordinary fabrics, was solved by determining the ratio between actual average consumption and the consumption which should be obtained for each product, if the mill (or group of mills) manufacturing these goods were operating under optimum conditions, with modern equipment, installations of an adequate size and good management. These relationships, which are comparable for all types of products, express the influence of all factors which affect productivity and may be considered as indices of the importance of all these causes together. The analysis was carried out in different stages, the first of which consisted in separating from the total indices the influences of type of equipment—of the employment of old instead of modern machinery—and of size, that is, of the use of installations which are smaller than optimum size, to which further reference will be made. The remaining influence was designated by the term "influence of operation", or the index of importance of the operating factors, since it expresses the manner in which a mill of a certain type and size is operated.

12. Since this stage of the analysis calls for the establishment of standard productivities (or standard labour consumptions), a group of 144 hypothetical standard mills was set up, including both old and modern mills, the size of which varied from 2,000 spindles or 40 looms to 50,000 spindles or 1,000 looms.[6] They were assumed to produce six counts of yarn and six types of fabric, which would cover practically the whole range of products found in the course of the investigation. According to their size and type of equipment, these standard mills were given the best organization possible, both from the process and labour standpoints, and they were assumed to be operating with the maximum efficiency attainable, without impairing the quality of the product. The computed productivity of these standard mills was also expressed by curves, in order to make it generally comparable to any results obtained in the actual mills.

13. Having obtained a series of theoretical productivity curves for different sizes of mills, it was easy to determine the influence exercised by size on productivity (or labour consumption). This information, allied to considerations of an administrative order,[7] was the basis for establishing the limits within which the optimum size of Latin-American units is probably found: that is, between 25,000 and 50,000 spindles for spinning mills and 500 to 1,000 looms for the weaving mills. The lower limits of optimum size were adopted as a basis for all comparisons because, from there upwards, productivity increases are very slight.

14. In order to simplify the explanation of the procedure followed during the first stage of analysing the factors which influence productivity, let it be assumed that the investigation deals with a single old mill, producing only one type of product, or, in other words, that only one measurement of labour consumption was taken.

15. The influence of equipment, that is, of the use of old instead of modern machinery, is defined as the relationship between labour consumption in an old standard mill and in a modern standard mill, both of which are of the same size as the actual mill and manufacture the same product. It therefore expresses the influence of equipment independently of the effect of other factors.

16. The influence of small size in the actual mill is calculated as the relationship between labour consumption in an old standard mill of the same size as the actual mill and the consumption of labour in an old standard mill of optimum size (25,000 spindles or 500 looms), both of which are manufacturing the same product as the actual unit.

17. The influence, or the index of importance, of operation is the relationship between labour consumption in the actual mill and labour consumption in a standard mill of the same size as that of the actual unit, both of which are producing the same article and have the same type of machinery installed. The result expresses the effect of all the factors which influence productivity, with the exception of the type of equipment and the small size of the mill.

18. The product of these three relationships is the influence, or the index of importance, of all the factors contributing to low productivity and may be obtained directly, as the relationship between labour consumption in the actual old mill and that in a modern standard mill of optimum size.

19. The influences or indices of importance for a whole industrial sector in a given country were calculated as weighted averages of the influences corresponding to the productivity observations in all the mills comprising the aforesaid sector, each of these observations being dealt with in the manner described above.[8]

20. In the case of sectors which are entirely modern, it was evidently not necessary to calculate the effect of the type of equipment, and in determining the other two influences, exclusive use was made of the standard productivities for modern mills.

21. The second phase of the analysis was the breaking down of the influences of type of equipment and of operation into their principal components. The influence of the type of equipment was divided into two parts, namely, the one caused by the differences in the output per machine unit (spindle or loom) for old and modern equipment; and the other arising from the difference between the minimum labour requirements of each type of machinery. This subdivision was solely based on the comparison of outputs and labour consumptions in the standard mills. The influence of operation was first divided into two parts, the one corresponding to the abnormality of the output of the machinery, and the other to the excess of workers employed. As will be shown below, the analysis was developed in greater detail, with a view to determining the factors which contribute to such abnormalities.

22. The analyses of the influence of operation could not have been made for all the mills visited, during the time available for the investigation. Therefore, within the general sample for each country, a smaller sample was selected consisting of a limited number of mills in which the speeds, the unit weights of the intermediary products, the efficiency of the processes, and the amount

[6] The basic data and the productivity of these mills will be found in the annex attached to the report.

[7] Chapter VII contains a discussion on the optimum size of mills.

[8] The details contained in chapter VII show that the observations were not always studied individually in the manner indicated, since this would have involved an elaborate procedure. The methods employed, however, gave equivalent results.

of direct, indirect and miscellaneous labour, were compared with the corresponding values of these elements in the standard mills of the same size and type of equipment. Adopting the same procedure employed for the influence of type of equipment and of size, these comparisons were used for determining the influence of each of the aforesaid elements, that is to say, the labour consumption which their abnormalities would imply if they prevailed independently of other factors. Labour consumption was expressed as its relationship to standard labour consumption, that is, the labour which would be applied in the absence of any abnormality.[9] The values of these influences were controlled by the fact that their product should equal the value of the influence of operation in the mill studied, this value having already been ascertained separately by the procedure outlined above.

23. The results of the analysis in the sub-sample mills of a given industrial sector were averaged and extended to the general sample for that sector and increased or decreased by the procedure of logarithmic proportions, in order that their product should equal the average influence of operation, which had already been obtained from the data of the general sample.

24. The third and last phase of the analysis of the influence of operation consisted in assessing, by observations and estimates, and with the help of spot checks—such as the frequency of machine stoppage and of yarn breakage—the importance of the factors which cause the abnormalities of speed, efficiency, unit weight, and staffing in the mills included in the sub-sample.

25. The value of the influences, that is, of the indices of importance of the factors which affect productivity, are expressed in every chapter of this report as a simple ratio, with the exception of the first chapter, in which these ratios were multiplied by 100, in order to present them in the usual form adopted for indices.

III. General characteristics of the industry

26. The cotton textile industry of the countries visited comprises a total of 786 mills, in which there are 4,602,411 spindles and 147,049 looms, constituting approximately 85 per cent of Latin-American cotton spinning and weaving capacity. Production is almost exclusively limited to articles for domestic consumption in the individual countries in which, with the exception of Ecuador,[10] present-day demand is fully met, at least for popular types of fabrics. The industry is featured by the integration of the spinning and weaving processes, except in the very small units.

27. Brazil's cotton industry is the largest in Latin America. There are 455 mills, with 3,279,677 spindles and 100,146 looms. There are mills in the Federal District and in eighteen of the twenty states, but manufacturing is principally concentrated in the State of São Paulo (38.2 per cent of the spindles), Rio de Janeiro-Federal District (27.3 per cent), the North-eastern States (23.6 per cent), and in Minas Gerais (12.2 per cent). The largest installations in Latin America are encountered here,[11] but like the majority of industries in this part of the world, the textile industry has a large proportion of old machinery (91 per cent of the spindles and 95 per cent of the looms), the period of greatest expansion having occurred at the beginning of the twentieth century. It was only recently that any attempt was made to modernize antiquated installations or establish entirely new mills. São Paulo, however, is notable for the modernity of its equipment (approximately 15 per cent of the machinery is new), in comparison with the rest of the country. This is largely because it developed at a later date than other regions; moreover, the general atmosphere of intensive progress in this state has proved an incentive to improvement in all industries. For the purposes of this investigation the modern mills of São Paulo have been selected to represent the modern sector of the Brazilian textile industry, whereas the old mills in the Rio de Janeiro-Federal District region are considered as typical of the older sector of the industry.

28. São Paulo supplies the larger part of the raw material consumed by the Brazilian cotton industry. After domestic consumption has been met, there is still a surplus for export.

29. The modernity of equipment is a striking feature of Chile's cotton industry (19 mills,[12] with 173,534 spindles and 5,012 looms). Seventy-seven per cent of the spindles and 72 per cent of the looms are entirely new. This provides a sharp contrast with the rest of Latin-American industry and may be explained by the country's delay in developing a textile industry.[13] Though a cotton factory had already been built in Chile in 1867, 72 per cent of the country's present spinning capacity and 47 per cent of its weaving capacity have been installed since 1938. Its vigorous development in ten years has enabled domestic production to replace imports almost entirely, though in 1938 the latter supplied 60 per cent of total consumption.

30. In the early period, the development of the industry was very favoured by exchange controls (since 1932), and by the devaluation of Chilean currency, which caused a sharp difference between foreign and domestic prices. Later, it was further encouraged by the Second World War, which not only eliminated foreign competition for a period of several years, but also led to an accumulation of capital that was invested or reinvested in industry. Prevailing conditions are favourable to the mills, owing to the restriction of imports, the shortage of foreign exchange, and the fact that total domestic demand has probably not yet been met. Seventy-nine per cent of the industry is concentrated in Santiago and the rest is located in the vicinity of Concepción (12 per cent) and Valparaíso (9 per cent). At present, all of the cotton is imported, but attempts are being made to grow the raw material in Chile.

[9] The influences, or indices of importance, of abnormalities in the unit weight of intermediary products (draft schedule), of speed, of the efficiency of the processes and of direct labour, are equal to the ratio between standard and actual values of the unit weight of the intermediary product, of the speed of the machinery, of the efficiency of the processes and of the units of machinery assigned to each tender, respectively. The influence of indirect labour is the relationship between standard and actual ratios of direct labour to direct-plus-indirect labour. The influence of miscellaneous labour is the relationship between standard and actual ratios of total labour, excluding miscellaneous labour, to total labour, including it. The product of these influences is the total influence of operation.

[10] The textile industry of Ecuador supplies approximately 60 per cent of domestic consumption of cotton fabrics.

[11] See the tables for the size distribution of the industry in the chapter dealing with Brazil.

[12] Not including twenty-two weaving mills which have less than twenty looms.

[13] The textile industry of Colombia, also because of its tardy development, is largely equipped with modern machinery.

31. The cotton industry is quite small in Ecuador (10 mills with 37,286 spindles and 1,454 looms), and is principally located in Quito and its surroundings (65 per cent of the total number of spindles). Other mills have been built at Riobamba (8 per cent), Ambato (9 per cent), and Otavalo (18 per cent), where the mills originally sought hydraulic power, and native labour—which, by tradition, is extremely skilful in textile crafts. The mills are extremely small and the machinery is almost all old. This can be accounted for by the fact that some of the mills were built at the beginning of the century, and there has been no renovation of their equipment, while others, founded later, use imported second-hand machinery. Production consists largely of coarse popular fabrics which supply about 60 per cent of total demand for cotton textiles. Seventy per cent of the raw material consumed by the mills is grown in the country, but deficiencies in cotton production—principally the lack of seed selection and of organization in the picking and ginning operations—contribute to its poor quality (short fibres which are irregular and weak). This affects the operation of the mills and places a limit on the yarn counts they produce.

32. The cotton industry in Mexico is second in importance to that of Brazil (278 mills with 935,582 spindles and 34,133 looms). It also resembles the Brazilian industry closely in the age of the machinery (85 per cent of the spindles are old and 95 per cent of the looms are non-automatic), since the principal phase of development took place during the first quarter of the present century and little progress has since been made. The mills are located in the Federal District and in eighteen of the twenty-eight states, but the greatest density is in Puebla (32.4 per cent of the total number of spindles), Veracruz (17.6 per cent), and in the Federal District (12.2 per cent). The greater part of the mills are engaged in the manufacture of "manta"—a thick cloth woven from coarse yarn (counts 16's and 18's)—which is generally used by the native population for clothing. During the Second World War and in the years immediately after the close of hostilities, the extraordinary foreign demand for textiles and the high prices obtaining proved to be a strong incentive for Mexico's textile industry. As a result, fifteen entirely new mills were built and others were partially modernized. The process of modernization has been slowed down in the recent past, especially since the early post-war years, though it is known that in certain undertakings funds are available with which to replace machinery. These firms, however, are awaiting the modification of the present labour-management contract legislation which, because its rigid provisions do not take into account possible technical improvements, prevents the modernization of equipment from giving rise to labour savings.[14]

33. Though the textile industry in Peru (24 mills with 176,332 spindles and 6,304 looms) also developed most intensely during the early part of the century, it reveals certain contrasts with the majority of the Latin-American textile industries founded in about the same era, in that it has progressed relatively further, not only as regards the increase of its capacity, but also in the degree of modernization of its installations[15] (25 per cent of new spindles and 35 per cent of automatic looms). Unlike the other countries, this degree of modernization of equipment in Peru has been achieved mainly by the gradual replacement of the machines in the old establishments; in other countries, this has been predominantly achieved by the building of new mills. Thus, often within the mills themselves, one finds a great variety of different types of machinery in Peru, whereas in other countries, on the whole, one may draw a fairly clear distinction between the old and modern mills. The production of Peruvian industry is featured by relatively high standards of quality, as compared with those of other Latin-American countries. This may be largely attributed to the excellent quality of the cotton grown in Peru. It is possible, however, that the fact that Peruvian industry has been protected to a relatively smaller extent than other Latin-American countries may also have exercised considerable influence, since the Peruvian industry has had to compete constantly against the quality of foreign production. The bulk of the industry is located in Lima (90 per cent of the total number of spindles), but there are also mills in Arequipa (5 per cent), Cuzco (2 per cent), Ica (1 per cent), and Sullana (3 per cent).

IV. Summary of the results of the investigation

34. The numerical results of the investigation have been summarized in tables 1 and 2, in the form of indices of importance of the factors affecting productivity. These have been shown in a diagram indicating the manner in which the causes, or principal factors, were analysed with a view to ascertaining their components. Each number in the tables indicates the labour consumption of the industry, if there were no cause for low productivity other than that to which the number refers. It therefore represents the influence of this cause independently of all other factors.

35. Instead of indicating labour consumption in the usual units, that is to say, in man-hours per kilogramme, it was decided to express it as an index or percentual ratio of normal or standard consumption, that is, the industry's consumption, operating under optimum conditions. In this manner, the influence or importance of a factor may be directly compared with that of any other, even though it be another mill or country, or different type of product. Similarly, it is also possible to compare productivities, since these are merely the reciprocals of labour consumption.[16]

[14] The mills which set up as new industries, with modern machinery, have managed to avoid this contract legislation since the beginning; they contend that they constitute different industries, the machinery of which is not governed by the aforesaid legislation. The mills which were already in operation could not escape from its provisions and for about six years attempts have been made to alter it. It would appear that in the near future some agreement will be reached and this will probably lead to an increase in the degree of modernization of the industry.

[15] From 1925 until the present date, Peru's textile production capacity has been increased by 68 per cent, whereas that of Brazil and Mexico increased 40 per cent and 18 per cent, respectively. During the same period, Peru has modernized about 30 per cent of its equipment, whereas Brazil and Mexico have only 7 and 10 per cent of modern equipment, respectively.

[16] The following examples may help to clarify this point: if fifty men are employed in a mill when the number of workers can be reduced to twenty-five, the index of the importance of this excess of labour, operating independently of any other causes of low productivity, would be 200. If, in fact, there were no other causes, the same index could be obtained by dividing the actual consumption of labour, measured in the factory, by the standard or normal consumption, and multiplying the result by 100. If a loom operates at 180 revolutions per minute instead of the standard speed of 200, the difference between speeds, operating independently of other factors, would give rise to a relative labour consumption of 111, which is obtained by dividing 200 by 180; or, if there were no other cause of low productivity, by dividing actual labour consumption by standard labour consumption.

36. As has been shown diagrammatically in tables 1 and 2, the indices of the importance of all the causes affecting productivity (in the upper box) are broken down into their component factors or causes. These are subsequently divided into two principal groups (lower boxes) for the purpose of: (*a*) bringing together the causes which can only be eliminated by the investment of large amounts in the purchase of machinery for modernization and expansion of the installations, and (*b*) grouping the causes which can be corrected principally by the improvement of organization and administration of the mills. In order to simplify the explanation, the first group of factors, causes or deficiencies were designated by the term "of equipment", and those in the second group "administrative", using the latter term with a wider connotation than is generally ascribed to it.

37. The results shown in table 1 indicate that in the countries visited, for the old industry as a whole,[17] labour consumption per kilogramme of fabric (taking into account the process of spinning and weaving) is five times greater[18] (index 505) than that which could be expected under the best conditions—within practical limits—of modernity of equipment, size, organization and administration. These deficiencies of productivity become very important when one considers that approximately 90 per cent of the industry, in all the countries visited (4 million spindles and 130,000 looms), is characteristically old.

38. However, the productivity of the old mills is not so low in all the countries visited; for instance, in Mexico the index, or relative labour consumption, barely reaches 369, whereas that of Ecuador is 1,210. There are also large differences between the deficiencies in the spinning and weaving mills; in Ecuador, for instance, the weaving mills are three times more deficient than the spinning mills (1,856/611),[19] whereas in Mexico labour consumption in both sectors is approximately affected to the same extent (381/360).

39. Instead of pursuing the analysis of total deficiencies and their immediate causes, subsequently to be examined in detail, attention will be drawn now to the summary in which these causes are classified into the two groups of deficiencies, namely, "of equipment" and "administrative" (lower part of table 1). From this summary it may be concluded that at least in two countries (Brazil and Ecuador) it is more important to reorganize old industry on a new administrative basis than to modernize equipment and expand the installations. In two other countries (Mexico and Peru), the opposite occurs; and for all the countries taken as a whole, it might be stated, to judge from the indices (230 and 220), that both groups of causes exercise approximately the same amount of influence.

40. This conclusion is of interest because it shows that what has been termed the "backwardness" of the Latin-American textile industry and has been generally attributed entirely to equipment, is partly due to the lack of organization and administration in the mills, although these conditions, as will be shown later, do not depend merely on the will, or on the administrative capacity, of the manufacturers. In the Latin-American countries which are unable to purchase new equipment because of their scanty savings capacity, or because they must divert capital to more pressing needs, the significance of administrative deficiency in the textile mills shows that there is still a wide margin to increase productivity without recourse to substantial investments.[20]

41. The results of the investigation in modern industry (table 2) show that the mills in this sector employ 82 per cent more labour (man-hours per kilogramme) (index 182) than would be consumed in an optimum size, well-organized and well-administered mill in which the same type of equipment is installed. As in the older sector, large differences in the rates of productivity are found among the modern mills of the countries visited. For instance, in Chile the relative labour consumption is 241 (an excess of 141 per cent), while in Mexico it only reaches 137 (an excess of 37 per cent). On the other hand, there are not very large differences in the productivity deficiency between spinning and weaving mills within each country.

42. Momentarily disregarding the analysis of deficiencies, and observing the indices corresponding to the group of causes designated by the terms "equipment" and "administration" (lower boxes of table 2), the conclusion may be drawn that modern industry does not take full advantage of the modernity of its equipment. This is due to administrative deficiencies which increase labour consumption by 61 per cent. The factor "equipment", which in this case refers almost exclusively to the small size of the industry, is responsible for a 13 per cent increase in labour consumption.

43. Though it is recognized that a part of the administrative deficiency of modern industry may be ascribed to the fact that some of the mills have only recently begun to operate—their performance, therefore, not yet being normal—the presence of these deficiencies in all the countries visited and their great importance in nearly every case, suggests the possibility that those general factors which give rise to administrative backwardness in the old industries are also affecting the modern mills. In this case, it is to be feared that the Latin-American textile industry will continue to have a low productivity, despite the modernization of its equipment, unless it makes a deliberate attempt to offset the pressure exercised by those factors.

44. The fact that there are many examples of Latin-American mills in which there are no administrative deficiencies, and other examples in which there are no deficiencies whatsoever in the mills,[21] shows that individual efforts by certain manufacturers have made it possible to counteract the influence of the economic environment. These constitute an excellent example of what can be done in Latin America, whilst also serving as a very useful source of experience in future projects.

[17] In order to simplify the explanation in this part of the report, it was decided to use only the weighted general averages of the indices for each of the mills visited and each of the products examined. Both the original indices for products and countries, and the labour consumption, expressed in man-hours per kilogramme, may be found in chapters II to VI. The individual productivities of the mills visited are shown in the corresponding graphs for each country.

[18] That is to say, productivity is five times lower.

[19] The old weaving mills of Ecuador show the extreme of low productivity since, on the average, they employ more than eighteen workers for tasks which one man could do in a modern factory of optimum size, good organization and administration.

[20] The correction of administrative deficiency also involves some expenditure, but this is considerably less than that required for the acquisition of new textile equipment.

[21] See the chapters in which the countries are dealt with separately.

V. Factors bearing on productivity

A. *Type of equipment*

45. The use of old machinery instead of modern equipment, if it is viewed apart from the influence of any other factor, increases labour consumption by approximately 33 per cent in the spinning mills, 164 per cent in the weaving mills, and by 106 per cent as an average for both sectors of the industry[22] (table 1). In other words, if an old, well-organized spinning and weaving factory acquires modern equipment and re-adapts its organization to the new machinery, it would more than double labour productivity.

46. In the case of spinning mills, the influence of the type of equipment (133) is of very little importance, compared to the joint effect of all the other factors—even in Peru, where the indices for these other factors (197)[23] are extremely low in comparison with those of the rest of the countries. This is because modern machinery in the spinning mills differs very little from the old type of equipment, as regards both production per unit of equipment and the number of workers required per unit of equipment. In the analysis of the indices of the type of equipment in the spinning mills, it will be seen that the difference in labour consumption between old and modern machinery generally arises from an increase of 6 per cent (106) in the output per spindle and a decrease of 20 per cent (125) in the number of workers required.

47. In the weaving mills, on the contrary, the influence of the type of equipment on labour consumption is of considerable importance (264). In two of the countries (Mexico and Peru) it is more important than the total of the remaining factors, but in the other two countries (Brazil and Ecuador) it is not as dominant, because of the great administrative deficiencies in the mills. As may be seen from the analysis of the indices for the type of equipment, the difference in productivity between the old and modern weaving machinery arises from a relatively low gain in the output per loom (26 per cent) and a considerable labour saving per unit of equipment (52.4 per cent),[24] principally due to the fact that the looms are automatic.

48. If all the spinning and weaving mills of the country are considered as a single unit, or if it is assumed that the two processes are integrated in the same old manufacturing units, it would be equally important to modernize both sectors of the industry because the proper functioning of the automatic looms requires high quality yarn (uniformity, cleanliness and strength), which cannot be produced on the antiquated and outworn machinery installed, even though this could be satisfactorily used from the point of view of labour productivity.

B. *Small size of the mills*

49. The textile factories in the countries visited are small, as compared with the lower limit of size which would enable them to attain the best productivity possible.[25] The general average size is 9,600 spindles and 230 looms, but the average for individual countries varies from 4,150 spindles and 145 looms in Ecuador to 12,400 spindles and 314 looms in Brazil. The influence of size on the group of mills as a whole, were it to operate independently of other factors, would involve an increase of 11 per cent in labour consumption in the spinning mills and 2 per cent in the weaving mills.[26]

50. Though the values of these indices are not very high, it is significant that the deficiencies to which they correspond are practically of a structural order, requiring a long period for their elimination; this can only be achieved through the joint action of the industry as a whole. It is also important to note that the new textile mills being built are of low capacity; this is especially important if one takes into account the fact that small size affects the modern units relatively more than the older ones, owing to the fact that in the former, the degree of labour specialization is more responsive to variations of size.[27] Among the new mills visited during the course of this investigation, many cases were encountered in which the smallness of size caused a loss of nearly all the advantages of productivity which might potentially be derived from the modernity of the installations.

51. The principal cause for the small size of the textile mills in the countries visited is the lack of capital concentration in the hands of a single firm. This can be ascribed to the characteristic individualism of many Latin-American manufacturers. The limited size of the market, which is frequently referred to as another of the main causes, has no general importance in this connexion (except probably in Ecuador), because the volume of domestic demand for textiles is several times greater than total production of an optimum size mill and, moreover, because the types of fabric which are produced in the greatest quantity are very similar to one another. In the manufacturing of fine and fancy fabrics, which are only consumed in small quantities in these countries, the existence of small mills can be justified even from the point of view of productivity, because flexibility in changing the type of production, which is the most important characteristic of this type of mill,

[22] As has been explained in the chapter on methodology, these figures are purely theoretical and have been calculated by comparing the productivity of old and modern hypothetical mills, both of which have optimum organization for each type of equipment. The small differences between the indices of the countries are due to differences in the types of products, which cause variations in the effect of old equipment on productivity.

[23] Obtained by the product of the indices for size (121) and those for operation (164).

[24] 52.4 per cent equals $(1 - \frac{100}{210})$ 100.

[25] In this report, the optimum size for Latin-American mills was considered to be probably between the limits of 25,000 and 50,000 spindles for the spinning mills, and 500 to 1,000 looms for the weaving mills. In the chapter on methodology, the reasons for this opinion have been set forth and the theoretical effect of the differences of size on productivity have been calculated with reference to the lower limits.

[26] These figures are the weighted averages of the influence of small size in the mills of the countries visited. They were all calculated as being old, because there were not sufficient data with which to discriminate. However, owing to the high percentage of old equipment installed, it is not believed that they vary much from the correct values. The small differences between these figures and the indices of table 1 are due to the fact that it was not possible to obtain a sample which was entirely representative of the universe as regards size.

[27] The average size of the modern factories in the sample (10,000 spindles and 325 looms, approximately) is slightly larger than the average size of the industry, as a whole. However, the effect of size is much more important in the sample of modern factories than it is for the group of mills as a whole, as may be seen from table 2.

does not allow a very high degree of labour specialization to be attained, even when the capacity of mills is very large.

C. *Operation in the old mills*

52. In this section, reference is made to all the low productivity factors in the old mills, excepting the type of equipment and the small size of the installations. It includes principally the causes which can be corrected by good organization and internal administration of the factories, but it also takes in others of less importance, not covered by administrative action (of the manufacturers in co-operation with labour), either because they demand the investment of large sums (such as for the irreparable deterioration of machinery), or because they depend upon the joint administrative action of the whole industry and of the government (such as the poor quality of the cotton and the lack of specialization in production).

53. As is shown diagrammatically in table 1, the factors of operation were divided into two groups, the first of which includes abnormalities in the output of the machinery, apart from the amount of labour allocated to it; and the second, comprised of abnormalities in the amount of labour employed in the textile processes, independently of the volume of production yielded by the machinery.

54. Excess labour in relation to the corresponding amount in a normal or standard organization has a far greater effect on productivity than the deficiencies in the yield of the machinery. In fact, table 1 shows that the average importance of excess labour in the old spinning and weaving mills of all the countries together is 196 (96 per cent labour excess), as compared with the average importance of the deficient output of the machinery, which is only 118 (15 per cent lower yield than normal).[28]

55. It is interesting to note that though there is an excess of labour in all the sectors—it varies between 28 per cent (index 128) in the Mexican weaving mills and 575 (index 675) in Ecuador—there are no deficiencies in the output of machinery in all the sectors. In many industries, as is shown by the indices which are lower than 100, higher equipment yields are being obtained than those which might normally be expected, that is to say, production is being forced from the machines. These are being worked at the highest possible speed and their period of inactivity is reduced to a minimum; intermediary products, with a heavier unit weight than is suitable in order to obtain a better quality, are being used on these machines.[29]

56. As will be seen below, in order to force production, especially in the mills in which the condition of the equipment is bad, it is necessary to employ a considerably greater amount of labour than would be required under normal circumstances. Therefore, the difference between the indices of the importance of the output of the machinery and the excess of labour may be taken as an indication of the existence of a Latin-American industrial policy, which is consistently attempting to draw the greatest advantage possible from the scarce element, namely, equipment, at the cost of wastage of the abundant factor, namely, labour, without the quality of the products being of sufficient importance to offset the results of this policy.

57. Despite the manufacturer's wish to obtain the highest yield possible from equipment, this cannot be done in every case, owing to a number of defective manufacturing conditions, mainly affecting the efficiency of the processes, that is to say, hindering the actual output from reaching the level which might be expected from machinery operating at the speeds, and with the unit weights of the product, that have been correctly or incorrectly adopted.[30] These defective conditions not only diminish efficiency but also demand more labour than is normal, in order to obtain the present rate of efficiency. In certain cases, the deficiency of manufacturing conditions also affects the speed of machinery or the organization of the processes, as will be shown below.

58. The following list covers some of the manufacturing conditions which are most commonly found to affect productivity in the old textile industry:

(*a*) The physical condition of the equipment is very deficient in the majority of the mills. This is largely due to natural deterioration caused by many years of constant use, but the lack of an adequate maintenance service is probably even more important. It is common to find card-clothings which should have been replaced long before; rolls of spinning frames requiring recovering; machines which are entirely off level; eccentric spindles, and looms which have been repaired with bits of wire. Very few mills have any systematic maintenance programme, that is, a frequent and regular inspection of the machinery and its complete overhauling for repairs, cleaning and adjustment. The practice of looking after the equipment in an emergency is far more current than the adoption of any preventive measures. These conditions are responsible for the poor quality of the intermediary and final products, causing stoppages due to mechanical breakdowns, and lowering efficiency in the processes. As has been said, low efficiency is frequently checked, or an attempt is made to check it, by increasing the number of workers allocated to each machine. In Brazil there are various cases in which the speed of some of the machines has been lowered in order to offset some of the effects of their bad physical condition.

(*b*) In many old spinning mills, principally in Mexico, a lack of balance was noted between the capac-

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[28] 15 per cent $= (1 - \frac{100}{118})\ 100.$

[29] See the analysis of the indices corresponding to the differences in the output of the machinery in their three constituent parts, that is, the indices of the abnormality of unit weight, of speed and of efficiency. It will be seen that the two first indices are mostly about 100 or a little below this figure, which shows that the unit weight of the intermediary products and the speed of the machinery are fairly close to, though generally a little higher than, normal. The efficiency of the process is well below normal, but in the detailed study of its causes, in each of the countries, it is found that though efficiency is low, it is better than might be expected from the defective manufacturing conditions which are found in nearly all the mills.

[30] In this report, the efficiency of the processes only expresses the relationship between actual hourly production of the machinery and the theoretical production that would be given by the same equipment if it were to operate without any stoppage, at the speed assigned. The index of importance of the abnormalities in efficiency has been calculated as an average relationship between standard efficiency and actual efficiency, but it might also be obtained by dividing actual labour consumption by standard labour consumption, if the abnormality of efficiency were the only cause of low productivity.

ity of the preparatory spinning processes (such as opening, picking, carding and drawing) and that of the final process (spinning frames). In the majority of cases, this lack of balance can be ascribed to the increase in the number of spindles without a proportional increase in the capacity of the initial processes. However, in other examples the gradual change-over in the type of product to coarser counts has also exerted some influence. As a result of this, the manufacturers speed up the preparatory machines or, alternatively, increase the unit weight of in-process products.

(*c*) It is common to find mills with a poor machine and room layout. This is principally due to the fact that the number of machines has been increased within the available space, which is really too small to contain them. In many cases, however, the original building plans and the equipment layout were at fault.

(*d*) Frequently one finds that the control systems of humidity are deficient or non-existent. Some manufacturers believe that the natural humidity of the atmosphere is sufficient not to require the installation of artificial humidification equipment. This, however, does not take into account the well-proven importance of maintaining humidity constant within the narrow limits which vary according to the process or group of processes involved.

(*e*) On the whole, in the textile mills of the countries visited, no proper attention is given to the problem of cleanliness in the rooms and the machinery, though the manufacturers recognize this to be a very important factor in obtaining high process efficiency and high quality products. It is possible that the reason for this deficiency lies simply in the fact that the standards of cleanliness are low. In many mills, the use of efficient tools and equipment for this purpose is entirely unknown.

(*f*) The poor quality of the yarn—its lack of uniformity, cleanliness and strength—is probably the factor which affects the efficiency of the weaving process most frequently and to the greatest extent. In a few cases, it is also encountered in conjunction with the poor preparation of the warp; that is, deficient slub catching at the spoolers or cone-winders and inadequate sizing at the slashers.

(*g*) Though there is undoubtedly a marked difference between the degree of product specialization in the Latin-American mills and that of some of the most highly industrial centres in the world, the investigation in the mills visited showed that the greater part of these mills constantly produce certain types of fabrics in amounts which do not vary greatly from month to month. It was considered, therefore, that the lack of specialization has not had so much effect on Latin-American productivity as is generally believed, or at least that its importance is considerably lower, compared with other factors which increase labour consumption. In Brazil and Mexico, however, many large weaving mills were found which, in order to meet market requirements, were producing relatively small amounts of different types of cloth; this factor was taken into account when assigning an estimated index of importance to this influence. The lack of standardization of the products for popular consumption is probably more important than the lack of specialization, not so much because of its effect on productivity, but as an element which unnecessarily increases the final price paid by the consumer. In Mexico, for instance, mills which are situated far away from each other manufacture almost the same type of cloth; however, small differences in their construction or in quality exist, and these are sufficient to enable the product of one region to find a large market among consumers in another region and vice versa. This trade would be necessary in the case of highly differentiated products, such as the majority of the fine and fancy fabrics absorbed by the high-income classes. However, in the case of goods for popular consumption, it only involves a waste in transport and intermediary functions which might be avoided if these products were subject to strict standards of construction and quality.[31]

(*h*) Only in Ecuador was it possible to say definitely that the poor quality of the cotton contributed to low productivity. Domestic raw material in Ecuador contains a large number of short fibres of low strength and is extremely irregular in staple length. Consequently, it leads to much waste, affects the efficiency of the processes, lowers the quality of the product, and limits the range of yarn counts which may be manufactured.

59. Within the time limit set for the investigation, it was impossible to determine the effect that each of the conditions enumerated above have on labour consumption, principally because they form a complex which is difficult to analyse. However, grouping these conditions under more or less homogeneous categories and making use of measurements, observations and rough estimates, it was likewise attempted to express their importance in the form of indices, with a view to comparing them with the importance of other factors affecting productivity. Table 1 contains the indices of these groups obtained in each of the countries visited and also their weighted averages. The detailed analysis and explanation of the procedure followed in order to obtain these numerical values is contained in chapters II to VII.

60. The majority of these defective manufacturing conditions affect productivity not only by changing the output of the equipment through variations in the unit weight of the product, speed of the machinery, or organization of the processes, but by demanding a greater number of workers than is normally required. It may therefore be said that the total excess of workers found in the Latin-American mills (index 196 for the industry as a whole) is partly employed in meeting this extraordinary demand (index 115); the rest may be considered absolutely superfluous, that is to say, it might be eliminated without correcting the manufacturing conditions. The importance of this superflous labour is expressed in the following indices: 193 for Brazil, 361 for Ecuador, 139 for Mexico, 153 for Peru, and 170 for these countries as a whole. Its existence is principally due to the prevalence of antiquated working methods and to the lack of organization and labour supervision which will be discussed elsewhere in this report. If the index of relative labour consumption corresponding to the excess of workers required by manufacturing conditions (115)[32] is compared with that of the amount of absolutely superfluous labour (170), it will be seen that the latter is by far the more important.

[31] The Secretariat of National Economy in Mexico has been working on standards of manufacture for industrial fabrics and for cloth for popular consumption.

[32] Index 115 is not shown in table 1. It is obtained by dividing the index of total excess labour (196) by the index of superfluous labour (170).

D. *Synthesis of the factors of low productivity in the old industry*

61. With the object of assessing the importance of the factors of low productivity, according to the type of action required for their elimination, the indices obtained by means of the analysis have been summarized in the following manner: (1) The irreparable deterioration of the equipment was separated from manufacturing conditions, as was the lack of balance between the capacity of the preliminary and final processes of the spinning mills and the defective machine and mill layout, for the purpose of associating them with the factors designated as "type of machinery" and "size of the plant". One could thus form a group which would include all those factors that cannot be eliminated except by investing large sums of capital in the replacement of machinery and in the expansion of the plant (index 230). (2) The remaining manufacturing conditions were broken up into two groups, of which one calls principally for internal administrative control (index 123), and the other requires the co-operation of all manufacturers, and of the government, in order to improve certain conditions, such as the poor quality of the cotton and the lack of specialization in production, that demand external administrative action (index 105). (3) All the factors of operation, with the exception of those associated with the type of equipment and the size of the plant, were drawn together in a single group, which, as has already been suggested, may be called "administrative factors", using this term in a wider sense than is generally ascribed to it (index 220).

E. *Operation in the modern mills*

62. The analysis of the operation of modern mills proceeded along similar lines to that made for the old mills, and there is therefore no need to repeat the details of procedure in this section.

63. In modern industries, the excess of labour in relation to the number of hands employed in a normal or standard organization also bears considerable influence on productivity, exercising a pressure which is greater than the deficiency in the output of machinery. In fact, table 2 shows that the average importance of excess labour, in the group of modern spinning and weaving units in the countries visited, is 154 (54 per cent excess labour) whereas the average importance of deficient machine output is only 105 (5 per cent less yield than is normal).[33]

64. Just as in the old industries, it was found that a higher than normal yield (97, 67 and 95) is being obtained from the machinery in the spinning mills of three of the countries visited (Brazil, Chile and Peru). This fact, together with the substantial excess of labour in these sectors (indices 145, 285 and 168) might be considered to confirm the existence of a policy of maximum utilization of the scarce factor, that is, of equipment, at the cost of a wastage of the factor which exists in abundance, namely, labour.[34] The same policy is probably adopted in the weaving mills, but the same results are not obtained on account of certain factors—to which further reference will be made—which limit the output of the machines, whatever number of hands are used on them.[35]

65. Just as in the case of the old industry, not all the excess of labour (index 154) may be considered entirely superfluous, since a part of it is employed to offset certain conditions which tend to reduce the efficiency of the processes. The most important of these conditions is the inadequate training of the workers which, were it to prevail independently of other factors of low productivity, would increase labour consumption by 14 per cent, not only because it involves the employing of more workers than are necessary, but because in any case, even after extra workers are taken on, it affects the efficiency of the processes. The clearest example will be found in the weaving sheds, where the lack of experience of the loom-fixers is a source of an excessive number of mechanical loom-stops, inevitably lowering the efficiency of the process, even when many weavers are employed. Moreover, the fact that weavers are also unskilled means that fewer looms can be assigned to each worker, in order to maintain the highest possible level of efficiency, within the limits established by other conditions.

66. Other factors which are of less importance are the poor quality of the yarn (in some of the Peruvian weaving mills, where the yarn comes from antiquated spinning mills), the defects in warp preparation and in the twisting and winding of the filling (in the spinning mills of Chile and Brazil); and, lastly, the lack of systems of humidity control (frequently found in the weaving and spinning mills of Peru).[36]

67. Considering the group of countries as a whole, the combination of all these factors tends to lower the efficiency of the processes to a level which is 93.5 per cent of normal,[37] and, at the same time, demands 12 per cent more labour (index 112)[38] than would be required under normal conditions. In other words, it involves an average increase of 20 per cent (index 120)[39] in the consumption of labour per kilogramme of fabric, if both spinning and weaving are taken into account.

68. The remainder of the total labour excess, after discounting the extraordinary demand for labour arising

[33] 5 per cent equals $(1 - \frac{100}{105})$ 100.

[34] Attention should be drawn to the analysis of the index corresponding to the differences in the output of the machinery in the spinning mill, and their three component parts, that is, the indices of abnormality in unitary weight, in speed and in efficiency. It will be seen that in the majority of countries, the first two indices are lower than 100, indicating that the unitary weight of the intermediary products and the speed of the machinery are higher than normal. The efficiency of the processes is slightly below normal in all the countries, with the exception of Chile, where it is higher.

[35] The analysis of the index corresponding to the differences in output of machinery in the modern weaving mills (table 2) shows that in the majority of countries the speed of equipment is below normal. This is principally caused by the fact that in some mills the machinery was still in the initial running-in period, and therefore operating at slower speeds, though in some cases speed was reduced in order to train recently-engaged labour. With the exception of Brazil, the efficiency of the weaving process is considerably below standard.

[36] See the reference made to the lack of humidity control in antiquated industry.

[37] 93.5 per cent equal $\frac{100}{107} \times 100$.

[38] This figure (112) is obtained by dividing the index corresponding to the total excess of labour (154) by the index for entirely superflous labour (137).

[39] This figure (120) is obtained by multiplying the average index for the abnormality of process efficiency (107) by the index representing extraordinary demand for labour arising from deficient conditions (112).

from the lack of skilled workers and other deficient conditions, may be considered as entirely superfluous, that is to say, it could be eliminated without greatly lowering the present output of the machinery. The presence of this labour in the mills causes labour consumption to be 37 per cent higher than if these hands were eliminated. It exists principally because of the lack of adequate organization and administration of the mills.

69. By comparing the index for superfluous labour (137) with other indices contained in table 2, it will be seen that this is the most important of the factors affecting the productivity of modern industry as a whole. However, it does not occur in all the countries visited since it was not found to prevail in Mexico (index 99); nor does it affect all sectors uniformly, since its index (with the exception of Mexico) varies from 131 in the weaving mills of São Paulo to 225 in the Chilean spinning mills.

F. *Synthesis of the factors of low productivity in the modern industry*

70. In preparing the summary of the indices corresponding to the factors affecting productivity in the mills contained in table 2, it was assumed that all the factors of operation could be eliminated by adequate administrative measures, without having recourse to large capital investments. On the whole, these factors involve the consumption of 61 per cent (index 161) more labour than would be required in a normal or standard unit, whereas the deficiencies which can be attributed to equipment and to size, the correction of which requires large capital investments, only involve the consumption of 13 per cent (index 113) more labour than that of the standard units.

VI. Deficiencies in the methods of technical and administrative control

71. Serious deficiencies were found in the systems of technical and administrative control, especially in the old mills. The majority of these deficiencies might be considered as indirect factors of low productivity since at all events they hamper the discovery and assessment of the true causes and make it difficult to correct these systematically.

72. Probably the most important of these deficiencies lies in the method used to determine the work-loads, that is to say, the number of machines or units of machinery which should be assigned a single worker.[40] It is generally found that the methods employed conform to customs, established since the early days of the Latin-American textile industry, which were very often passed down from the old British organizations. The work-load is characteristically small and irrational, that is, it is not related to the intensity and duration of work really demanded in textile operations. Only recently, in some of the new mills, has there been an attempt to adopt modern systems based on the frequency and duration of the various elementary functions of the worker and also on the percentage of time allowed for the rest period corresponding to these functions[41] during the working day. The majority of the undertakings have not even attempted the correct determination of these elementary functions in accordance with the optimum degree of specialization corresponding to the size and type of the plant.

73. The systems of quality control for the cotton, the in-process products (picker lap, card web, slivers and roving) and the finished goods (yarn and cloth) are very deficient in the large majority of the old factories. They have few laboratory instruments and their systematic checking is generally limited to an inspection of the raw material (in order to verify the length of staple), the determination of yarn count and strength, and the grading of cloth, according to the number of flaws it contains. In very few cases is there any orderly inquiry into the causes of these irregularities of quality and nowhere are modern methods of statistical quality control adopted, such as those which are beginning to be used by the textile industries of the highly industrialized countries.[42]

74. Though in many mills efficiency of the processes is checked[43] (at least in the spinning-frame and loom sections), very few check the source of abnormalities by measuring the frequency of breakages or machine stops, classifying them according to the apparent immediate motive, and investigating these immediate causes in order to discover the underlying factors. It is likely that many of the causes of low productivity to which reference has been made in this report occur simply because their existence has never been noted, or because no adequate assessment has been made of the full influence of these causes on the low yield of the machinery, or of labour.

75. In the majority of the mills there is no real system of cost control. The average cost of production is determined by means of global accounting data, but no effort is made to break it up by sections and distribute it among the various products. In very few cases are standard costs used, nor are analyses made of the variances between actual costs and the said standards, which would make it possible to discover the main discrepancies and correct their causes or at least recognize them. Since the deficiencies in the yield of machinery and in the utilization of labour are among the outstanding causes of cost variances, it is believed that the lack of adequate cost systems indirectly affects productivity, unless the mills have other direct means of determining and controlling productivity.

[40] The work-load may also be defined in terms of production per unit of time or, more directly, as the sum total of the elementary times which a worker requires for the execution of all his duties or activities during a working day.

[41] In the new Mexican factories, the introduction of modern methods of determining work-loads is most frequently encountered and undoubtedly contributed to the absence of excess labour in these units (see table 2). The practice generally adopted is as follows: (1) a detailed list of the elementary functions is drawn up for each worker; (2) by means of time studies the average duration of each of these functions is established; (3) these durations, or elementary times, are multiplied by a practical factor varying generally from 1.10 to 1.15, for the purpose of establishing a period of rest for the worker; (4) the frequency with which the elementary functions are repeated must be established, per unit of machinery, during a given period (480 or 2,880 minutes) and multiplied by the corresponding durations; and, lastly (5), the selected period must be divided by the sum of the products thus obtained, in order to determine the number of machines or units of machinery which may be assigned to a single worker, without compelling him to make an extraordinary effort.

[42] This refers principally to the systematic use of adequate sampling procedures, and the Shewhart chart for quality control.

[43] In this report, the efficiency of the processes only shows the relationship between actual hourly production of the machinery and its theoretical continuous production, that is to say, if the machinery were used continuously without any stoppages.

76. Though raw cotton is the most important element in the cost of Latin-American textile goods, no methods exist whereby the wastage of the raw material can be adequately controlled, even in countries which have to import cotton from abroad. Just as in the case of costs, it is not sufficient to measure the total amount wasted; it is necessary to analyse it by sections, comparing it with pre-determined standards, and to verify the reasons for differences as compared with the set standards, insisting on corrective measures where necessary. Even though, during the course of this inquiry, it was impossible to determine numerically the effects of cotton waste, precisely because no methods of control exist, it is generally recognized that the waste is excessive. The repercussion of this wastage is felt principally in the cost of the raw material, but it also affects productivity, since it involves a certain amount of wasted textile labour.

VII. Fundamental causes of backwardness in the Latin-American textile industry

77. The considerations contained in the preceding sections might be summarized by saying that, on the whole, the Latin-American textile industry is not only affected by the stagnation of technical progress as regards equipment, but also by the lack of progress in management. That these two deficiencies do not occur with uniform intensity in all the countries, allied to the fact that in the course of this inquiry examples have been found of old and modern mills without administrative deficiencies, and also of modern mills with practically no deficiencies at all,[44] indicates that the improvement of productivity in the field of textiles, specifically, is not hampered by insuperable obstacles. This, nevertheless, does not exclude the presence of problems which hinder the achieving of such improvements, which at the same time, would bring about an increase of general productivity in these countries.

78. At the outset, the Latin-American textile industry was marked by an intense period of development, almost parallel in modernity and technique with that of the more highly industrialized countries; this was followed by fifty or sixty years of stagnation—or even of regression—except for increases in capacity. This phenomenon can be explained by a complex of factors, establishing fundamental differences between the climate for industrial development in Latin America and that in the more advanced world centres. Some of these factors are described in the following pages.

A. *Lack of extension of technical progress in matters of equipment*

79. It might be said that Latin America's backwardness in the textile industry, in so far as equipment is concerned, can be mainly ascribed to the fact that since the period of outstanding development, early in the century, until the present day, manufacturers have had little incentive to modernize their machinery. This encouragement might have been offered by four different sources: (1) a substantial increase of production per unit of equipment (spindle or loom) or in a general way, per unit of capital invested; (2) considerable savings in labour, per unit of finished goods; (3) a marked increase of quality in the textile goods per unit of capital invested; and (4) the compelling need to replace machinery, because physical deterioration rendered its continued use impracticable.

80. The increase of production per unit of capital invested has acted as a negative stimulus because, since the beginning of the century until the present day, machine manufacturers have only increased production per spindle by 6 per cent and output per loom by 26 per cent, as is shown in table 1, though the prices of equipment per unit are now eight times higher than previously.[45] If textile machinery had progressed during the past fifty years, from the point of view of unitary production, in a measure corresponding to that in other industries, such as the manufacture of glass or the casting of metals,[46] it is quite likely that the Latin-American textile mills would now be equipped with more modern machinery. This would probably have occurred despite the limitations of the capacity to save, since the incentive offered by increased production per unit of machinery is very strong in Latin America, where profits can be more easily augmented by increasing the volume of production than by reducing costs.

81. The stimulus to modernize machinery offered by the reduction in the amount of labour required per unit of equipment might have been stronger, since improved working methods, and automatic mechanisms added to machinery during the past fifty years, have reduced the amount of labour required in spinning mills by 20 per cent and the amount of labour in the weaving mills by 53 per cent.[47] However, this stimulus has also been extremely weak in Latin America, principally owing to the relative unimportance of the average wage level in industry, as compared with the average price of textile goods. In fact, if the price of a popular fabric in each country is assumed to be 100, expressed in local currency, the cost per man-hour would be 60 in Brazil, 82 in Chile, 36 in Ecuador, 83 in Mexico, and 57 in Peru, whereas in the United States, where the price of labour is of the highest importance, the cost per man-hour would be 355.

82. The improvement in the past fifty years, in so far as the quality of the textile goods is concerned, is of considerable importance, especially in the spinning mills. However, this advantage would hardly encourage manufacturers to modernize machinery, since the high customs tariffs in the majority of the Latin-American countries do not contribute to free competition with the imported goods in so far as quality is concerned. It is certain that when dealing with ordinary fabrics, the manufacturers have always forced the market to accept whatever type or quality of products they have either wished to, or been able to, manufacture, and the factor

[44] See chapters referring to each of the countries.

[45] Even if the cost of equipment were deflated in order to allow for the general rise in prices between the two periods, the small increase of production would not in itself justify any change of machinery.

[46] During the past few years, a great deal more scientific research has been taking place in the textile machinery factories, and it may therefore be expected that radical improvements will shortly be made therein. It is curious to note that in one of the Brazilian mills, one of the weaving sheds has shuttleless looms manufactured in the same mill, whereas in machine-manufacturing countries this type of loom is still in the experimental stage. In another Brazilian factory, there are European spinning frames, which are fed directly with the card sliver, whereas in the United States this process has not yet been adopted on a commercial scale.

[47] The weighted average for spinning and weaving is 44 per cent. The reciprocals of these percentages are shown in table 1, in the box "Difference in the number of workers required".

of consumer preference has had hardly any influence on production policies.

83. Lastly, physical deterioration in itself has had little influence in hastening the process of modernization because the maintenance service of the mills has undertaken repairs, or the changing or fixing of broken and worn-out parts to such an extent that very little of the original equipment remains in the machinery now standing. It cannot be denied, however, that there has been a functional depreciation which has caused an increase in the number of man-hours required in order to complete the process of production with the machinery available, and to service that machinery. This factor, because of the low price of labour, does not provide sufficient incentive to render the postponing of the replacement of equipment impossible.

84. Together with the lack of incentive, the modernization of equipment has been affected by the decreasing capacity of many mills to create adequate reserves for the replacement of their machinery. This has been because of: (1) a financial policy unsuited for the proper establishment of such reserves; (2) the extraordinary increase in the cost of machinery, due to higher prices and variations in the exchange rates; and (3) the fact that in periods of high profits in industry, that is, during the war, it was impossible to obtain equipment and the savings that could have been used for that purpose had either been employed mainly in other types of investments or, when an opportunity to purchase equipment occurred, these savings had already been set aside in order to expand working capital, which was necessary because of inflation.

B. *Lack of extension of administrative progress*

85. During the past fifty years remarkable administrative progress has been made in the textile industries in the more highly industrialized countries, such as the United States. The organization of labour has been perfected, its functions have become more highly specialized, and the methods of working are more efficient. Training has been intensified, the work-loads have been determined by rational systems; and, in short, there has been a substantial reduction in the amount of labour required for the production of one kilogramme of yarn or fabric. Methods have also been evolved for controlling the quality of the product, the efficiency of the processes, the waste of raw materials, manufacturing costs, and the yield of the workers, so that it is possible to locate and correct systematically all the causes contributing to low productivity, defective quality and wastage of resources.

86. The failure of management to progress in the Latin-American mills is difficult to explain because many factors are involved, some of them connected with the human element itself. Broadly speaking, it may be said that administrative backwardness is due to the combination of: (1) the lack or inefficiency of media for the spreading of technical knowledge; (2) the absence of conditions which would encourage the manufacturers to seek such knowledge, and to attempt to replace present organization by a better system, based on stricter controls and the employment of a minimum amount of labour; and (3) special circumstances created by economic forces or trade union stipulations, which limit the administrative action of the manufacturer.

87. The typical method of spreading knowledge regarding the textile industry and the limited management techniques that are used in the Latin-American mills, is direct transmission from practical textile experts — most of them foreigners—to apprentices or subordinates. In the majority of cases, this method has its difficulties and limitations, mainly because this information has been given a tone of secrecy, making it appear that it can only be acquired after long years of experience. There are very few textile schools, and those which do exist have been opened very recently. Many of them are exclusively for the purpose of training workers, and those which have courses for engineers or technicians place more stress on specific textile knowledge than on administrative techniques. Textile literature, especially in Portuguese or Spanish, is scarce and rarely deals with subjects connected with the administrative organization of the mills. It would seem that the only existing means of obtaining any knowledge of textile management, apart from studying in countries where the techniques have been developed, is the calling in of foreign consultants, of which there are not many, and which proves to be a costly business for the many small mills spread over Latin America. Undoubtedly, these deficiencies in the means of spreading knowledge have contributed to the backwardness of industry, especially as they have combined with other factors which, as shown below, have hampered the modernization of administrative methods.

88. The lack of incentive to modernize organization derives principally from the relatively low cost of labour, to which reference has already been made. This leads the manufacturer to assign very few units of equipment per worker, not only to ensure a high output from the machinery—a very important consideration—but also to avoid the inherent problems of establishing strict controls, intensive supervision, the training of unskilled personnel and, above all, the readjustment or displacement of labour.[48]

89. The lack of proportion in the measures adopted to protect industry, in order to compensate only the constitutional deficiency of the factors, has also limited any incentive there might be to reduce costs and to improve the quality of the products.

90. Certain circumstances, which in some cases are the cause and in others the consequence of the factors outlined above, have arisen that hamper administrative progress, though to some extent they also influence stagnation in matters of equipment. The most important of these is labour resistance to any change which may involve its displacement. It is principally encountered in the rigidity of certain labour contracts, which require not only the immovability of labourers as individuals, but also the perpetuation of their occupations, despite the fact that technical and management progress may render their tasks unnecessary. Another feature often con-

[48] This does not imply that the attitude of the manufacturers can be ascribed to their having solved the purely financial problem of choosing between investing capital in administrative improvements, or alternatively, of continuing to pay wages to an excessive supply of labour, since there have been very few managers or owners who have had all the necessary data with which to consider the matter from a technical standpoint. On the contrary, it might be said that they have followed the line of least resistance.

tained in these contracts is that of a fixed ratio between wages and production, neutralizing any incentive the manufacturer may have to introduce more specialized working methods, or mechanical modifications, which would increase the number of units which each worker can handle.[49]

91. Labour resistance, however, should not be held exclusively responsible for the low productivity of the backwardness of the textile industry. It is merely a symptom of the real cause, which is far more important and fundamental, namely, the limited capacity of the Latin-American countries to invest in undertakings capable of absorbing personnel displaced by technological progress. Administrative improvements in the textile industry demand the flexibility of the labour contracts, but for this to occur, it is necessary to organize the migration of textile labour to other centres of activity, which, by reason of their development, are in a position to offer work to displaced textile labour. The indemnities paid to discharged workers would be an internal means of solving a specific problem in the factories, but they do not modify the general condition causing labour resistance to modernization.

92. The evident difficulty in changing established customs and breaking down traditions, which have prevailed since the beginning of the century, has also served to check the contraction of the amount of labour employed, though this must at least partly result from favourable conditions for stagnation, as was mentioned previously. The state of Rio de Janeiro and the Federal District, in Brazil, are probably the best examples of the persistence of traditional organization of labour. Since the majority of the factories are very large and have been established at some distance from the towns, they now form important communities which depend both economically and socially on the mills. The owners, who are fully convinced of the importance of labour-management relationships, have for many years sought to surround their employees with all the social benefits which develop a sentiment of attachment to the factory and to the community. The offspring of the workers from an early age are trained for factory work, and it is likely that their entry in the mill depends principally on the fact that they belong to a social body organized for the industry and the community. This is especially noticeable in the case of female labour, whose ability to find work outside this community is naturally more restricted. The fact that some of the mills have textile schools for the children of their workers tightens the bonds uniting the community and its source of labour, and tends to direct labour to an occupation which already has an excess thereof.

VIII. General recommendations

93. In view of the fact that the backwardness of the textile mills is closely linked with factors which depend on the low degree of economic development in the Latin-American countries, and that it is impossible for the industry to postpone its modernization until a higher phase of development creates favourable factors, it is recommended that the modernization of existing industry be incorporated in the plans of industrial development, and that deliberate and systematic action be taken to encourage its improvement, both in matters of equipment and management.

94. Since one of the important problems in the improvement of the textile industry is that of transferring displaced labour to other productive activities, it is recommended that an effort be made, as soon as possible, to direct the migration of the younger sectors of labour which are normally absorbed by the textile industry to other industries where labour is not abundant. There are prospects of achieving this goal by establishing schools for the children of the textile workers, where they may specialize in different branches of industry.[50] This may likewise be accomplished by modifying the aims of some of the existing schools, so that, instead of training new textile workers, they improve the training of those already engaged in industry. Later, and in co-ordination with other projects of industrial development, the migration of textile workers to new sources of employment must be organized.

95. To promote greater flexibility of certain labour contracts, which at present hinder the reorganization of industry. Because the rigidity of these contracts arises from the fear of unemployment, their modifications will have to be based on a guarantee of employment for labour in industries other than textile, and labour's re-adaptation to such new occupations. This will perforce require the co-ordination of textile modernization with plans for development of other industries.

96. To stimulate the establishment of more schools for textile engineers and technicians in which, further to the courses commonly associated with textile education, stress will be particularly laid on management subjects.

97. To promote the diffusion of certain technical knowledge which has not been generally divulged, due to the lack of adequate methods for its dissemination. One of the most effective means of obtaining this objective would be to approach experts with a request that they prepare manuals for the spreading of knowledge on the following subjects, in a manner which can be used directly by the Latin-American factories:

(*a*) Organization of labour and determination of work-loads;

(*b*) Methods of quality control;

(*c*) Methods of waste control;

(*d*) Determination of standard costs and simplified methods of cost control;

(*e*) Methods of controlling labour productivity and the efficiency of the processes;

(*f*) Standard specifications for the construction of textile factory buildings, machinery and mill layouts, fire protection, optimum size of mills, lighting, humidification and systems of internal transport, which aid the

[49] The following example for Mexico illustrates this point well: since 1912, it has been established that each card tender should work eight cards. Certain simple attachments and changes in organization have made it possible for one worker to tend forty cards without undue effort. If the Mexican manufacturer were to establish this work-load, and if he could discharge the surplus tenders, he would have to pay one man five times his salary and pay an indemnity to the other four displaced. His investment in the attachments and his effort to modernize the working methods would not, therefore, be compensated by a reduction in costs.

[50] An important textile factory in northern Mexico has already established a school for the offspring of its workers, where they are taught to handle agricultural machinery.

manufacturer in planning new factories or remodelling old ones;

(*g*) Size preparation;

(*h*) The organization of maintenance and cleaning services.

98. To promote the spreading of productivity standards for different types and sizes of mills, and a sufficient number of popular products, in order that the manufacturers may have a basis of comparison for the results obtained in their factories.

99. To stimulate inquiries into the physical and administrative consolidation of small mills, with the object of creating larger units, especially when plans are under way for the modernization of a group, or the establishment of new units.

100. To promote the preparation and establishment of standards for the construction and quality of the fabrics, which will serve to stimulate the simplification of the varieties, the standardization of popular products, and the general raising of the quality of fabrics.

101. To stimulate Latin-American manufacture of some textile supplies, such as bobbins, shuttles and reeds.

102. To promote scientific research with a view to developing new types of textile machinery which are better adapted to the nature of Latin-American industrial resources, that is to say, equipment designed with more stress on the increase of production per unit of capital invested rather than on the reduction of labour. It is likely that small textile machinery factories located in Latin America[51] offer good prospects as regards the improvement of equipment, since the characteristic features of their production factors—large amount of labour and little mechanization of their operations—are conducive to a certain degree of flexibility as regards frequent changing of the designs.

[51] There are factories in Brazil and Argentina.

Table No. 1

INDICES OF IMPORTANCE OF THE FACTORS AFFECTING THE PRODUCTIVITY OF THE OLD TEXTILE INDUSTRY

COMBINATION OF ALL THE CAUSES OF LOW PRODUCTIVITY

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	380	794	615
Ecuador	611	1856	1210
Mexico	360	381	369
Peru	266	511	404
Average	368	615	505

SMALL SIZE OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	100	100	100
Ecuador	131	103	112
Mexico	118	106	111
Peru	121	101	107
Average	115	103	106

TYPE OF EQUIPMENT

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	137	261	208
Ecuador	123	296	205
Mexico	132	262	188
Peru	134	261	205
Average	133	264	206

DIFFERENCE IN THE OUTPUT OF THE MACHINERY

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	106	126	113
Ecuador	106	130	110
Mexico	106	126	110
Peru	106	128	115
Average	106	126	115

DIFFERENCE IN THE NUMBER OF WORKERS REQUIRED

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	129	207	183
Ecuador	116	228	186
Mexico	124	208	171
Peru	126	204	179
Average	125	210	179

OPERATION OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	276	304	296
Ecuador	379	608	526
Mexico	231	137	177
Peru	164	194	184
Average	241	227	231

SIMPLIFIED DIAGRAM WITH THE AVERAGE INDICES

TOTAL 505

SIZE 106

EQUIPMENT 206

OPERATION 231

CONDITIONS WHICH CAN NOT BE CORRECTED WITHOUT MODERNIZATION 105

CONDITIONS WHICH CAN BE CORRECTED WITHOUT MODERNIZATION 129

SUPERFLUOUS PERSONNEL 170

CAUSES WHICH CAN BE ELIMINATED BY MODERNIZATION 230

CAUSES WHICH PRINCIPALLY REQUIRE ADMINISTRATIVE ACTION 220

DIFFERENCE IN THE OUTPUT OF THE MACHINERY

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	130	153	151
Ecuador	98	90	93
Mexico	90	107	99
Peru	96	120	113
Average	101	125	118

EXCESS LABOUR

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	212	199	196
Ecuador	387	675	566
Mexico	256	128	179
Peru	171	162	163
Average	238	182	196

ABNORMAL UNITARY WEIGHT OF THE PRODUCTS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	98	100	100
Ecuador	100	100	100
Mexico	96	100	98
Peru	100	100	100
Average	97	100	99

ABNORMAL SPEEDS OF THE MACHINERY

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	115	105	108
Ecuador	93	67	76
Mexico	75	101	90
Peru	90	97	95
Average	85	101	96

ABNORMAL EFFICIENCY OF THE PROCESSES

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	115	146	140
Ecuador	106	135	122
Mexico	125	106	112
Peru	107	124	119
Average	173	124	124

EXCESSIVE WEAR OF MACHINERY, LACK OF SPACE, AND OTHER CONDITIONS WHICH CAN NO LONGER BE CORRECTED WITHOUT HEAVY INVESTMENTS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	127	105	111
Ecuador	127	110	116
Mexico	95[a]	105	100
Peru	107	105	106
Average	103	105	105

DEFECTS IN MAINTENANCE, HUMIDIFICATION, CLEANING, LIGHTING, AND ORGANIZATION OF TEXTILE PROCESSES

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	122	111	114
Ecuador	116	77[b]	93
Mexico	122	106	112
Peru	104	102	103
Average	120	106	110

DEFECTS IN THE QUALITY OF THE YARN (WEAVING MILLS ONLY)

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	100	120	113
Ecuador	100	139	119
Mexico	100	116	109
Peru	100	112	109
Average	100	118	112

LACK OF SPECIALIZATION OF PRODUCTION (WEAVING MILLS ONLY)

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	100	110	107
Ecuador	100	100	100
Mexico	100	106	104
Peru	100	100	100
Average	100	107	105

DEFECTS IN THE QUALITY OF THE COTTON (SPINNING MILLS ONLY)

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	100	100	100
Ecuador	133	100	114
Mexico	100	100	100
Peru	100	100	100
Average	102	100	100

DEFECTIVE MANUFACTURING AND OPERATING CONDITIONS WHICH CAN BE CORRECTED WITHOUT HEAVY INVESTMENTS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	122	133	129
Ecuador	116	107	111
Mexico	122	123	122
Peru	103	114	111
Average	120	125	123

CAUSES WHICH CAN ONLY BE ELIMINATED BY THE CONCERTED ACTION OF THE INDUSTRIALISTS, THE GOVERNMENT AND THE PRODUCERS OF RAW MATERIAL

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	100	110	107
Ecuador	133	100	114
Mexico	100	106	104
Peru	100	100	100
Average	102	107	105

COMPLETELY SUPERFLUOUS PERSONNEL, EVEN ALLOWING FOR OTHER DEFECTIVE CONDITIONS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	180	199	193
Ecuador	193	520	361
Mexico	200	100	139
Peru	148	162	156
Average	191	161	170

CAUSES WHICH CAN ONLY BE ELIMINATED BY THE MODERNIZATION OF THE MACHINERY AND THE ENLARGEMENT OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	174	274	231
Ecuador	205	334	267
Mexico	148	292	209
Peru	174	277	233
Average	157	286	230

CAUSES WHICH CAN BE ELIMINATED WITHOUT MODERNIZATION, BUT WHICH REQUIRE THE INTRODUCTION OF NEW WORKING METHODS: THE IMPROVEMENT OF TEXTILE TECHNIQUE AND ADMINISTRATION; A CO-ORDINATION OF THE EFFORTS OF INDUSTRIALISTS, AUTHORITIES, LABOUR AND PRODUCERS OF RAW MATERIAL; AND, ABOVE ALL, A SOLUTION OF THE PROBLEM OF DISPLACING PERSONNEL TOWARDS OTHER PRODUCTIVE ACTIVITIES

	spi	wea	s&w
Std. Consumption	100	100	100
Rio—D.F.	219	290	266
Ecuador	298	556	454
Mexico	243	130	176
Peru	153	195	173
Average	234	215	220

Notes:
std = standard.
spi = spinning.
wea = weaving.
s&w = weighted average of spinning and weaving.
[a] Includes the effect of the lack of equipment.
[b] Includes the effect of high speeds.

UN Presentation

Table No. 2

INDICES OF THE IMPORTANCE OF THE FACTORS AFFECTING THE PRODUCTIVITY OF THE MODERN TEXTILE INDUSTRY

COMBINATION OF ALL THE CAUSES OF LOW PRODUCTIVITY

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	154	198	174
Chile	229	258	241
Mexico	131	142	137
Peru	246	224	234
Average	177	191	182

SMALL SIZE OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	109	105	107
Chile	120	113	117
Mexico	117	111	114
Peru	154	107	129
Average	119	107	113

TYPE OF EQUIPMENT

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	100	100	100
Chile	100	100	100
Mexico	100	100	100
Peru	100	115[e]	107
Average	100	102	100

OPERATION OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	141	189	162
Chile	191	229	206
Mexico	112	128	120
Peru	160	182	170
Average	149	175	161

SIMPLIFIED DIAGRAM WITH THE AVERAGE INDICES

- TOTAL 182
  - SIZE 113
    - CAUSES WHICH CAN ONLY BE ELIMINATED BY NEW INVESTMENTS 113
  - OPERATION 161
    - MANUFACTURING AND OPERATING CONDITIONS 103
    - LACK OF TRAINING OF THE WORKERS 114
    - SUPERFLUOUS PERSONNEL 137
    - CAUSES WHICH REQUIRE PRINCIPALLY ADMINISTRATIVE ACTION 161

DIFFERENCE IN THE OUTPUT OF THE MACHINERY

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	97	111	102
Chile	67	113	86
Mexico	114	130	122
Peru	95	121	107
Average	93	120	105

EXCESS LABOUR

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	145	170	159
Chile	285	203	241
Mexico	98	98	98
Peru	168	150	159
Average	160	146	154

ABNORMAL UNITARY WEIGHT OF THE PRODUCTS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	100	100	100
Chile	96	100	98
Mexico	99	100	100
Peru	100	100	100
Average	99	100	99

ABNORMAL SPEEDS OF THE MACHINES

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	96	109	101
Chile	74	96	83
Mexico	108	106	107
Peru	95	105	99
Average	93	105	99

ABNORMAL EFFICIENCY OF THE PROCESSES

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	101	102	101
Chile	95	118	106
Mexico	107	123	114
Peru	100	115	108
Average	101	114	107

LACK OF CONTROL OF HUMIDIFICATION

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	100	100	100
Chile	100	100	100
Mexico	100	100	100
Peru	110	105	108
Average	101	100	100

DEFECTIVE QUALITY OF THE YARN AND ITS PREPARATION FOR WEAVING

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	100	109	104
Chile	100	108	103
Mexico	100	100	100
Peru	100	118[d]	108
Average	100	111	105

LACK OF TRAINING OF THE PERSONNEL

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	110	121	116
Chile	120	137	127
Mexico	107	121[c]	113
Peru	100	100	100
Average	110	119	114

COMPLETELY SUPERFLUOUS PERSONNEL, AFTER ALLOWING FOR LACK OF TRAINING AND DEFECTIVE CONDITIONS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	133	131	133
Chile	225[a]	161	196
Mexico	98	100	99
Peru	153[b]	140	147
Average	146	126	137

DEFECTIVE MANUFACTURING AND OPERATING CONDITIONS WHICH CAN BE CORRECTED WITHOUT HEAVY INVESTMENTS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	96	119	105
Chile	71	104	84
Mexico	107	106	107
Peru	104	130	115
Average	93	117	103

CAUSES THE ELIMINATION OF WHICH REQUIRE HEAVY INVESTMENTS MAINLY TO ENLARGE MILL CAPACITY

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	109	105	107
Chile	120	113	117
Mexico	117	111	114
Peru	154	123	138
Average	119	109	113

CAUSES WHICH CAN BE ELIMINATED BY ADEQUATE ADMINISTRATIVE ACTION, PARTLY DUE TO THE NEWNESS OF SOME OF THE MILLS

	spi	wea	s&w
Std. Consumption	100	100	100
São Paulo	141	189	162
Chile	191	229	206
Mexico	112	128	120
Peru	160	182	170
Average	149	175	161

Notes:
std = standard.
spi = spinning.
wea = weaving.
s&w = weighted average of spinning and weaving.
[a] Includes the effect of efficiency above normal.
[b] Includes excess labour due to abnormal speeds.
[c] Includes lack of specialization of work.
[d] To simplify the diagram, this figure includes the effect of excessive wear of the machinery.
[e] Corresponds to the low speed of the old automatic looms.

Chapter II

BRAZIL

I. Summary and conclusions

A. *Productivity of the industry*

103. The regions of Rio de Janeiro-Distrito Federal and São Paulo were chosen for the measurement of textile labour productivity in Brazil, both because they are the most important textile centres and because they were considered sufficiently representative of the old and modern sectors of the industry to give an adequate picture of the type and magnitude of the problems affecting productivity in the country. It was deemed that the inspection of the old mills of the north-east, which also form an important group, would have led to the same conclusions as those obtained with regard to Rio de Janeiro-Distrito Federal, although it is believed that the average values of productivity in the former region are lower than in the latter, since the mills are older and the working methods more backward.

104. The measurement was made in nine old spinning mills, six modern spinning mills, five old weaving mills and five modern weaving mills, representing 21, 16, 12 and 50 per cent, respectively, of the capacities of these sectors of the industry in the regions included in the report.[52] Eleven of these mills were afterwards selected for a detailed study of the factors affecting productivity.

105. The results of the investigation show that both in the old and in the modern sectors of the industry, there is much room for improvement of labour productivity. In fact, if the mills of the Rio de Janeiro-Distrito Federal region are taken as examples of the old mill industry, it could be stated that the productivity of the latter could be raised by 280 per cent in the spinning mills and 694 per cent in the weaving mills, if modern machines were fitted in the factories and the personnel adequately organized. This extremely low level of productivity in the old industry of the country is of the greatest significance when one considers that nearly 3 million spindles (91 per cent of the total) and 95,000 looms (95 per cent of the total) would probably have to be replaced if the whole industry were to be equipped with the most modern machinery. At the present prices of machinery, modernization would cost more than 350 million dollars.

106. As regards modern industry, even though São Paulo has mills in which the performance can be regarded as exemplary, the average results show that productivity could still be increased by 54 per cent in the spinning mills and by 98 per cent in the weaving mills, which means that the modern machinery is not being used to the best advantage.

B. *Causes of low productivity in the old industry*

107. To begin with, the causes of low productivity were divided into two principal groups, the first of which comprised those which can be corrected without modernizing the machinery; these include superfluous excess labour, defective methods of work, lack of specialization of production and certain manufacturing conditions which can be corrected without involving the expenditure of large sums. The second group is made up of causes which can be corrected only by the installation of new machinery, as for example, obsolete equipment, the small size of the mills, excessive wear on the machines, and certain other manufacturing conditions which cannot be corrected without considerable expense.

108. The results of the investigation made in the spinning and weaving mills of Rio de Janeiro-Distrito Federal show that the first group, that of those causes which do not require modernization of the machinery for correction, is 1.61 and 1.09 times as important,[53] respectively, as the group of causes which can only be corrected by means of modernization. The increase of labour consumption originating from causes which can be remedied is 119 per cent in the spinning and 190 per cent in the weaving mills; this means that productivity could be increased in a corresponding measure if the managers undertook to reduce personnel, organize the methods of work and correct certain manufacturing conditions. If, after obtaining these potential increases, it was decided to buy modern machinery and readapt the organization of the personnel strictly in accordance with normal requirements, further increases of 74 per cent in the spinning and 174 per cent in the weaving mills could be obtained, as compared with the highest productivity possible with the old equipment.

109. Thus, in Brazil, a first stage of full utilization of the existing equipment is more important than a second phase of modernization of the machinery. This fact indicates that in a country such as this, where the concentration of capital is insufficient to re-equip its industry within a short period where there is a pressing need for investing financial resources in other economic activities, there are still means of increasing productivity

[52] Due to lack of time it was not possible to include a sufficient number of mills of less than 5,000 spindles and 100 looms. However, it is not thought that this affects the important conclusions relating to the industry as a whole, since these groups represent only 8.22 and 5.80 per cent respectively, of the capacity of the country, as it may be seen in tables nos. 5 and 24.

[53] The importance of one cause of low productivity in relation to another is expressed as the relationship between the percentage of excess labour consumption per kilogramme produced, arising from the causes.

considerably by operating its old installations in accordance with a more rational system of work.

110. In the spinning mills of São Paulo, where the condition of the machinery is somewhat better than the spinning mills of Rio de Janeiro-Distrito Federal, and where operating conditions are considerably better, the elimination of low-productivity factors different from the age and condition of the equipment is of less absolute importance, since these are responsible only for 72 per cent excess labour per kilogramme. Even so, they are 1.28 times as important as those which require modernization and which account for 56 per cent of the increase in labour consumption. However, the São Paulo area has the smallest productivity problem, as the mills are now being modernized. The industrial environment in that region is more progressive and the problem of replacing equipment is not so great, since the mills are smaller and belong to heavily capitalized enterprises. At present, approximately 35 per cent of the spindles in this region are modern or semi-modern, and 12.5 per cent of the looms are new.

111. The group of causes not requiring modernization is made up principally of (1) a superfluity of workers over and above those required to counteract the influence of certain defective manufacturing conditions; (2) defective manufacturing conditions which can be corrected without great expense (quality of the yarn, humidification, cleanliness and maintenance of the machinery); and (3) lack of specialization of production.

112. The factor which affects productivity most is superfluous personnel; this alone produces an excess of labour consumption per kilogramme equivalent to 80 per cent and 99 per cent, respectively, in the spinning and weaving mills of Rio de Janeiro-Distrito Federal, and 50 per cent in the spinning mills of São Paulo. The other two causes together increase labour consumption by 22, 46 and 15 per cent, respectively, in those three sectors of the industry.

113. The superfluous labour in the old mills of Brazil is not entirely due to the incapacity of the managers to recognize this excess, but to the perpetuation of traditional work patterns which date from the end of the last or the beginning of the present century, when the majority of the textile mills were established.[54] It is possible that in the region of Rio de Janeiro-Distrito Federal the greatest influence is that exercised by the social system which links employers and employees. As the majority of the mills are very large and are located far from the cities, they have become important communities which depend economically and socially on the mills themselves. From an early age, the workers' children are trained for textile work and they are accepted at the mill principally because they form part of the social entity constituted by the industry and the community. This applies especially in the case of women, whose freedom to seek work elsewhere is naturally more restricted. The fact that some mills have textile schools for their workers' children further strengthens the social link between the community and the source of labour[55] and established an almost moral obligation constantly to admit more workers.

114. However, the traditions and the social ties mentioned above spring from deeper and more fundamental economic factors. One is the excess of working population in relation to the country's capacity to invest in projects which create new employment opportunities. This factor occurs in most of the Latin-American countries and is of considerable importance when the increasing of the industry's productivity is envisaged.

115. Another factor closely connected with the foregoing is the relatively low wage level of the textile industry, compared to the price level of the manufactured article. In fact, the ratio of the average price per man-hour to the average price of the fabric is 0.60 in Brazil, whereas in the United States it is 3.55.[56] This difference in the relative importance of the price of labour explains the great incentive which moves American industry to reduce labour consumption, as against the very slight drive for Brazilian management to do likewise.

116. The third fundamental factor is also related to the two preceding ones, and consists of the lack of keen commercial competition between the Brazilian mills. This is due both to the fact that until recently the industry was unable to meet domestic textile demand and to the lack of communications which hampers trade between the various regions of the country, setting up exclusive trading areas around the industrial textile centres.

117. The defective manufacturing conditions which can be corrected without great expense exist mainly in the spinning mills and include such things as deficiencies in maintenance, in the cleanliness of the rooms and machinery, in the lighting, and in the lack of humidity control.[57] In the weaving mills, productivity is mostly influenced by the poor quality of the yarn used, but there is also much room for improvement in the preparation of the warp, the maintenance of the machinery, and the lighting. These factors together increase the consumption of labour per kilogramme by 22 per cent in the spinning and 33 per cent in the weaving mills of

[54] Examples of antiquated organizations were found in spinning mills in which workers attended 336 spindles when 1,500 to 1,700 might have been attended; weavers were found working on very coarse and narrow fabric in three looms, when they might have been in charge of five or six. A great waste also was found in indirect labour as a result of antiquated methods of work: in several mills the doffers who changed the bobbins of the spinning frames were carrying them by hand without using any container. Other cases were found where the full bobbins of the roving frames were marked by stamping a number on each one with a rubber stamp, instead of marking them with a coloured chalk while still on the machine.

[55] In Mexico, where the industry is similar in some respects to that of Brazil, the textile mills have started to set up schools for workers' children in which they are taught the mechanics of farm machinery and other work for which there is a great demand in the country. It is hoped in this way to direct the excess of textile workers to other activities which are not yet filled.

[56] This relationship was calculated for Brazil on the basis of 4.63 cruzeiros per man-hour and 7.67 cruzeiros per metre, and for the United States on the basis of 0.982 dollars per man-hour and 0.276 dollars per metre.

[57] In Rio de Janeiro-Distrito Federal systems of humidification control are practically non-existent, and even though the climate provides natural humidity, this is not constantly maintained within the limits required for the highest efficiency in each of the sections. However, it is thought that no effort has been made to correct, even partially, this cause of low productivity. It has been included among the causes which could be corrected without great expense even though in certain mills the necessary investment would be considerable, because it is considered that those mills which require several years for modernization should attempt to control humidification, possibly as a preliminary step before changing machinery.

Rio de Janeiro-Distrito Federal, and by 15 per cent in the spinning mills of São Paulo.[58]

118. The third cause which can be corrected, the lack of specialization of production, affects only the weaving mills, where it is estimated to be responsible for 10 per cent of the excess of labour consumption. Its correction is considered feasible, but to some extent it would require the combined effort of the whole industry, in order to simplify varieties of popular fabrics.

119. Of the causes of low productivity which can only be eliminated by means of large capital investments, the most important is the type of equipment, that is, the use of old instead of modern machinery, which is responsible for an excess of 37 per cent in the consumption of labour per kilogramme of yarn, and 161 per cent in the consumption of labour per kilogramme of fabric. The difference between these two percentages indicates that, as regards productivity, the modernization of the weaving machinery is 4.3[59] times more important than that of the spinning mills. However, since the achievement of ideal productivity in modern weaving mills is based on the use of high quality yarn which can only be produced in modern spinning mills, modernization becomes equally important for both sectors of the industry.

120. It has been estimated that excessive wear on the machinery causes an average increase of 27 and 5 per cent respectively in the labour consumption of the spinning and weaving mills of Rio de Janeiro-Distrito Federal and 14 per cent in the spinning mills of São Paulo. The influence of the size of the mills, which is the last factor included among those which would require modernization, is not of great importance in the old mills of Brazil, since 62 per cent of the spinning capacity is found in mills of 15,000 spindles or over and 77 per cent of the weaving capacity is provided by mills of 300 looms or over.

121. Summing up the causes of low productivity in the old industry and their relative importance, and taking the region of Rio de Janeiro-Distrito Federal as an example, it can be said that the first step in the reorganization of the mills could be the elimination of superfluous personnel, which would increase productivity by 80 per cent in the spinning mills and 99 per cent in the weaving mills. It would involve the breaking of old traditions governing the distribution of tasks among the workers in order to introduce specialization, improve working methods and assign a greater number of spindles, looms, etc. to each worker. This would naturally imply the selection of the more highly-skilled workers, and their adaptation to new conditions, by means of a certain amount of complementary training. It would also require the introduction of modern systems for the rational determination of work-loads, that is to say, the number of units of machinery allocated to each worker, in accordance with the manufacturing conditions and the product in question.

122. The second step in reorganization would be the improvement of certain manufacturing conditions, such as cleanliness of rooms and machinery, maintenance, humidification and lighting. In this stage, productivity could be increased by 22 per cent in the spinning mills and 33 per cent in the weaving mills, though it must be understood that a part of this increase would be derived directly from the greater hourly production of the machines and another part from a further reduction of personnel made possible by improved manufacturing conditions. This step would involve expenditure on spare parts, lighting, humidification, cleaning equipment and machine repairs; but the amount spent would not be very great, in comparison with the price of new spinning and weaving machinery. It would also be necessary to introduce adequate systems both for the control of the quality of the cotton and of the intermediate and final products and for the control of the efficiency of the processes. If it were possible to make a substantial reduction in the variety of the fabrics manufactured, the weaving mills would gain approximately a further 10 per cent in productivity.

123. Subsequent modernization of all the machinery, followed by further reorganization of the personnel, in accordance with the demands of the modern machinery, would increase productivity by an additional 74 per cent in the spinning mills and 174 per cent in the weaving mills.

C. *Causes of low productivity in the modern industry*

124. Judging by the sample examined in São Paulo, there are no important causes of low productivity in the modern spinning mills of Brazil which could not be eliminated within a short time. Setting aside the influence of the small size of the mills, which, in the group of mills visited, increases labour consumption by 9 per cent, the only cause of low productivity is the excess of personnel that represents an increase of 45 per cent in the consumption of labour. The fact that there are still workers who have not completed their training only justifies a small proportion of the excess labour. The remainder is entirely unnecessary and can be eliminated by specialization in the organization and the increase of workloads.

125. A further breakdown of this principal influence shows that in a preliminary phase of reorganization, the industry could gain 32 per cent in productivity by eliminating unnecessary personnel; and that in the next stage, another 7 per cent could be gained by completing the training of the workers. The investigations carried out in the mills show that in most of them training is now in progress and that present deficiencies may be eliminated in a very short period.

126. Similarly, in the modern weaving mills, excess labour is the factor which most affects productivity, since it increases labour consumption by 70 per cent, when the other factors are only responsible for 16.5 per cent thereof. In contrast with the spinning mills, the excess of weavers is due principally to their lack of training, especially in the case of the conewinders and

[58] In the case of the spinning mills, part of these percentages represent the increase of productivity which would automatically follow from the correction of conditions, since the unit production of the machines would increase. The other part represents the increase of productivity which would result from a further reduction of personnel following the improvement of conditions. The numerical values of this breakdown of the percentages can be found in the schematic tables of the analysis. In the case of the weaving mills, the increase in productivity brought about by the corrections would have to come only from the higher unit production of the machines.

[59] The index of relative importance has been calculated as the quotient between both percentages of increase in labour consumption.

loom tenders. This deficiency is being actively corrected and there is no reason why it should not disappear in a short time.

127. It is estimated that the absolutely superfluous personnel, that is, workers who could be eliminated immediately, increase labour consumption per kilogramme by 31 per cent, while the lack of training adds a further 21 per cent.

128. The other causes of low productivity in the modern weaving mills are their small size, which increased the labour consumption of the sample by 5 per cent, together with the speed of the machinery, which was reduced intentionally, in order to facilitate the training of the workers and, in some cases, because the machinery was still being run in. This factor increases labour consumption by 9 per cent.

129. As in the case of the old mills, the superfluous personnel in modern mills is due to the abundance and low cost of labour. Moreover, new machinery involves substantial investments, thus compelling the manufacturers to obtain as great a yield as possible from it, at the expense of labour productivity. This is evident from the fact that in many mills the hourly output of the machines is higher than normal and this can only be achieved by employing extra labour on the machines.

130. The conditions of productivity in the modern mills can be summed up by saying that the industry can increase its productivity 32 per cent in the spinning mills and 31 per cent in the weaving mills by eliminating all the superfluous personnel. Further increases of 10 per cent in the spinning mills and 21 per cent in the weaving mills could be achieved by completing the training of the tenders. A final increase of 9 per cent would follow in the weaving mills, when all the machines run at their normal speeds. The reduction of personnel implies the establishment of rational systems for the determination of workloads, in accordance with the degree of training of the personnel and the type of products manufactured. Such systems were not found in the majority of mills at the time of the investigation.

131. There are not thought to be any fundamental problems which impede the improvement of productivity in a short time. As nearly all the mills are working one or two shifts, the personnel which must be eliminated from them could be absorbed into additional shifts; this would be advisable in view of the large investments represented by modern mills.

II. Comments, results and analysis of the old spinning mills of São Paulo

A. *General comments*

132. The individual productivity of the old spinning mills of São Paulo included in the sample, is shown in graph 1, together with the general averages and the productivity of the standard mills which served as a norm of comparison.

133. A general examination of the graph reveals great consistency among the results obtained in the old spinning mills, with one exception (no. 9), the productivity of which is much higher than that of the others. Taking into account the fact that these mills are of varying sizes and degrees of modernity, the consistency of the results may imply the presence of a general factor, independent of size or type of equipment, which affects all the mills more or less uniformly. The exception of mill no. 9, however, indicates that this factor is not completely beyond the control of mill managers. According to observations made in the spinning mills of both São Paulo and Rio de Janeiro-Distrito Federal, this factor would appear to be the existence of antiquated working methods.

134. Mill no. 9 is equipped with modern European machinery for opening and picking and for a part of the card section, but the remainder dates from 1912 to 1930. It can be said that roughly a quarter of the mills is modern. Even so, its productivity is higher than that of mill no. 7, which is of approximately the same size and has twice as much modern machinery as mill no. 9. As both mills work under the same general management, but are controlled by different superintendents, the difference in productivity may indicate that the degree of modernization has not had a very important effect compared to other factors, and that probably the difference of internal performance between the two mills can be attributed to the effectiveness of direct supervision.

135. The relatively small influence of the degree of modernization is also apparent from the comparison of mills nos. 8 and 7, for which the levels of productivity are fairly similar, though the former is typically old in all its processes, while as already stated, 50 per cent of the latter's machinery is modern. If differences of size are taken into account, the productivity of mill no. 7 (on the extreme right of the graph) is relatively low, compared with that of mill no. 10, which is old though its spinning frames are equipped with long-draft systems.

136. The type of cotton used does not appear to cause important differences in productivity, since during the course of the investigation mills of both high and low productivity were found to be using the same type of cotton. This does not exclude the possibility of the influence of all types of Brazilian cotton on the industry as a whole.

137. With the exception of the left part of curve no. 7, which represents a rather unusual example of coarse combed spinning, the curves of the old spinning mills appear ranged progressively according to size, both in the section of the graph corresponding to carded yarn and that of combed yarn. Their relative productivity, however, does not vary according to the theoretical influence of size, since this influence is obscured by other more important influences.

138. The following conditions were observed in most of the mills:

(*a*) The quality of the intermediate products is defective;

(*b*) The cleaning of the air, machines and floors is poor;

(*c*) The working condition of the machinery is only fair; in many mills maintenance was found to be carelessly carried out;

(*d*) Control of quality is non-existent or very defective. Most of the mills have only the instruments which are indispensable for determining the weight and strength of the yarn;

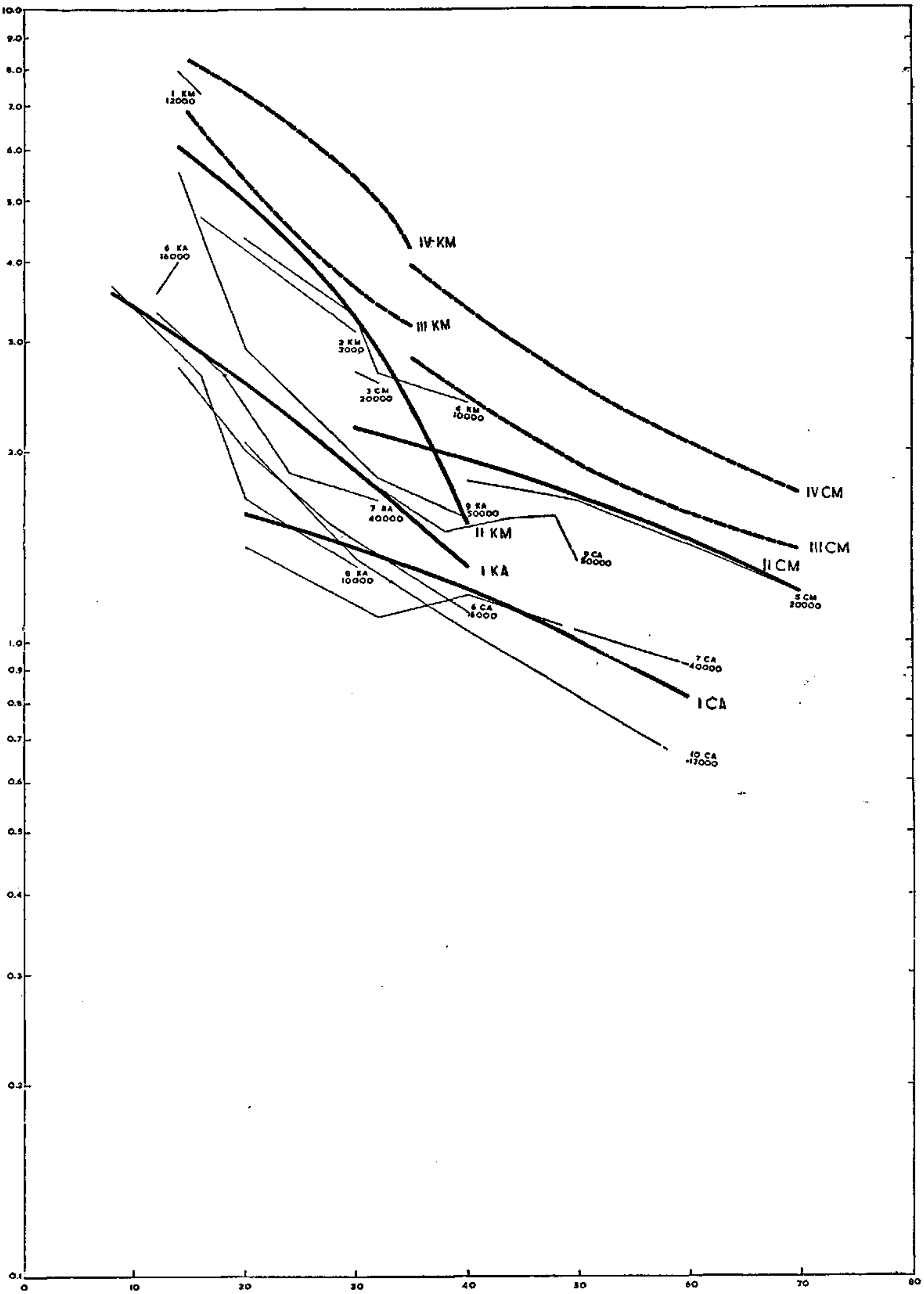
(*e*) Control of efficiency is practically non-existent;

(*f*) The lighting is defective. In most mills natural

Graph No. 1

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Brazil (São Paulo)



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill

K—Means carded yarn
C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key is a reference. The number underneath is the size of the mill in spindles.

daylight from skylights is used, together with incandescent lamps;

(*g*) Work-loads are not determined by rational methods;

(*h*) Minors are allowed to work, under the supervision of governmental agencies. In view of their inexperience and naturally restricted capacity, more tenders are needed per machine or to carry out any other tasks;

(*i*) As a result of the industrial development of São Paulo, there is a large percentage of labour turn-over in the textile mills, and consequently, many enterprises are unable to provide new workers with adequate training;

(*j*) In some mills defective methods of work were observed, especially as regards doffing and yarn hauling;

(*k*) In the time available for visiting mills, it was not possible to determine whether the type of cotton used in Brazilian spinning mills did or did not affect productivity.[60] In many mills the card web was found to be neppy, even at normal doffer speeds; on the other hand, cases were found where the card web was perfect with three different types of Brazilian cotton. This indicates that the method of processing the cotton, or the adjustments and speeds of the machines, have probably not been adapted accurately for Brazilian cotton. Some manufacturers stated that Brazilian cotton led to excessive waste at the pickers and the cards.

B. *Analysis of the results*

139. Table 3 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity.[61] The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences of each yarn count, which were obtained in table 4 by means of comparisons between the actual and the standard consumption of labour per kilogramme of yarn.

140. The influence of size (1.02) is of no importance, as far as the mills of the sample are concerned. However, the weighted average of the influences of size in all the spinning mills of Brazil is 1.08, indicating that the sample was mainly made up of larger than average size mills for Brazil. The choice was made bearing in mind that in the distribution of the industry according to size (table 5), the large mills of 15,000 spindles or over represent almost two-thirds of the total capacity and that general conclusions regarding productivity would have been the same, had a greater number of small mills been included.

141. The influence of the type of equipment (1.34) was calculated assuming that all the mills were entirely old, as it would have been very laborious to prepare standards for the degree of modernity of each mill. It should therefore be remembered that this value is, in fact, less than 1.34. The number of long draft and standard draft spindles in each Brazilian state can be found in table 6.

142. The influence of operation (1.96), the most important component of total influence, was broken down into the influences of the draft schedule, of speed, of efficiency, and of the excess of direct, indirect and miscellaneous labour, by means of an examination of the two mills showing the highest and the lowest productivity (tables 7 and 8). Averages were taken of the influences of all the processes of these mills and, in table 17, they were adjusted so that the result was equal to the influence of operation which had already been determined by means of the general sample.

143. The redistribution of the influences was carried out in the light of the following considerations, which emerge from a study of the tables of analysis mentioned above, and of the general observations made in the industry.

144. Low speeds were found at the cards, the drawing frames and the spinning frames. At the cards, this is generally due to (1) the poor condition of the card clothings, which could certainly be corrected by adequate maintenance, and (2) the need for giving the cotton a more thorough cleaning, at lower doffer speeds; this could not be achieved by any other means, unless the opening and picking equipment is modernized. There was no proof that the low speed of the drawing frames is due to any outstanding cause and in any case its correction was considered simple. In some spinning frames, speed has been reduced as a partial compensation for the excessive wear on the machines, but it is estimated that, on the whole, the spinning frames of São Paulo could work at normal speeds if they were carefully maintained and if the quality of the product were improved in the earlier processes. Thus, this difficulty can likewise be remedied.

145. In view of these observations, it was decided to divide the influence of speed (1.07) into two parts, namely, that which could be corrected (1.04) and another which could not (1.03).

146. The existence of defective manufacturing conditions, such as the excessive wear on machinery and lack

[60] The principal characteristics of Brazilian cottons are as follows:

Paulista: Grades 2 to 7 (approx. GM to SGO); length of staple 24/26 to 32/34 mm.; uniformity slightly better than average; character slightly better than average; colour white; strength good; elasticity fair; cleanliness good; in the average and high grades, the waste of pickers and cards is from 9 per cent to 11 per cent, and in the lower grades it reaches 13 per cent; card web tests show 19 to 30 neps per 100 sq. inches; the fineness is from 3.7 to 4.8 microgrammes per inch of fibre (av. of 4.2 to 4.4); the appearance of the yarn is usually better than average; it is used mainly for coarse and medium yarns up to 30's; it is similar to the Texas and Express varieties from which it originated.

Serido: grades 2 to 4 (approx. GM to M); length of staple 32/34 to 36/38 mm; uniformity average; colour white; strength good; elasticity excellent; cleanliness fair (contains foreign matter, neps and dead fibres); it is used for fine yarns from 50's to 90's.

Sertão: grades 3 to 6 (approx. SM to SLM); length of staple 30/32 to 32/34 mm; uniformity poor to average; colour ivory; strength fair; elasticity good; cleanliness poor to average (contains foreign matter, neps and a great amount of dead fibre); fibre silky; it is used for yarns from 30's to 50's.

Matas: grades 4 to 5 (approx. M to SLM); length of staple 22 to 26 mm.; uniformity poor; colour beige; strength less than average; elasticity less than average; cleanliness poor; fibres rough; it is used for coarse yarns from 6's to 20's.

[61] If 1 is substracted from these influences and the result is multiplied by 100, they become the actual percentages of the excess labour per kilogramme produced; they also become the potential increases of productivity, expressed as a percentage of present productivity, which could be obtained by the elimination of the causes affecting it. The component or partial influences have the same meaning as the total influences, but they refer to specific causes. When the influences of two or more causes are multiplied together, the product is the influence of the combination of these causes. The reciprocal of an influence, subtracted from 1 and multiplied by 100, is the loss of productivity expressed as a percentage, arising from the cause corresponding to that influence.

of maintenance, lighting and cleaning, would normally be conducive to low efficiency in all the processes, especially in the spinning frames. Since this is not the case, as can be seen from the influences of efficiency in both mills, which are almost normal or even better than normal, this condition indicates that part of the total excess labour is employed in counteracting these manufacturing conditions and raising efficiency. In order to estimate a value for this part of the excess and separate it from what has been termed absolutely superfluous personnel, the breakage frequency of yarn was measured in the spinning frame section of several mills. The conclusion was drawn that manufacturing conditions probably require 15 to 30 per cent more personnel than indicated by the standard work-loads. In order to simplify the analysis, an excess of 23 per cent, that is, an influence of 1.23, has been ascribed to defective manufacturing conditions, as a whole, with the exception of low speeds. As the influence of efficiency represents 1.05, the remainder, 1.17, must be separated from the influence of the total labour excess (1.75) in order to determine, by division, the influence of the absolutely superfluous personnel (1.50), that is, the proportion which can be eliminated without correcting manufacturing conditions. An inspection of conditions in the mill indicated that both the influence of efficiency (1.05) and the fraction of excess labour influence corresponding to manufacturing conditions (1.17) may be divided equally between the causes which can be corrected and those which cannot; this gives rise to the figures 1.02, 1.03, 1.08 and 1.09 which appear in the summary of the analysis.

147. As can be seen in the tables of analysis of mills "A" and "B", a superfluity of personnel occurs in practically all sections, although the effect on the general productivity is more important in the spinning frame section because its consumption of labour per kilogramme is normally quite high. Since the influence of direct labour is very high and that of indirect labour very low, even lower than 1, it is evident that labour is wasted not only because few machine units are assigned per tender, but because the relative lack of indirect labour forces operators to carry out auxiliary tasks which they should not have to fulfill. Specialization of work alone would probably enable the industry to make considerable reductions in personnel, without demanding of the tenders a greater effort than they are making at present.

148. The improvement of working methods, especially as regards transport and doffing operations, could also bring about an immediate reduction of personnel. Reference has already been made to the fact that in Brazilian mills, frequent cases of manual transport were encountered when containers or small wheeled-carriers might have been used.

149. In the lower part of the analytical summary table, the influences have been rearranged in groups corresponding to: (1) causes which require only immediate action by the management to reduce the personnel; (2) causes which call for preliminary action by the management, in order to improve certain manufacturing conditions; (3) causes which can be corrected without modernization; and (4) causes which can only be eliminated by means of the modernization of the industry.

150. The increase in productivity which could be achieved by means of the reduction of personnel and the improvement of manufacturing conditions, demands the establishment of adequate systems for determining work-loads and controlling efficiency and the quality of the products. It would also be necessary to select the best workers and to train them so that they can adjust themselves to the new conditions.

III. Comments, results and analysis of the modern spinning mills of São Paulo

A. *General comments*

151. The individual productivity of the modern spinning mills of São Paulo included in the sample is shown in graph 1, together with the general averages and the productivity of the standard mills which were adopted as norms for comparison.

152. General observation of the chart reveals that good productivity conditions prevail in the modern spinning industry of this region. If the influence of the size of the mills is taken into account, the observations reflect conditions varying from 54 to 103 per cent of the productivities set up as standard.

153. All the mills manufacture a limited number of yarns and are outstanding for the high quality of their management. The productivity of mills nos. 3 and 5 should be higher since conditions of manufacturing and supervision there are excellent. However, they were designed to make very fine yarns and, at the time of the investigation, market conditions obliged them to manufacture yarns of a much lower count. As a result, their processes were thrown off balance, causing a reduction of productivity.

154. There is no correlation between the size of the units and their productivity, because surplus labour is a more important factor than differences of size. Nor does the chart indicate any differences of productivity caused by the type of cotton used. On the contrary, the modern spinning mills of São Paulo prove that with good equipment and adequate technical management, certain defects in the cotton have no appreciable effect on productivity, although they may have on total raw material costs.

155. On the whole, conditions in the mills are fairly good, except that there are more workers than necessary. Owing to the low cost of wages, in relation to the cost of investment in the mills, attempts are made to obtain high efficiency rates in the processes at the expense of labour productivity. The systems of quality control adopted for the intermediate and final products are good; most of the mills are equipped with laboratories and well-trained technicians. On the other hand, not much attention is given to the rational determination of work-loads, probably because there is little incentive to assign a maximum number of machines per man.

B. *Analysis of the results*

156. Table 9 contains the summary of the analysis of the influences, that is, the indices of the relative importance of the factors affecting productivity. It is similar to the table for the old spinning mills and is based on the averages of the total influence, and of the influences of operation and size, which can be found in table 10.

157. The influence of the small size of the mills of the sample (1.09) is almost equal to that of the Brazilian spinning industry as a whole (1.08). It is important, not only because its value is relatively large and cannot

be diminished, but because it indicates that mills are being built in Brazil, which, from the time of their installation, contain structural defects which prevent them from achieving optimum productivity. However, within the group of countries visited, the largest mills being installed are those of São Paulo.

158. Even without making a detailed analysis of some mills, it might have been concluded that the influence of operation in the industry (1.41) is principally due to an excess of labour, arising from two closely connected causes: (1) the fact that many tenders are still in the process of training and (2) a certain policy or attitude on the part of the managers, who are not considered to have made every possible effort to increase work-loads and reduce personnel. However, it was deemed of interest to analyse mills "C" and "D" (tables 11 and 12), where conditions of capacity and manufacture are absolutely uniform, but which differ in that the former is exclusively equipped with European machinery and the latter with American machinery. The average of the influence of operation of these mills was almost equal to the general average of the modern spinning mills of São Paulo, and therefore the adjustment required in order to extend the data to the general sample was insignificant (table 17).

159. The redistribution of the influence was made in the light of the following considerations, which arise from a study of the tables of analysis of mills "C" and "D" and the general observations made in the industry.

160. Although there are small differences in nearly all the processes between the actual and the standard draft schedules, speeds and efficiencies, the over-all influence of production (0.97) is not important and no attempt has been made to analyse it; it has been included among the influences of causes which are being actively corrected.

161. The influence represented by the excess of workers (1.45) has been divided into two parts, one of which (1.10) has been attributed to the fact that the training of the workers is still incomplete, the other (1.32) being ascribed to the existence of a superfluous number of workers, even taking into account their incomplete training. This figure of 1.10 is an estimative allowance which was based on the observed slowness of the workers in carrying out certain operations such as piecing-up broken ends, and doffing.

162. The analysis can be summed up by saying that the modern spinning industry of São Paulo works under the best conditions of production, that is, of efficiency of the processes, organization of the draft schedule, and machine speeds. The elimination of the absolutely superfluous personnel could increase productivity by 32 per cent, and the completion of its workers' training could add another 10 per cent. The uneconomic size of some of the mills is the only innate difficulty preventing the modern mills from attaining optimum productivity.

IV. Comments, results and analysis of the modern weaving mills of São Paulo

A. *General comments*

163. The individual productivity of the modern weaving mills of São Paulo, included in the sample, is shown in graph 2, together with the general average and the productivity of the standard mill which was taken as a norm for comparison.

164. Mill no. 6 is only partly modern, since it still has non-automatic looms and its spinning mill is also semi-modern. As a result of these two circumstances, its productivity is comparatively low. Mills nos. 7 and 9, which are about average in their productivity, have semi-modern spinning mills; and mills nos. 1 and 4, which show the best results, are equipped with completely modern machinery, both for spinning and weaving. This correlation between productivity and types of equipment agrees with what has been repeated several times in other sections of this report: (1) that modern weaving mills require the quality of yarn produced by modern spinning mills in order to work under the best conditions for productivity; and (2) the mechanical differences between the old and modern looms are themselves responsible for a great variation in productivity.

165. Taking into account the influence of size and excluding mill no. 6, the two extremes observed are approximately 34 and 79 per cent of normal productivity.

166. The following conditions were observed in most of the mills:

(*a*) The excessive number of mechanical stops per loom per hour indicates that the loom fixers probably have not yet acquired sufficient experience to enable them to determine the causes of the stops and correct them rapidly;

(*b*) The training of weavers and cone-winder tenders is also deficient, though relatively better than that of the loom fixers;

(*c*) Control of efficiency is deficient or non-existent;

(*d*) The work-loads are small, even taking into account other abnormal conditions, such as the lack of training of the tenders. At the same time, the mills have few auxiliary workers thus compelling the tenders to perform tasks which they should not have to fulfill;

(*e*) In the majority of the mills, the work-loads are not determined by rational methods. The number of stops per loom, or of breakages of yarn, is not measured systematically, in order to assign machines to the tenders in accordance with the actual time required for the performance of their functions;

(*f*) The type of cotton used by the mills was not found to influence productivity.

B. *Analysis of the results*

167. Table 13 contains a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity. The total influence and its principal components—the influences of operation and size—are the averages of the influences of each fabric count, which were obtained in table 14, by means of comparisons between the actual and standard consumption of labour per kilogramme of fabric.

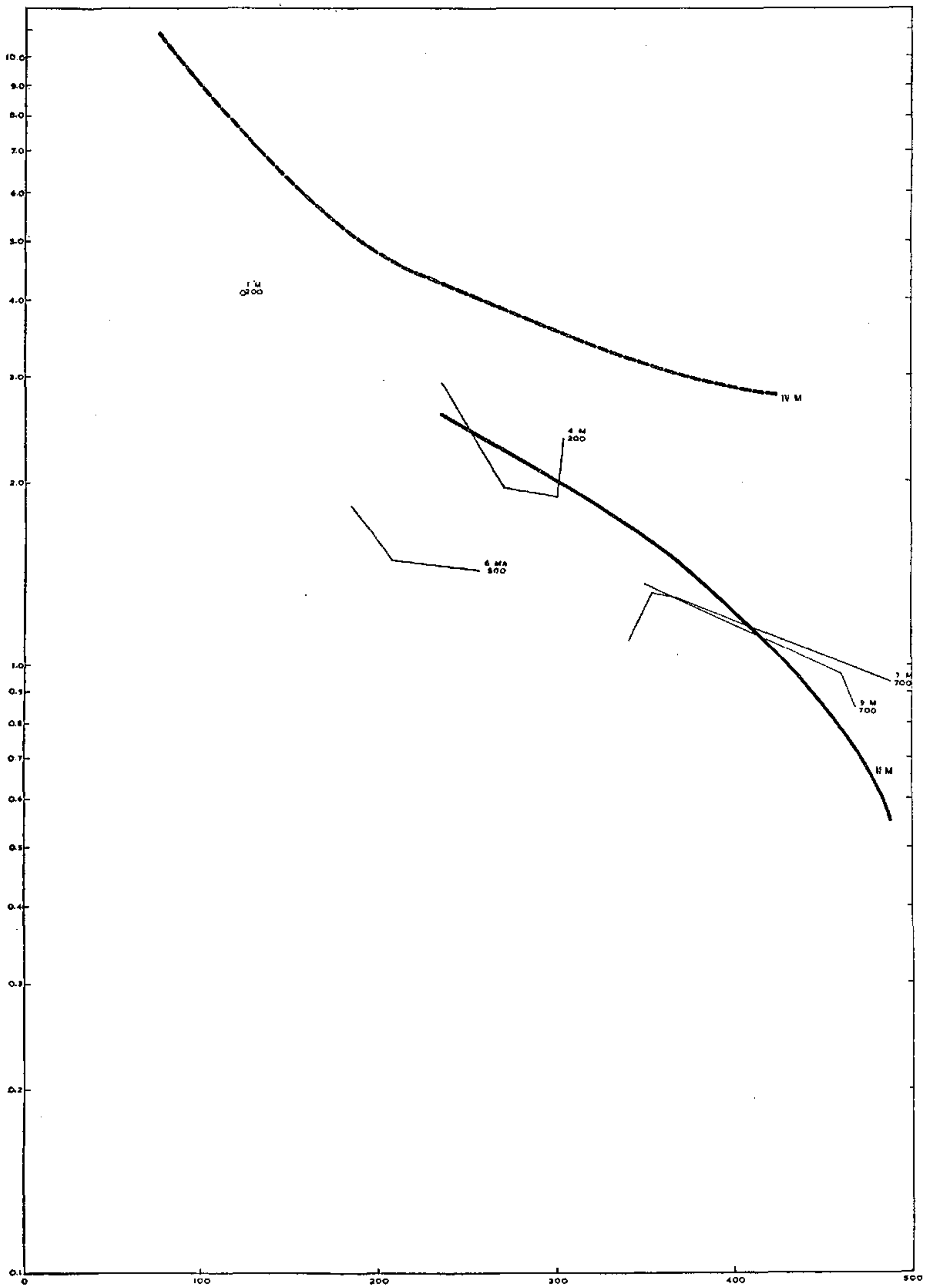
168. The influence of size (1.05) is not very great, but a comparison with the influence of size in the Brazilian weaving mills (1.02) indicates a tendency to build small modern mills, which was also encountered in other Latin-American countries.

169. Although the performance of the modern weaving mills of São Paulo is fairly good compared with that of similar industries elsewhere, with the exception of Mexico, the influence of operation (1.89) shows that its

Graph No. 2

PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE

Brazil (São Paulo)



X—Fabric count
Y—Productivity in kilograms per man-hour
II—Average of the modern mills
IV—Standard productivity of a modern 500-loom mill

M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms.

productivity could almost be doubled by the correction of certain factors which do not depend either on the machinery or the size of the mills.

170. The influence of operation was broken down into the influences of speed, efficiency, and excess of direct, indirect and miscellaneous labour. This was done by examining mills "E" and "F" (tables 15 and 16), the first of which works with yarn produced by a semi-modern spinning mill, and the second with the yarn from a completely new mill. Averages were taken of the influences of all the processes of these mills and they were adjusted, in table 17, so that the result should equal the influence of operation which had already been determined by means of the general sample.

171. The redistribution of the influences was made in the light of the following considerations, which arise from a study of the analyses of mills "E" and "F", and of the general observation made in the industry.

172. Nearly all the processes of the two mills (column 13 of tables 15 and 16) show speeds which are lower than normal, but they have more effect on productivity in the loom section because it normally consumes more labour per kilogramme. The looms of the mills visited work at approximately 94 per cent of their normal speed, chiefly because they are still in the running-in period and also because, by working slowly while the tenders are still being trained, they can achieve a better output. This influence, therefore, may be considered as being actively corrected.

173. A certain inverse correlation was observed both in mills "E" and "F" and in other mills visited, between the influences of efficiency and of the excess labour employed at the looms; in other words, high efficiencies were achieved with low work-loads, and vice versa. This indicates the presence of factors which require a greater consumption of labour than normal and which, if they do not appear in the influence of efficiency, as is the case of the weighted average of values in "E" and "F" (1.02), have been included in the influence of excess labour. The factors observed are, in order of importance, the lack of training of the loom fixers, defects in the preparation of the warp, lack of training of weavers and cone-winder tenders, and defects in the twisting and winding of the filling.

174. In order to give a numerical value to the relative importance of these factors, occasional observations were made of the frequency of stops in the looms, classifying them as far as possible according to their origin: mechanical, breakages in the warp, or breakages in the filling. As a result of these observations it was possible to estimate (1) the excess of skilled weavers necessary to maintain normal efficiencies, under the defective conditions revealed by the frequency of the stops (influence: 1.26 approximately); and (2) the relative importance of the mechanical causes, which depend mainly on the training of the loom fixers, in relation to the deficiencies of the warp and of the filling (influences: 1.14, 1.05 and 1.04 respectively). After separating, by division, the influences of the conditions just mentioned, the remainder of the total influence of excess labour was found to be 1.35. This figure is divided, by estimation, into the influence which can be attributed to the lack of training of the weavers and cone-winders (1.04) and that ascribed to superfluous personnel; that is, labour which could be eliminated at once without lowering efficiency (1.31).

175. This analysis was based on the loom section only, since, as can be seen in tables 15 and 16, it is the origin of nearly 90 per cent of the excess consumption of labour per kilogramme.

176. In the lower part of table 13, the influences have been rearranged in the following groups: (1) causes which require only immediate action on the part of the managers to reduce the personnel; (2) causes which are being corrected and are expected to disappear very shortly; (3) causes which require action on the part of the manager in order to modify certain internal manufacturing conditions, and (4) causes which can be attributed to the spinning mills.

177. It must be remembered that the potential increase in productivity, as expressed by these influences, can only be achieved if the elimination of causes, other than low efficiencies and speeds, is accompanied by the corresponding reduction in personnel thus made possible.

178. In order to enable the mills to raise their productivity to normal levels, they will have to install or perfect systems for the control of efficiency and of the quality of products and for the rational determination of work-loads.

V. Comments, results and analysis of the old spinning mills of Rio de Janeiro-Distrito Federal

A. *General comments*

179. The individual productivity of the old spinning mills of the region of Rio de Janeiro and the Distrito Federal can be found in graph 3, together with the general averages and the productivity of the standard mills which were used as norms for comparison. As none of the mills is subject to the influence of size, the relationship between the individual curves and the standard curves can be seen in the graph, without the need for any adjustment.

180. All the mills included can be considered as typically old, with the exception of spinning mill no. 1, which could be qualified as being 65 per cent modern.

181. It is interesting to note the consistency of the results, especially in the sector of the graph between counts 30 and 40. Setting aside mill no. 1, the productivity values range between the limits of 18 and 44 per cent of the standard productivity of the old mills and 14 and 32 per cent of that of the modern mills. The limits of mill no. 1 are 43 and 73 per cent of the productivity of the standard old mills and 32 and 50 per cent of that of the modern mills.

182. The following conditions were observed in most of the mills:

(*a*) Systems for the control of humidification are practically non-existent, and consequently, although the climate provides natural humidity, it cannot be maintained constant within the required limits in order to achieve the highest efficiency in each section of the spinning mills. The problem is difficult to solve in Rio de Janeiro-Distrito Federal where the mill buildings with high saw-toothed roofs, lead to variations of temperature. Even so, it is considered that no effort has been made to correct, even partially, this cause of low productivity. In the São Paulo mills, on the other hand, where there are similar conditions of natural humidity, although the outside temperature is lower,[62] mills with partial or total humidity control are commonly found.

(*b*) The working condition of the machinery is bad. The main defects observed were badly worn card clothing, poor operation of the spindles of the spinning-frames, and lack of stability of the roving-frames.

(*c*) The labour turnover is low in mills which are far from the cities and which have their own working communities. This is attributed to the good labour-management relations existing there, based on excellent social services and a praiseworthy effort on the part of the managers to instill in the workers a sense of attachment both to the mill and the community. A situation similar to that of São Paulo was observed in the mills situated near or within the cities: a boom in building and the irregular activity of that trade gave rise to a continual flow of workers from one industry to the other.

(*d*) The remaining comments coincide with those mentioned in connexion with the old spinning mills of São Paulo.

B. *Analysis of the results*

183. Table 18 contains a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity. The total influence and its principal components—the influences of the type of equipment, operation and size—are the averages of the influences of each yarn count, which were obtained, in table 19, by comparisons between the actual and the standard consumption of labour per kilogramme of yarn.

184. The influence of size is 1, in other words, there is no size influence since all the mills included in the sample have over 25,000 spindles. The influence of the type of equipment is 1.37.

185. The influence of operation (2.76) was broken down into the influences of the draft schedule, speed, efficiency and the excess of direct, indirect and miscellaneous labour, by means of the analysis of mills "G" and "H" (tables 20 and 21) which, in the yarn counts examined, represent medium and low conditions of productivity, respectively. Averages were taken of the influences of all the processes of these mills and they were adjusted, in table 28, so that the result is equal to the influence of operation which had already been determined by the general sample.

186. The redistribution of the influences was made in the light of the following considerations which arise from the study of the tables of analysis mentioned above and of the general observations made in the industry.

187. The influence of the draft schedule observed in mills "G" and "H" is due to discrepancies between the process organization actually observed, and the standard organization. Although similar discrepancies were observed in the industry as a whole, they are of no importance; their values are not sufficiently great to affect productivity to any great extent and, because of the necessity to adapt the draft schedule to a relatively large number of yarn counts, the values may alter from one day to another and even become positive where they were negative, or vice versa. For that reason, this influence has been grouped with the others considered as capable of being corrected.

188. It was observed that in some mills of Rio de Janeiro-Distrito Federal, productivity was affected by the machine speeds, which were lower than normal. This was due to the excessive wear of the machinery, the additional cleaning necessary for the cotton, and the carelessness of the personnel responsible for mechanical adjustments and changes of pulleys and gears. Mills "G" and "H" which probably represent the extremes of good and bad preservation of machinery, show contrasts in the influence of speed in nearly all their processes. When the influence of speed (1.15) was unequally allocated between causes requiring modernization for correction (1.05), such as the lack of maintenance of the mechanical and operational conditions of the machinery, and causes not requiring modernization (1.10), such as the excessive wear of the machinery, it was borne in mind that the most important defective mechanical conditions (e.g., those of the spinning-frames) cannot be corrected without the investment of large sums in new spindles and other pieces of machinery subject to wear. If these investments could be made, it would be more profitable to modernize, or semi-modernize, the machines by fitting them with high-draft systems and increasing the capacity of their bobbins.

189. The observations of a high frequency of yarn breakages in the spinning-frames led to the conclusion that most of the low efficiency is due to deficient humidity control, cleaning, and maintenance. These are not the sole causes, however, because excessive wear of the machinery must also influence efficiency, and numerous cases were found of tenders leaving their machines especially when they were ready for doffing. More importance has been attributed to the conditions of humidification, cleaning and maintenance (1.06) and less to the carelessness of the tenders (1.05) and the excessive wear of the machinery (1.03).

190. The estimate of the number of superfluous workers under exsting conditions was based on general observation of their activities and on occasional measurements of the breakage frequency of the yarn in the spinning-frames. It was estimated that as a result of the defective manufacturing conditions, the labour employed per kilogramme is probably 40 to 60 per cent more than that established as standard. For the sake of simplification, an excess of 50 per cent (or an influence of 1.50) was attributed to manufacturing conditions. Since certain portions deriving from the influence of production, totalling 1.24,[63] had already charged to these conditions, the remainder of the influence (1.20) was separated from the total influence of excess labour (2.12) and allocated equally among conditions such as humidification, which can be corrected, and others such as the excessive wear of the machinery, which cannot be corrected without modernization. The rest of the total influence of excess

[62] The climatological conditions of the places visited can be judged from the following data published in the *Anuario Estatistico do Brasil*, 1948:

	Absolute maximum and minimum temperature (°C)	*Average monthly compensated temperature (°C)*	*Average monthly relative humidity (%)*
Rio de Janeiro	40.3—10.9	19.4—27.8	73.0—86.1
Distrito Federal	37.4—14.9	21.2—27.9	74.0—89.4
São Paulo	34.4—02.1	13.7—22.4	70.1—86.4

[63] Calculated as the product of influences 0.98, 1.05, 1.06, 1.10 and 1.03, which appear in the third and fourth columns of the redistribution of the influence of production.

labour (1.71) was attributed to superfluous personnel which could be eliminated without affecting efficiency.

191. In the lower part of table 18 the influences have been re-arranged into groups according to (1) causes which require only immediate action on the part of management in order to reduce personnel; (2) causes which require preliminary action on the part of the managers to improve certain manufacturing conditions; (3) causes which can be corrected without recourse to modernization; and (4) causes which can only be eliminated by modernizing the industry.

192. In order to increase productivity, it is necessary to establish adequate systems for the determination of work-loads and for the control of efficiency and of product quality. It would also be necessary to select the best workers and re-train them in order to adapt them to the new conditions.

193. The lack of control of humidification was included among the causes of low productivity which can be remedied without modernization, since it will probably be many years before these mills can be modernized. In their case it would be advisable to invest in the improvement of humidification control.[64]

VI. Comments, results and analysis of the old weaving mills of Rio de Janeiro-Distrito Federal

A. *General comments*

194. The results of the measurements of productivity made in five mills in the region of Rio de Janeiro-Distrito Federal appear in graph 4, together with their general average and the curves of the standard productivity which were used as a basis for comparison.

195. The old weaving mills of this group have machinery of approximately the same type and age. They are all equipped with modern cone-winders and warpers, but their slashers and looms are typically old. Some differences were found in the state of preservation of the machinery and in the quality of the yarn used, but all their other manufacturing conditions can be considered similar.

196. The proximity of the individual curves and the frequency with which they cross one another indicate generally consistent results, although divergencies are found in certain fabric counts, due, principally, to irrational work-loads, in relation to the type of product manufactured.

197. The observations range between limits representing 16 and 59 per cent of the standard productivity for old mills, and 5.5 and 23 per cent of that of modern mills.

198. The following conditions were observed in most of the mills:

(*a*) Systems for the control of humidification are practically nonexistent;[65]

(*b*) With a few exceptions, the yarn used is irregular and neppy; this is probably the most important cause of low efficiency;

(*c*) The lighting is insufficient;

(*d*) A great variety of fabrics is manufactured, many of them in small quantities. As a result, the number of times the machines must be stopped in order to change the product is increased, and efficiency is consequently lowered;

(*e*) The work-loads are on the whole very low, both in the old and in the modern sections. An excess of service personnel was also noted, especially in the yarn depots, where there did not seem to be much work to be done.

B. *Analysis of the results*

199. Table 22 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity. The total influence and its principal components — the influences of type of equipment, operation and size—are the averages of the influences corresponding to each yarn count, which were obtained in table 23, by means of comparisons between the actual and the standard consumption of labour per kilogramme.

200. The influence of size is 1, which means that size exercises no influence, since the mills included in the sample have more than 500 looms. The weighted average of the influence of size in the weaving mills of the country as a whole is extremely low (1.02) because, as can be seen in table 24, a high percentage of the industry is made up of large mills.

201. The influence of equipment is in fact slightly lower than indicated by the average value given (2.61), as all the mills have modern cone-winders and warpers. Even were the necessary adjustment made, it would still remain very important, in view of the mechanical differences between ordinary and automatic looms. The fact that the consumption of labour of the ordinary looms is over two and a half times as great as that of modern machinery (other conditions being equal), indicates the vital importance of installing modern looms in order to increase productivity.

202. In this part of Brazil, the influence of operation (average 3.04) is more important than that of the type of equipment, and it is the highest of all the similar industries in the countries visited, with the exception of Ecuador. It has been subdivided into the influences of speed, efficiency and excess of direct, indirect and miscellaneous labour, by the analysis of the weaving mills "I", "J" and "K", as shown in tables 25, 26 and 27. Conditions are approximately the same in all three mills, with the exception of the quality of the yarn (which is superior in "I" and "K"), the control of humidification (which is better in "K"), and the working condition of the machinery (which is inferior in "J").[66] Averages were taken of all the processes of these mills and were adjusted, in table 28, to make their product equal to the influence of operation which had already been determined by the general sample.

203. The redistribution of the influences was made in the light of the following considerations, which arise

[64] The supervisor of a São Paulo mill declared that in his yarn section, production increased 15 to 20 per cent after the installation of a modern system of humiducts.

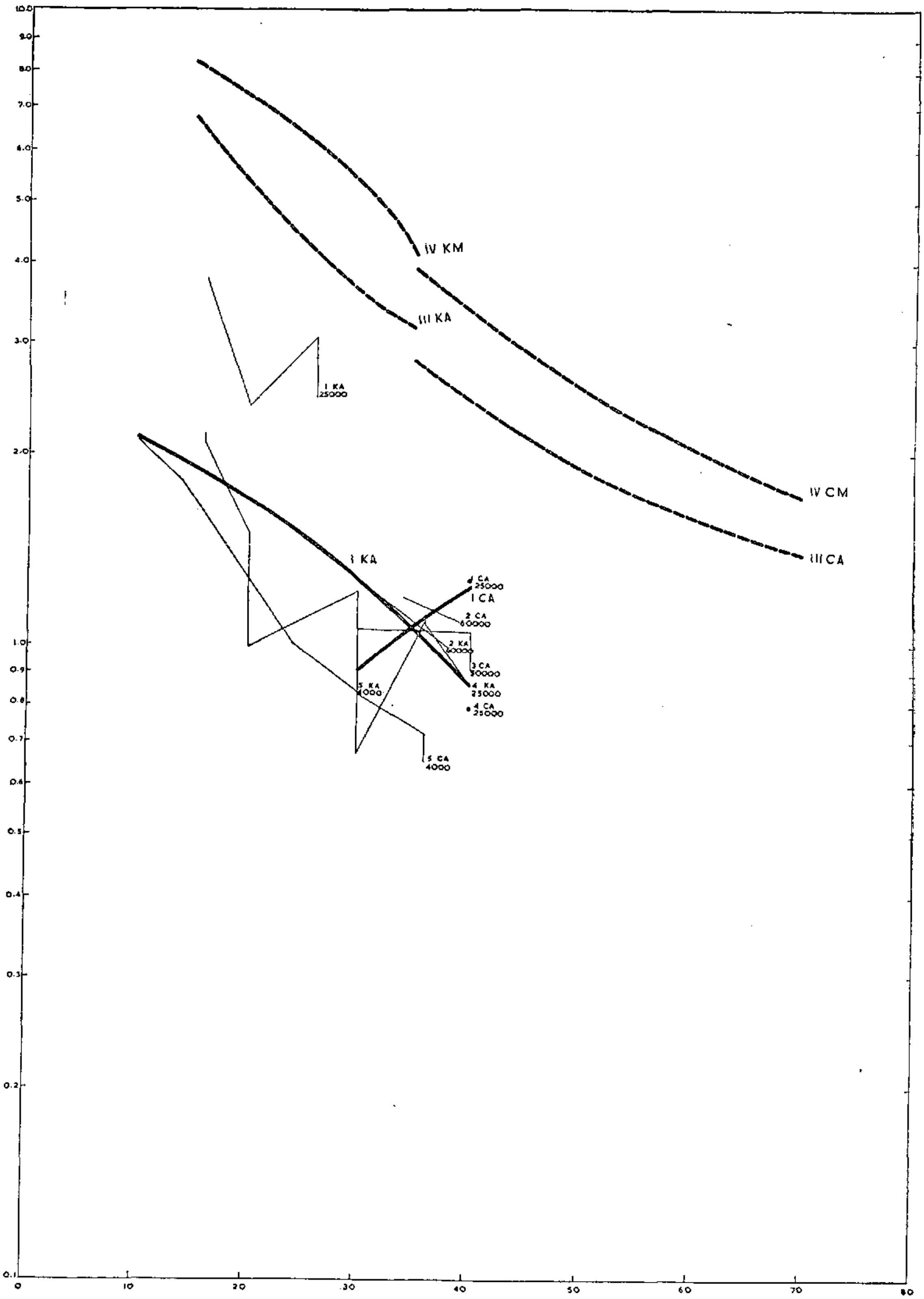
[65] See the general comments relating to the old spinning mills of Rio de Janeiro-Distrito Federal.

[66] These remarks refer only to the old sections of the mills. The quality of the yarn refers only to the yarn manufactured in the old sections of the spinning mills.

Graph No. 3

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Brazil (Rio de Janeiro-Distrito Federal)



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill
K—Means carded yarn

C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in spindles.

from a study of the tables of analysis mentioned above and from general observations made in the industry.

204. It was found that cases of low speed were not frequent in the loom section, which affects general productivity to the greatest extent. Moreover, there is no reason why the looms should work at low speeds, even though they are old, if their mechanical and operational conditions are adequately maintained. For these reasons, it was decided to attribute the resulting average influence (1.05) to lack of adequate maintenance of the machinery.

205. In the redistribution of the influence of efficiency (1.46), more weight was given to the poor quality of the yarn (1.20) because it was observed that the majority of loom stops were merely due to breakages in the warp and the filling caused by defects in the yarn. The lack of specialization of production, which varies greatly from one mill to another, accounts for losses in changes and delays equivalent to nearly 10 per cent of the available machine-hours in the mills of Rio de Janeiro-Distrito Federal (influence 1.10). The mechanical stops due to frequent breakdowns of the looms, and other conditions, such as defects of humidification and lighting, were considered less important than the causes previously mentioned, an influence of 1.05 being ascribed to them.

206. The total influence of excess labour (1.99) was attributed to the existence of absolutely superfluous personnel, even after taking into consideration the fact that large numbers of workers are needed to offset certain defective manufacturing conditions. This was done because it was considered that the influence of efficiency, which is very high, makes ample allowance for these defective conditions. In fact, there are two circumstances which support this estimate: (1) the excessive frequency of loom stops observed in some mills could not, of itself, give rise to an influence of efficiency which is much greater than that observed; and (2) the analyses of mills "I", "J" and "K" show that the low influences of efficiency do not correspond to high influences of labour, as would be expected if there were a close relationship between the numbers of tenders and output. In other words, all excess labour could probably be eliminated without any further deterioration of the efficiency of production.[67]

207. In the lower part of table 22 the influences have been re-arranged into groups corresponding to (1) causes which require only immediate action on the part of the managers in order to reduce personnel; (2) causes which require preliminary action on the part of the managers to improve certain manufacturing conditions; and (3) causes which require action on the part of the industry as a whole, in order to be eliminated. The influences have also been re-classified as to whether their correction is or is not dependent on the introduction of new machinery.

208. As stated in the cases of other sections of the industry, the improvement of productivity also requires the installation of modern systems to control efficiency and quality, together with rational methods of determining work-loads. The latter is less important in the old weaving mills than in the other sections of the industry since the work-loads in non-automatic looms are relatively inelastic with respect to the type of product and to conditions. Moreover, there is a limit, probably of six looms, beyond which the weaver could not supervise production adequately.

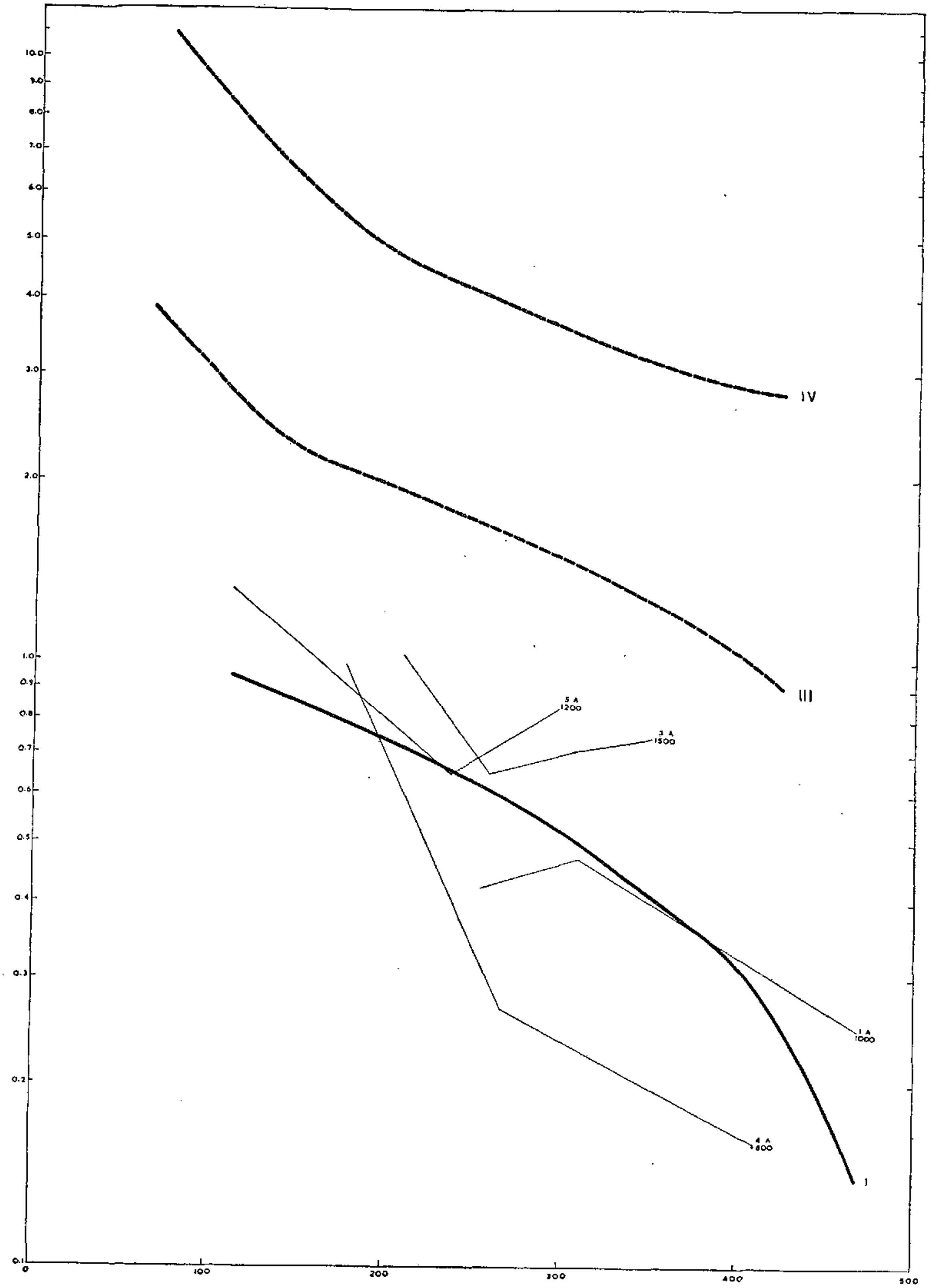
209. The reduction of personnel would not require such important re-training as in the case of the old spinning mills, since in the section which affects productivity most (the looms), the increase in work-loads would not be very large.

[67] Tables 25, 26 and 27 show that the efficiency of the cone-winders of "J" is 9 per cent below normal and that labour is 14 per cent below normal, while the efficiency of the cone-winders of "I" is 45 per cent below normal with ten times more labour than is necessary. The efficiency of the looms of "I" is 19 per cent below normal with 1.26 times more labour (direct plus indirect) than is necessary, while the efficiency of those of "J" is 26 per cent less than normal with 2.66 times more labour (direct plus indirect) than necessary. Mill "K" shows excellent efficiency in both processes, due mainly to the fact that its yarn is supplied by a semi-modern spinning-mill. The excess labour falls between that of the other two mills.

Graph No. 4

PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE

Brazil (Rio de Janeiro-Distrito Federal)



X—Fabric count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
III—Standard productivity of an old 500-loom mill
IV—Standard productivity of a modern 500-loom mill
A—Means an old mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms.

Table No. 3

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Brazil (São Paulo)
Industry: Spinning
Type of mills: Old

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Excess labour, after allowing for present conditions*	*Humidification, machine maintenance, cleanliness, lighting*	*Excessive wear of machines*	*Type of equipment*	*Size*		
Total influence 2.68	*Influence of operation 1.96*	*Production*	Draft Sch.	1.00							
			Speed	1.07		1.04	1.03				
			Efficiency	1.05		1.02	1.03				
			Total	1.12							
		Excess labour	Direct	2.91							
			Indirect	0.74							
			Miscel.	0.81							
			Total	1.75	1.50	1.08	1.08				
	Size 1.02								1.02		
	Type of equipment 1.34							1.34			
TOTALS					1.50	1.15	1.14	1.34	1.02		
Action to reduce labour					1.50						
Action to improve conditions						1.15					
Causes not requiring modernization for correction					1.72						
Causes requiring modernization								1.56			

Table No. 4

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Brazil (São Paulo)
Industry: Spinning
Type of mills: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size: Old (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size: Modern (m-h/100 kg.)*	*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences: Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
15 K	34.01	14.66	12.02	15.10	1.22	1.03	2.25	2.83
20 K	39.37	18.15	13.62	18.69	1.33	1.03	2.11	2.89
25 K	45.87	22.68	15.75	23.13	1.44	1.02	1.98	2.91
30 K	54.05	27.78	18.69	28.34	1.49	1.02	1.91	2.89
35 K	63.69	31.65	24.10	32.28	1.31	1.02	1.97	2.64
35 C	76.92	35.71	25.44	36.42	1.40	1.02	2.11	3.02
40 C	83.33	40.65	29.50	41.06	1.38	1.01	2.03	2.82
45 C	90.91	46.30	34.36	46.76	1.35	1.01	1.94	2.64
50 C	100.–	52.63	39.52	53.16	1.33	1.01	1.88	2.53
55 C	109.89	58.14	44.44	59.30	1.31	1.02	1.85	2.47
60 C	123.46	62.89	49.02	64.15	1.28	1.02	1.92	2.52
Averages	—	—	—	—	1.34	1.02	1.96	2.68

Table No. 5

BRAZIL: SIZE DISTRIBUTION OF THE SPINNING MILLS

Size (spindles)	*Number of Mills*	*Percentage of total number of mills*	*Number of spindles*	*Percentage of total spindles*
Up to 2,000	32	13.17	35,995	1.19
2,000– 5,000	62	25.51	211,763	7.03
5,000–10,000	59	24.28	426,693	14.13
10,000–15,000	39	16.05	464,792	15.42
15,000–25,000	21	8.64	399,418	13.25
25,000–50,000	21	8.64	750,828	24.92
50,000 and over	9	3.71	724,870	24.06
TOTALS	243	100.00	3,014,359	100.00
Up to 5,000	94	38.68	247,758	8.22
5,000–15,000	98	40.33	891,485	29.55
15,000 and over	51	20.99	1,875,116	62.23

Source: The data used were taken from *Indústria Textil Algodoeira,* Comissão Executiva Textil, 1946.
Note: The totals differ from those of the geographical distribution, because the latter were adjusted by means of estimates and information from other sources.

Table No. 6

GEOGRAPHICAL DISTRIBUTION OF THE BRAZILIAN COTTON TEXTILE INDUSTRY

	Number of spindles				*Number of looms*			*Number of mills*					
States	*Standard*	*Long Draft*	*N/Spec.*	*Total*	*Non-automatic*	*Automatic*	*Total*	*Spinning only*	*Weaving only*	*Spinning-weaving only*	*Total*	*Number of firms*	*Total number of workers*
Pará	2,288	3,920	1,596	7,804	281	—	281	—	—	1	1	1	584
Maranhão	70,071	5,532	7	75,610	2,121	—	2,121	—	—	9	9	8	3,878
Piauí	4,428	312	—	4,740	158	—	158	—	—	1	1	1	237
Ceará	26,064	5,224	600	31,888	1,065	—	1,065	—	—	11	11	9	3,476
Rio Grande do Norte	704	—	—	704	—	—	—	1	—	—	1	1	68
Paraíba	65,635	1,680	—	67,316	2,922	—	2,922	—	—	5	5	5	12,168
Pernambuco	171,000	35,136	—	206,136	8,331	—	8,331	1	—	13	14	13	31,510
Alagoas	95,034	16,634	58	111,716	3,415	—	3,415	—	—	10	10	9	11,763
Sergipe	88,408	14,044	60	102,512	3,306	—	3,306	—	—	13	13	12	8,824
Bahia	82,430	21,456	90	103,976	4,595	—	4,595	—	—	9	9	5	4,637
Distrito Federal [a]	437,606	160,793	—	598,399	13,713	566	14,279	3	—	12	15	13	23,981
Rio de Janeiro	225,934	69,196	3,156	298,286	13,723	—	13,723	1	—	25	26	22	17,164
Minas Gerais	274,735	59,515	15,160	349,410	11,961	241	12,202	4	—	61	65	56	27,011
São Paulo	764,146	451,816	35,128	1,251,090	27,651	3,953	31,604	28	149	75	252	234	72,335
Santa Catarina	20,334	25,416	168	45,918	1,496	—	1,496	—	8	11	19	16	5,474
Paraná	—	—	—	—	31	—	31	—	1	—	1	1	26
Rio Grande do Sul	24,172	—	—	24,172	603	14	617	—	1	2	3	3	1,116
TOTALS	2,352,990	870,664	56,023	3,279,677	95,372	4,774	100,146	38	159	258	455	409	224,252

[a] The looms and spindles of Distrito Federal were adjusted to reflect a new modern mill.

Sources:

Total spindles of São Paulo: *Bôlsa de Mercadorias, São Paulo.*
Breakdown of the spindles of São Paulo: estimated.
Looms of São Paulo: estimated.
The rest of the data were furnished by Comissão Executiva Textil, Ministério do Trabalho, Indústria e Comércio.

Table No. 7

Yarn count: 18's corded
Actual productivity: 2.655 kg/m-h
Standard productivity: 6.020 kg/m-h
Operational influence: 2.27

ANALYSIS OF THE OPERATIONAL INFLUENCE
IN SPINNING MILLS

Country: Brazil (São Paulo)
Type of mill: Old
Mill: "A"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence									Man-hours per 100 kg. added by the influences	Percentage of total excess
								Production influence				Labour influence						
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	165	175.71	2	3	0.61	1.36	1.000	1.000	1.063	(1.063)	1.50	1.095	0.256 [a]	(0.421)	0.448	0.74	—
Carding	Cards	3.4	6.82	14	31	4.01	1.17	1.350	1.468	1.010	(2.00)	2.215	0.775	1.000	(1.715)	3.430	2.84	12.9
Drawing	Delivery	4.47	7.41	16	34	1.54	0.41	1.270	1.250	1.043	(1.658)	2.124	1.067	1.000	(2.264)	3.775	1.13	5.2
Drawing	Delivery	4.47	7.41	16	34	3.11	0.41	1.270	1.250	1.043	(1.658)	2.124	1.067	2.010 [b]	(2.264)	7.580	2.74	12.4
Slubber	Spindle	0.671	1.407	94	176	1.38	0.41	1.875	1.118	1.000	(2.095)	1.874	0.866	1.000	(1.606)	3.365	0.97	4.4
First intermediate	Spindle	0.269	0.184	140	372	4.28	1.44	0.850	0.872	0.922	(0.684)	2.658	1.640	1.000	(4.350)	2.970	2.84	12.9
Spinning	Spindle	0.0157	0.0194	500	1390	22.93	11.40	1.000	1.000	1.235	(1.235)	2.780	0.778	0.754 [c]	(1.627)	2.007	11.48	52.2
Totals and averages						37.86	16.60	1.047	1.053	1.128	(1.242)	2.575	0.850	0.835	(1.825)	2.27	21.26	100.00

[a] The standard mill has two more picking processes.
[b] The actual mill has one more drawing process.
[c] Represents general labour existing only in the standard mill.

Table No. 8

Yarn count: 32's carded
Actual productivity: 1.805 kg/m-h
Standard productivity: 3.350 kg/m-h
Operational influence: 1.85

ANALYSIS OF THE OPERATIONAL INFLUENCE
IN SPINNING MILLS

Country: Brazil (São Paulo)
Type of mill: Old
Mill: "B"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence									Man-hours per 100 kg. added by the influences	Percentage of total excess
								Production influence				Labour influence						
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	160.0	114.0	2	3	0.69	1.71	1.076	0.611	1.01	(0.713)	1.500	0.673	0.561 [a]	(0.566)	0.403	−1.12	—
Carding	Cards	2.8	3.63	13	36	4.44	2.15	0.909	1.390	1.027	(1.297)	2.770	0.576	1.000	(1.595)	2.065	2.29	8.5
Drawing	Delivery	6.0	5.31	20	44	0.76	0.44	0.909	1.067	0.962	(0.885)	2.200	0.888	1.000	(1.955)	1.730	0.33	1.2
Drawing	Delivery	6.5	5.31	20	44	0.72	0.44	0.962	0.849	1.000	(0.817)	2.200	0.909	1.000	(2.000)	1.635	0.29	1.0
Slubbers (I)	Spindle	0.950	0.940	84	164	1.47	0.66	1.051	0.931	1.019	(0.989)	1.951	1.155	1.000	(2.260)	2.230	0.82	3.3
First intermediate (II)	Spindle	0.270	0.230	132	402	3.35	1.05	0.883	0.966	1.000	(0.853)	3.050	1.225	1.000	(3.760)	3.190	2.32	8.6
Jacks (III)	Spindle	0.060	0.426	372	830	4.22	2.85	0.833	0.896	0.953	(0.710)	2.230	0.934	1.000	(2.085)	1.480	1.39	5.2
Spinning	Spindle	0.0080	0.0091	500	1728	39.75	20.55	1.000	1.132	1.005	(1.138)	3.456	0.656	0.750 [b]	(1.700)	1.934	19.23	72.2
Totals and averages						55.40	29.85	0.975	1.084	1.004	(1.061)	3.174	0.688	0.800	(1.748)	1.85	25.55	100.00

[a] The standard mill has two more picking processes than the actual mill.
Represents general labour existing only in the standard mill.

Table No. 9

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Brazil (São Paulo)
Industry: Spinning
Type of mills: Modern

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Excess labour, after allowing for necessary training*	*Influence favouring production*	*Lack of training of the workers*				
Total influence 1.54	*Influence of operation 1.41*	*Production*	Draft Sch.	1.00							
			Speed	0.96							
			Efficiency	1.01							
			Total	0.97		0.97					
		Excess labour	Direct	3.21							
			Indirect	0.54							
			Miscel.	0.84							
			Total	1.45	1.32		1.10				
	Size 1.09							1.09			
	Type of equipment —										
TOTALS					1.32	0.97	1.10	1.09			
Action to reduce labour					1.32						
In active process of correction						1.07					
Causes that can be eliminated						1.41					
Causes that cannot be eliminated except by enlarging the mills								1.09			

Table No. 10

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Brazil (São Paulo)
Industry: Spinning
Type of mills: Modern

Yarn or fabric count	Actual average labour consumption (m-h/100 kg.)	Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)	Standard labour consumption adjusted for size (m-h/100 kg.)	Influences: Size (S)	Influences: Operation (O)	Influences: Total (T)
	a	c	d	d/c	a/d	a/c
15 K	16.78	12.02	14.66	1.22	1.14	1.40
20 K	20.12	13.62	16.62	1.22	1.21	1.48
25 K	24.45	15.75	19.06	1.21	1.28	1.55
30 K	30.58	18.69	21.87	1.17	1.40	1.64
35 K	42.19	24.10	27.23	1.13	1.55	1.75
35 C	50.00	25.44	27.73	1.09	1.80	1.96
40 C	51.81	29.50	31.56	1.07	1.64	1.76
45 C	55.25	34.36	36.76	1.07	1.50	1.61
50 C	59.52	39.52	42.28	1.07	1.41	1.51
55 C	64.10	44.44	47.55	1.07	1.35	1.44
60 C	69.44	49.02	52.45	1.07	1.32	1.42
65 C	75.76	53.48	57.22	1.07	1.32	1.42
70 C	84.03	58.48	62.57	1.07	1.34	1.44
Averages	—	—	—	1.09	1.41	1.54

Table No. 11

Yarn count: 30's combed
Actual productivity: 2.656 kg/m-h
Standard productivity: 4.220 kg/m-h
Operational influences: 1.590

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Brazil (São Paulo)
Type of mill: Modern
Mill: "C"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence: Production influence				Operational influence: Labour influence					Man-hours per 100 kg. added by the influences	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	99.3	113.2	1	2	0.757	0.838	1.077	1.060	1.000	(1.142)	2.000	0.396	1.000	(0.792)	0.905	−0.079	—
Carding	Cards	3.1	3.6	13.3	40	3.240	1.887	0.894	1.410	0.922	(1.160)	3.000	0.494	1.000	(1.382)	1.720	1.363	9.9
Drawing	Delivery	6.95	5.2	16	37	0.860	0.628	0.688	1.192	0.912	(0.748)	2.310	0.792	1.000	(1.830)	1.370	0.137	0.9
Lap winding	Machine	127	131.4	2	2	0.630	0.419	0.654	1.267	1.250	(1.036)	1.000	1.449	1.000	(1.449)	1.502	0.210	1.5
Combing	Delivery	13.0	18.0	2	6	3.660	1.258	0.964	1.197	1.200	(1.384)	3.000	0.700	1.000	(2.100)	2.910	2.402	17.2
Lap winding	Machine	127	105.5	2	2	0.630	0.628	0.726	1.000	1.090	(0.792)	1.000	1.258	1.000	(1.258)	0.997	−0.001	—
Drawing	Delivery	6.95	6.0	16	27	0.860	0.628	0.812	1.049	1.012	(0.864)	1.688	0.933	1.000	(1.582)	1.370	0.230	1.6
Roving	Spindle	0.0074	0.161	384	504	5.100	1.258	2.000	1.287	0.844	(2.178)	1.313	1.420	2.124[a]	(3.962)	8.630	9.698	68.9
Spinning	Spindle	0.01285	0.01060	750	3000	16.240	16.32	1.000	0.895	1.000	(0.895)	4.000	0.443	0.627[b]	(1.112)	0.996	−0.065	—
Totals and averages						37.710	23.700	1.020	1.002	0.985	(1.005)	3.150	0.540	0.932	(1.585)	1.593	13.90	100.00

[a] The actual mill has two extra roving processes.
[b] Represents general labour existing only in the standard mill.

Table No. 12

Yarn count: 50's combed
Actual productivity: 1.647 kg/m-h
Standard productivity: 2.22 kg/m-h
Operational influence: 1.349

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Brazil (São Paulo)
Type of mill: Modern
Mill: "D"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence: Production influence				Operational influence: Labour influence					Man-hours per 100 kg. added by the influences	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	140.0	113.2	1	1	0.54	1.570	1.02	0.793	1.000	(0.809)	1.000	0.382	1.000	(0.382)	0.344	−1.029	—
		3.1	2.7	10.7	40	4.77	3.530	0.958	0.916	1.000	(0.871)	3.740	0.416	1.000	(1.554)	1.352	1.192	6.3
Carding	Cards	4.41	5.2	20	40	1.86	0.588	1.000	1.180	1.000	(1.180)	2.000	1.343	1.000	(2.686)	3.163	1.220	6.3
Drawing (4 rolls)	Delivery	127.0	131.4	1	2	0.79	0.588	0.962	1.000	1.076	(1.034)	2.000	0.650	1.000	(1.300)	1.345	0.202	1.1
Lap winding (20 ends)	Machine	14.8	17.0	2	5	4.90	2.355	1.040	1.074	1.027	(1.149)	2.500	0.725	1.000	(1.812)	2.080	2.540	13.2
Combing	Delivery	102.0	105.5	1	2	1.18	0.588	1.033	1.000	1.000	(1.033)	2.000	0.983	1.000	(2.949)	3.040	1.995	10.3
Lap winding (16 ends)	Machine	4.72	6.0	12	32	2.62	0.588	0.782	1.024	1.586	(1.271)	2.665	1.316	1.000	(3.505)	4.460	2.030	10.5
Drawing (5 rolls)	Delivery	0.137	0.144	136	300	7.52	2.355	0.840	0.808	1.548	(1.050)	2.205	1.380	1.000	(3.045)	3.200	5.060	26.2
Roving (I)	Spindle	0.067	0.050	320	880	7.42	2.355	0.945	0.840	0.940	(0.746)	2.744	1.539	1.000	(4.220)	3.149	5.025	26.1
Roving (II)	Spindle																	
Spinning	Spindle	0.00610	0.00568	800	3000	29.10	30.650	1.000	0.935	0.997	(0.932)	3.750	0.416	0.653	(1.018)	0.950	−1.535	—
Totals and averages						60.70	45.167	0.987	0.930	1.028	(0.945)	3.350	0.533	0.798	(1.428)	1.348	15.70	100.00

Table No. 13

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Brazil (São Paulo)
Industry: Weaving
Type of mills: Modern

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Excess labour, after allowing for present conditions*	*Reduced speed during break-in and training period*	*Lack of training of the loom fixers*	*Lack of training of weavers and cone-winder tenders*	*Defective warp preparation*	*Defective twist and winding of the filling*	*Size*
Total influence 1.98	*Influence of operation 1.89*	*Production*	Draft Sch.	—							
			Speed	1.09		1.09					
			Efficiency	1.02			1.02				
			Total	1.11							
		Excess labour	Direct	2.34							
			Indirect	1.23							
			Miscel.	0.59							
			Total	1.70	1.31		1.14	1.04	1.05	1.04	
	Size 1.05										1.05
	Type of equipment —										
TOTALS					1.31	1.09	1.16	1.04	1.05	1.04	1.05
Action to reduce labour					1.31						
In active process of correction							1.32				
Action to improve conditions									1.05		
Attributable to spinning mills										1.04	
Causes that can be eliminated							1.89				
Causes that cannot be eliminated except by enlarging the mills											1.05

Table No. 14

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Brazil (São Paulo)
Industry: Weaving
Type of mills: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences*		
				Size (S)	*Operation (O)*	*Total (T)*
	a	*c*	*d*	*d/c*	*a/d*	*a/c*
125	30.12	13.46	13.86	1.03	2.17	2.24
150	31.54	15.92	16.40	1.03	1.92	1.98
175	33.22	18.52	19.26	1.04	1.72	1.79
200	35.34	20.83	22.29	1.07	1.59	1.70
225	37.45	22.73	24.78	1.09	1.51	1.65
250	40.82	24.45	27.63	1.13	1.48	1.67
275	44.44	26.11	29.76	1.14	1.49	1.70
300	49.02	27.86	30.65	1.10	1.60	1.76
325	54.94	29.67	31.15	1.05	1.76	1.85
350	61.73	31.64	31.96	1.01	1.93	1.95
375	70.42	33.44	33.44	1.00	2.10	2.10
400	81.30	35.09	35.09	1.00	2.32	2.32
425	96.15	36.10	36.10	1.00	2.66	2.66
Averages	—	—	—	1.05	1.89	1.98

Table No. 15

Actual fabric: 469's; 97/44 x 86/60; 3160 w.e.; 91 g/sq.m.
Standard fabric: 469's; 97/44 x 86/60; 3160 w.e.; 91 g/sq.m.
Actual productivity: 0.842 kg/m-h
Standard productivity: 2.140 kg/m-h
Influence of operation: 2.54

ANALYSIS OF THE OPERATIONAL INFLUENCE ON SELECTED WEAVING MILLS

Country: Brazil (São Paulo)
Type of mill: Modern
Mill: "E"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m. – Actual	Speed – Standard	Efficiency percentage – Actual	Efficiency – Standard	Units of equipment per tender – Actual	Units – Standard	Ratio of direct to total labour – Actual	Ratio – Standard	Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence – Production influence – Speed	Production influence – Process efficiency	Production influence – Total	Labour influence – Direct	Labour influence – Indirect	Labour influence – Miscellaneous	Labour influence – Total	TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Cone winding	Spindle	530	600	80	70	16	50	150/150	15/15	23.4	4.27	1.132	0.875	(0.991)	3.121	1.000	1.000	(3.121)	3.100	8.97	12.3
Warping	Warper	250	500	87.4	60	1	1	9/21	2/7	50.2	1.99	2.000	0.687	(1.375)	1.000	0.667	1.000	(0.667)	0.916	−0.16	—
Slashing	Slasher	25	32	58	65	1	2	18/48	2/4	87.8	1.14	1.280	1.120	(1.435)	2.000	1.134	1.000	(2.670)	3.830	3.22	4.4
Weaving	Loom	180	192	93	90	13	56	48/141	27/60 27/138	2.54	39.38	1.067	0.968	(1.032)	4.310	1.321	0.435[a]	(2.470)	2.550	60.70	83.3
Totals and averages										2.140	46.78	1.117	0.941	(1.051)	3.948	1.280	0.475	(2.400)	2.52	72.73	100.0

[a] Represents general labour existing only in the standard mill.

Table No. 16

Actual fabric: No. 122.5; 54/16 x 41/14; 4000 w.e.; 181 g/sq.m.
Standard fabric: No. 122.5; 54/16 x 41/14; 4000 w.e.; 181 g/sq.m.
Actual productivity: 4.10 kg/m-h
Standard productivity: 6.614 kg/m-h
Influence of operation: 1.613

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Country: Brazil (São Paulo)
Type of mill: Modern
Mill: "F"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m. – Actual	Speed – Standard	Efficiency percentage – Actual	Efficiency – Standard	Units of equipment per tender – Actual	Units – Standard	Ratio of direct to total labour – Actual	Ratio – Standard	Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence – Production influence – Speed	Production influence – Process efficiency	Production influence – Total	Labour influence – Direct	Labour influence – Indirect	Labour influence – Miscellaneous	Labour influence – Total	TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Cone winding	Spindle	555	600	68.4	70	26	30	39/39	18/18	47.1	2.121	1.081	1.023	(1.105)	1.153	1.000	1.000	(1.153)	1.274	0.58	6.1
Warping	Warper	274	500	60	60	1	1	3/9	2/8	104.6	0.955	1.824	1.000	(1.824)	1.000	0.750	1.000	(0.750)	1.368	0.35	3.6
Slashing	Slasher	27.4	27.4	75	65	1	1	3/9	2/4	210.0	0.476	1.000	0.866	(0.866)	1.000	1.500	1.000	(1.500)	1.299	0.14	1.4
Weaving	Loom	132	140	61	85	16	25	42/129	24/48 24/97	8.650	11.550	1.060	1.393	(1.476)	1.562	1.535	0.494[a]	(1.184)	1.747	8.62	88.9
Totals and averages										6.614	15.102	1.109	1.286	(1.426)	1.461	1.444	0.545	(1.149)	1.630	9.69	100.0

[a] Represents general labour existing only in the standard mill.

Table No. 17

BRAZIL (SAO PAULO)

SUMMARY OF THE ANALYSES OF THE INFLUENCE OF OPERATION, AND EXTENSION OF THE RESULTS TO THE GENERAL SAMPLE

				Influence of operation								
				Production				*Excess of labour*				
Industry	*Mill*	*Actual labour consumption m-h/100 kg.*	*Standard labour consumption m-h/100 kg.*	*Draft schedule*	*Speed*	*Process efficiency*	*Total*	*Direct*	*In-direct*	*Miscel-laneous*	*Total*	*Total*
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Old spinning mills	A	37.86	16.60	1.047	1.053	1.128	(1.242)	2.575	0.850	0.835	(1.825)	2.270
	B	55.40	29.85	0.975	1.084	1.004	(1.061)	3.174	0.688	0.800	(1.748)	1.850
	Averages	46.63	23.22	1.001	1.072	1.050	(1.127)	2.938	0.739	0.814	(1.767)	1.992
	Extension to the general sample	74.68	38.04	1.00	1.07	1.05	(1.12)	2.91	0.74	0.81	(1.75)	1.96
Modern spinning mills	C	37.71	23.70	1.020	1.002	0.985	(1.005)	3.150	0.540	0.932	(1.585)	1.593
	D	60.70	45.17	0.987	0.930	1.028	(0.945)	3.350	0.533	0.798	(1.428)	1.348
	Averages	49.20	34.44	0.998	0.955	1.012	(0.964)	3.278	0.535	0.845	(1.482)	1.429
	Extension to the general sample	49.56	35.20	1.00	0.96	1.01	(0.97)	3.21	0.54	0.84	(1.45)	1.41
Modern weaving mills	E	117.88	46.78	—	1.117	0.941	(1.051)	3.948	1.280	0.475	(2.400)	2.520
	F	24.61	15.10	—	1.109	1.286	(1.426)	1.461	1.444	0.545	(1.149)	1.630
	Averages	71.24	30.94	—	1.120	1.024	(1.147)	3.194	1.303	0.486	(2.023)	2.320
	Extension to the general sample	51.27	27.10	—	1.09	1.02	(1.11)	2.34	1.23	0.59	(1.70)	1.89

Table No. 18

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Brazil (Rio de Janeiro–D.F.)
Industry: Spinning
Type of mills: Old

Analysis of the total influence (*data of the general sample*)	*Analysis of the influence of operation* (*data of the small sample, extended to the general sample*)				*Redistribution of the influences*: *Excess labour, after allowing for present conditions*	*Machines unattended for long periods*	*Humidification, machine maintenance, cleanliness, lighting, process organization*	*Excessive wear of the machines*	*Type of equipment*
Total influence 3.80	*Influence of operation 2.76*	*Production*	Draft Sch.	0.98			0.98		
			Speed	1.15			1.05	1.10	
			Efficiency	1.15		1.05	1.06	1.03	
			Total	1.30					
		Excess labour	Direct	3.02					
			Indirect	0.84					
			Miscel.	0.84					
			Total	2.12	1.71		1.11	1.12	
	Size 1.00								
	Type of equipment 1.37								1.37
TOTALS					1.71	1.05	1.22	1.27	1.37
Action to reduce labour					1.80				
Action to improve conditions							1.22		
Causes not requiring modernization for correction						2.19			
Causes requiring modernization								1.74	

Table No. 19

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Brazil (Rio de Janeiro–D.F.)
Industry: Spinning
Type of mills: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*: *Old (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*: *Modern (m-h/100 kg.)*	*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences*: *Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
15 card.	52.63	14.66	12.02	14.66	1.22	1.00	3.59	4.38
20 card.	59.52	18.15	13.62	18.15	1.33	1.00	3.28	4.37
25 card.	68.03	22.68	15.75	22.68	1.44	1.00	3.00	4.32
30 card.	78.84	27.78	18.69	27.78	1.49	1.00	2.83	4.21
35 card.	94.34	31.65	24.10	31.65	1.31	1.00	2.98	3.91
35 comb.	94.34	35.71	25.44	31.71	1.40	1.00	2.64	3.71
40 comb.	81.30	40.65	29.50	40.65	1.38	1.00	2.00	2.76
Averages	—	—	—	—	1.37	1.00	2.76	3.80

Table No. 20

Yarn count: 24's carded
Actual productivity: 1.530 kg/m-h
Standard productivity: 4.52 kg/m-h
Operational influence: 2.96

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Brazil (Río de Janeiro)
Type of mill: Old
Mill: "G"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence: Production influence				Operational influence: Labour influence					Man-hours per 100 kg. added by the influences	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	96.2	114.0	1.50	3	5.59	1.38	1.000	1.378	0.860	(1.185)	2.000	1.710	1.000	(3.420)	4.050	4.21	9.41
		2.8	3.63	15	32	7.88	2.13	0.880	1.415	1.040	(1.297)	2.130	1.338	1.000	(2.850)	3.700	5.75	13.22
		6.2	5.31	15	41	1.20	0.46	0.927	0.694	1.333	(0.857)	2.735	1.113	1.000	(3.045)	2.610	0.74	1.70
Carding	Cards	6.2	5.31	15	41	2.44	0.46	0.927	0.694	1.333	(0.857)	2.735	1.113	2.030[a]	(6.180)	5.300	1.98	4.55
Drawing	Delivery	0.525	0.940	80	176	2.65	0.62	1.627	1.071	1.025	(1.790)	2.187	1.092	1.000	(2.385)	4.275	2.03	4.67
Drawing	Delivery																	
Slubber (I)	Spindle	0.209	0.330	134	398	4.01	0.77	1.240	0.898	1.418	(1.578)	2.970	1.116	1.000	(3.315)	5.221	3.24	7.45
Intermediate (II)	Spindle	0.079	0.066	164	820	8.63	1.85	0.638	0.665	1.970	(0.835)	5.000	1.116	1.000	(5.590)	4.660	6.77	15.80
Fine (III)	Spindle																	
Spinning	Spindle	0.00882	0.01437	454	1584	33.24	14.45	1.000	1.122	1.450	(1.629)	3.480	0.527	0.771[b]	(1.412)	2.302	18.80	43.2
Totals and averages						65.640	22.12	0.974	1.107	1.358	(1.467)	3.295	0.693	0.882	(2.015)	2.96	43.52	100.00

[a] Represents an extra drawing process in the actual mill.
[b] Represents general labour existing only in the standard mill.

Table No. 21

Yarn count: 30 carded
Actual productivity: 0.840 kg/m-h
Standard productivity: 3.600 kg/m-h
Operational influence: 4.280

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Brazil (Río de Janeiro)
Type of mill: Old
Mill: "H"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence: Production influence				Operational influence: Labour influence					Man-hours per 100 kg. added by the influences	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	157.0	175.7	1	3	2.72	1.76	0.876	1.100	1.162	(1.120)	3.000	0.460	1.000	(1.380)	1.546	0.96	1.1
Carding	Cards	6.56	6.82	8	36	2.53	1.88	0.909	1.091	1.050	(1.040)	4.500	0.287	1.000	(1.293)	1.345	0.65	0.7
Drawing (I)	Delivery	5.430	7.41	6	36	2.96	0.566	0.909	1.252	1.200	(1.365)	6.000	0.645	1.000	(3.865)	5.280	2.32	2.5
Drawing (II)	Delivery	5.378	7.41	6	36	3.42	0.566	0.962	1.252	1.146	(1.380)	6.000	0.729	1.000	(4.380)	6.040	2.85	3.1
Slubber roving	Spindle	0.557	0.872	72	148	4.87	0.755	0.930	1.182	1.342	(1.476)	2.055	2.130	1.000	(4.370)	6.450	4.12	4.5
Speeder roving	Spindle	0.062	0.116	142	504	15.03	3.02	1.000	1.120	1.672	(1.871)	3.550	0.750	1.000	(2.660)	4.970	12.00	13.1
Spinning	Spindle	0.0081	0.0106	336	1728	87.55	19.23	1.000	1.315	0.996	(1.310)	5.140	0.921	0.735[a]	(3.480)	4.560	68.40	75.0
Totals and averages						119.08	27.787	0.983	1.258	1.088	(1.342)	4.650	0.866	0.790	(3.182)	4.28	91.30	100.00

[a] **Represents general labour existing only in the standard mill.**

Table No. 22

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Brazil (Rio de Janeiro–D.F.)
Industry: Weaving
Type of mills: Old

Analysis of the total influence (*data of the general sample*)		*Analysis of the influence of operation* (*data of the small sample, extended to the general sample*)			*Redistribution of the influences*: *Excess labour, after allowing for present conditions*	*Humidification, machine maintenance, lighting*	*Quality of the yarn*	*Lack of product specialization*	*Excessive wear of the machines, lack of space*	*Type of equipment*
Total influence 7.94	*Influence of operation 3.04*	*Production*	Draft Sch.	—						
			Speed	1.05		1.05				
			Efficiency	1.46		1.05	1.20	1.10	1.05	
			Total	1.53						
		Excess labour	Direct	2.21						
			Indirect	1.15						
			Miscel.	0.78						
			Total	1.99	1.99					
	Size 1.00									
	Type of equipment 2.61									2.61
TOTALS					1.99	1.11	1.20	1.10	1.05	2.61
Action to reduce labour					1.99					
Action to improve conditions						1.33				
Action of the industry as a whole								1.10		
Causes not requiring modernization for correction					2.90					
Causes requiring modernization									2.74	

Table No. 23

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Brazil (Rio de Janeiro–D.F.)
Industry: Spinning
Type of mills: Old

Yarn or fabric count	Actual average labour consumption (m-h/100 kg.)	Standard labour consumption for a mill of optimum size: Old (m-h/100 kg.)	Standard labour consumption for a mill of optimum size: Modern (m-h/100 kg.)	Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)	Influences: Type of equipment (E)	Influences: Size (S)	Influences: Operation (O)	Influences: Total (T)
	a	b	c	d	b/c	d/b	a/d	a/c
125	109.89	39.68	13.46	39.68	2.95	1.00	2.77	8.16
150	117.65	44.44	15.92	44.44	2.79	1.00	2.65	7.39
175	126.58	48.31	18.52	48.31	2.61	1.00	2.62	6.83
200	135.14	51.55	20.83	51.55	2.47	1.00	2.62	6.49
225	147.06	54.64	22.73	54.64	2.40	1.00	2.69	6.47
250	158.73	58.48	24.45	58.48	2.39	1.00	2.71	6.49
275	175.44	62.50	26.11	62.50	2.39	1.00	2.81	6.72
300	192.31	67.57	27.86	67.57	2.43	1.00	2.85	6.90
325	212.76	72.99	29.67	72.99	2.46	1.00	2.91	7.17
350	243.90	80.00	31.64	80.00	2.53	1.00	3.05	7.71
375	285.71	87.72	33.44	87.72	2.62	1.00	3.26	8.54
400	344.83	98.04	35.09	98.04	2.79	1.00	3.52	9.83
425	416.67	109.89	36.10	109.89	3.04	1.00	3.79	11.54
Averages	—	—	—	—	2.61	1.00	3.04	7.94

Table No. 24

BRAZIL: SIZE DISTRIBUTION OF THE WEAVING MILLS

Size (looms)	Number of mills	Percentage of total number of mills	Number of looms	Percentage of total looms
10– 20	19	6.48	264	0.28
20– 50	46	15.70	1,462	1.58
50– 100	57	19.45	3,632	3.94
100– 200	55	18.77	7,846	8.51
200– 300	32	10.92	7,913	8.58
300– 500	40	13.65	15,674	17.00
500– 700	9	3.07	5,180	5.62
700–1,000	14	4.78	11,460	12.43
1,000–1,500	11	3.75	13,714	14.86
1,500–2,000	2	0.69	3,243	3.52
2,000 and over	8	2.74	21,837	23.68
Totals	293	100.00	92,225	100.00
Up to 100	122	41.63	5,358	5.80
100–300	87	29.69	15,759	17.09
300 and over	84	28.68	71,108	77.11

Source: The data used were taken from *Indústria Textil Algodoeira*, Commissão Executiva T extil, 1946.

Note: The totals differ from those of the geographical distribution, because the latter were adjusted through estimates and information from other sources.

Table No. 25

Actual fabric: 469's; 90/50 x 90/60; 3896 w.e.; 89.5 g/sq.m.
Standard fabric: 469's; 90/50 x 90/60; 3896 w.e.; 89.5 g/sq.m.
Actual productivity: 0.262 kg/m-h
Standard productivity: 0.489 kg/m-h
Influence of operation: 1.875

ANALYSIS OF THE
OPERATIONAL INFLUENCE
IN SELECTED WEAVING MILLS

Country: Brazil (Rio de Janeiro)
Type of mill: Old
Mill: "I"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cone winding	Spindle	600	600	35.5	65	5	50	160/162	15/15	20.00	5.000	1.000	1.830	(1.830)	10.000	1.012	1.000	(10.120)	18.510	87.55	50.0
Warping	Warper	225	500	22.5	60	1	1	18/23	2/8	37.50	2.666	2.221	2.662	(5.930)	1.000	0.319	1.000	(0.319)	1.890	2.372	1.4
Slashing	Slasher	20	20	80	65	1	1	8/12	6/9	33.33	3.000	1.000	0.813	(0.813)	1.000	1.000	1.000	(1.000)	0.813	−0.561	—
Weaving	Loom	162	170	61	75	2.5	3	2400/2607	498/513 498/582	0.515	194.000	1.049	1.229	(1.290)	1.200	1.053	0.881[a]	(1.115)	1.439	85.116	48.6
Totals and averages										0.489	204.666	1.062	1.278	(1.358)	1.479	1.015	0.915	(1.372)	1.866	174.527	100.0

[a] Represents general labour existing only in the standard mill.

Table No. 26

Actual fabric: No. 237; 72/30 x 50/24; 2540 w.e.; 120.0 g/sq.m.
Standard fabric: No. 237; 72/30 x 50/24; 2540 w.e.; 120.0 g/sq.m.
Actual productivity: 0.719 kg/m-h
Standard productivity: 1.677 kg/m-h
Influence of operation: 2.33

ANALYSIS OF THE
OPERATIONAL INFLUENCE
IN SELECTED WEAVING MILLS

Country: Brazil (Rio de Janeiro)
Type of mill: Old
Mill: "J"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cone winding	Spindle	500	600	58.8	65	35	30	48/48	30/30	20.95	4.77	1.200	1.105	(1.326)	0.858	1.000	1.000	(0.858)	1.137	0.65	0.8
Warping	Warper	274	300	53	60	1	1	27/54	5/14	46.50	2.15	1.094	1.131	(1.239)	1.000	0.714	1.000	(0.714)	0.884	−0.25	—
Slashing	Slasher	35	30	60	65	1	1	24/48	9/15	42.00	2.38	0.857	1.082	(0.928)	1.000	1.200	1.000	(1.200)	1.113	0.26	0.3
Weaving	Loom	200	180	59	80	3	6	1200/1695	249/264 249/334	1.98	50.50	0.900	1.357	(1.221)	2.000	1.331	0.790[a]	(2.103)	2.570	79.28	98.9
Totals and averages										1.677	59.80	0.930	1.310	(1.218)	1.833	1.307	0.802	(1.920)	2.33	79.94	100.0

[a] Represents general labour existing only in the standard mill.

Table No. 27

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Actual fabric: No. 226; 64/26 x 54/26; 2216 warp ends; 121.6 g/sq.m.
Standard fabric: No. 226; 64/26 x 54/26; 2216 warp ends; 121.6 g/sq.m.
Actual productivity: 0.889 kg/m-h
Standard productivity: 1.64 kg/m-h
Influence of operation: 1.848

Country: Brazil (Rio de Janeiro)
Type of mill: Old
Mill: "K"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence: TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cone winding	Spindle	600	600	75	65	9	30	200/224	24/24	25.65	3.900	1.000	0.867	(0.867)	3.335	1.120	1.000	(3.735)	3.235	8.71	16.4
Warping	Warper	189	250	75	60	1	1	12/24	4/12	51.30	1.950	1.322	0.800	(1.058)	1.000	0.666	1.000	(0.666)	0.705	−0.57	—
Slashing	Slasher	20	30	60.5	65	1	1	15/27	6/9	68.30	1.465	1.500	1.073	(1.610)	1.000	1.200	1.000	(1.200)	1.930	1.36	2.6
Weaving	Loom	188	180	82	85	3	6	1026/1246	249/264 249/331	1.860	53.685	0.958	1.036	(0.992)	2.000	1.146	0.797[a]	(1.826)	1.800	42.94	81.0
Totals and averages										1.64	61.00	0.986	1.018	(1.001)	2.000	1.130	0.821	(1.853)	1.854	53.01	100.0

[a] Represents general labour existing only in the standard mill.

Table No. 28

BRAZIL (RIO DE JANEIRO-D.F.)

SUMMARY OF THE ANALYSES OF THE INFLUENCE OF OPERATION, AND EXTENSION OF THE RESULTS TO THE GENERAL SAMPLE

Industry	*Mill*	*Actual labour consumption m-h/100 kg.*	*Standard labour consumption m-h/100 kg.*	*Influences of operation*								
				Production				*Excess of labour*				*Total*
				Draft schedule	*Speed*	*Process efficiency*	*Total*	*Direct*	*In-direct*	*Miscel-laneous*	*Total*	
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Old spinning mills	G	65.64	22.12	0.974	1.107	1.358	(1.467)	3.295	0.693	0.882	(2.015)	2.960
	H	119.08	27.79	0.983	1.258	1.088	(1.342)	4.650	0.866	0.790	(3.182)	4.280
	Averages	92.06	24.96	0.979	1.191	1.199	(1.398)	4.021	0.800	0.820	(2.638)	3.688
	Extension to the general sample	75.56	27.32	0.98	1.15	1.15	(1.30)	3.02	0.84	0.84	(2.12)	2.76
Old weaving mills	I	381.89	204.66	—	1.062	1.278	(1.358)	1.479	1.015	0.915	(1.372)	1.866
	J	139.33	59.80	—	0.930	1.310	(1.218)	1.833	1.307	0.802	(1.920)	2.330
	K	113.09	61.00	—	0.986	1.018	(1.001)	2.000	1.130	0.821	(1.853)	1.854
	Averages	211.44	108.49	—	1.024	1.236	(1.266)	1.619	1.094	0.870	(1.541)	1.950
	Extension to the general sample	205.13	67.37	—	1.05	1.46	(1.53)	2.21	1.15	0.78	(1.99)	3.04

Chapter III

CHILE

I. Summary and conclusions

A. *Productivity of the industry*

210. The Chilean cotton textile industry can be considered as typically modern, 77 per cent of its spindles and 72 per cent of its looms being entirely new. This feature, which is in direct contrast with other countries studied, is due to the late development of the Chilean textile industry; though there was one mill as early as 1867, 72 per cent of the present spinning capacity and 47 per cent of the weaving capacity were installed after 1938.[68] If the shortage of equipment during the last war had not obliged some manufacturers to import old machinery, about 90 per cent of the industrial equipment would now be modern.

211. For this reason, only the modern sector, which is the most representative, has been discussed in connexion with the productivity of the Chilean industry. The measurements made in the old spinning mills have been used only as additional observations in the study of the Latin-American industry in general. The low productivity of this sector is not important, from the point of view of replacing equipment, since it corresponds to a few mills which will probably be modernized shortly, without the necessity for large investments or displacements of workers, as is the case in other Latin-American countries.

212. In order to measure productivity in Chile's textile industry, a sample was made of five modern spinning mills, five modern weaving mills and three old spinning mills, representing 32, 50 and 60 per cent respectively of the capacity of the corresponding sectors of the industry. Four of these mills were subsequently chosen for a detailed analysis of the factors affecting productivity, independently of the type of equipment and the small size of the establishments.

213. The results of the investigation show that productivity could be substantially increased in the modern mills. In fact, the spinning mills could increase their productivity by an average of 91 per cent with their present installations. If their size were increased to at least 25,000 spindles, the gain in productivity would be 129 per cent. The productivity of weaving mills could be increased 129 per cent while retaining their present size, and 158 per cent, if their individual capacity were enlarged to 500 looms.

[68] The development of the industry, expressed as percentages of the number of spindles (173,534) and of looms (5,012) existing in 1950, can be seen below:

Period	*Spindles*	*Looms*
1867-1924	10.8	17.2
1924-1938	17.0	36.2
1938-1950	72.2	46.6

214. Modern industry in Chile is not taking full advantage of its new equipment, as may be seen from the fact that the average productivity of its spinning mills is 30 per cent lower than the maximum productivity which could have been attained with old equipment. The productivity of the modern weaving mills is only 15 per cent higher than the maximum productivity which could have been obtained on antiquated looms.[69]

B. *Causes of low productivity in the modern industry*

215. The most important cause of low productivity is the employment of an excessive number of workers, even taking into account the fact that they are not fully skilled, and that, as a result of certain manufacturing conditions to be discussed later, a greater amount of labour must be applied to obtain a good output from the machinery. In the analysis made of the mills, it was concluded that on the average 58 per cent of the labour in the spinning mills and 38 per cent in the weaving mills could be eliminated without altering to any great extent the efficiency at present obtained in the processes; that is, provided that corrections are made to the hourly output per unit of the spinning machinery and the speed of the weaving machinery, which have been raised intentionally in order to obtain greater production. Expressed in other terms, it can be said that superfluous labour is responsible for increases of 137 and 61 per cent respectively in the consumption of labour per kilogramme produced.

216. The most important reason for the employment of a superfluous number of workers is the production policy followed by some Chilean mills, whereby the greatest possible output must be obtained from the machinery, even if this means the employment of numerous workers and the lowering of the output of labour. The results of this policy are evident not only in the indices showing the excess of labour, but also in those recording the increase of production above the levels considered normal. In the spinning mills, average output of the machines is 33 per cent higher than normal, due to average increases of 4 per cent in the unit weight of the intermediate products, 26 per cent in the speeds and 5 per cent in efficiency. In the weaving mills, production is 4 per cent higher than normal due to excessive speed, but this is offset by the low efficiency in the processes, deriving from other defective conditions discussed later, which raise the consumption of labour per kilogramme.

[69] A comparison with the productivity graphs of other countries will show that the productivity of many old mills is higher than the average of the modern Chilean industry. In the graph of the Chilean spinning mills, some old mills obtain better results than certain modern mills.

217. The policy described arises from the relatively small importance of wages in the industry compared to the level of prices of the manufactured articles. It is also influenced by the lack of commercial competition, which weakens any incentive to reduce costs and stimulates the effort to obtain a greater volume of production. If the importance of the level of wages is expressed as the relationship between the price of a man-hour and that of a popularly-consumed fabric, it is seen that in Chile this importance is only 0.82, while in the United States, with a fabric equivalent in type and popularity, it is 4.26.[70] This disparity demonstrates both the incentive in the United States industry to increase labour productivity and the corresponding lack of incentive in Chilean industry to do likewise. As regards the lack of commercial competition, it must be pointed out that during the last few years the Chilean textile industry has enjoyed a sellers' market which now seems to be disappearing as a result of the increase in the capacity of production. This is borne out by the fact that stocks are beginning to accumulate.

218. Another factor which sometimes influences the decision to follow a policy of high production volume at the expense of labour productivity is the excessive cost of textile equipment in Chilean currency, compared with the cost of labour. Making still another comparison with a more highly industrialized country, it can be seen that if in the American textile industry the relationship between the price of the man-hour and that of the loom-hour[71] were assumed equal to 100, in the modern Chilean industry it would equal 485.[72] This contrast partly explains the emphasis laid by Chilean industry on the high output of machinery.

219. The second important cause of low productivity is the lack of training of the workers. It is estimated that if an attempt were made to normalize the oganization of labour and other conditions such as efficiency, speed and yarn defects over a short period, it would still be necessary to maintain 20 per cent more workers in the spinning mills and 36 per cent more workers in the weaving mills than would be the case with adequately trained labour. The lack of training is principally due to the fact that the workers have not been given the opportunity of practising with heavier work-loads. Another important factor, however, is that the industry is almost entirely new and not only the workers but the instructors themselves must be trained. The greatest weakness in the weaving mills, for instance, lies with the loom-fixers; much of the efficiency of the machines depends on them, and it takes several years of well-guided work to produce a competent loom-fixer. It should be stated that, despite this fact, no great effort was being made by industry, generally, towards completing the workers' training. The system adopted in several mills is that of contracting workers, testing them and dismissing them if they do not immediately evince the ability necessary for the work assigned to them.

220. The small size of the mills is the next most important cause of low productivity. The majority of the spinning mills have fewer than 5,000 spindles, which, according to the sample, means that there would be a 20 per cent excess of labour in this sector, as a whole, even if all other conditions were normal. The position in the weaving mills is not so serious, since nearly all of them have more than 200 looms. In this sector of the industry the average excess of labour arising from the small size of the mills is only 13 per cent.

221. The modern Chilean industry probably developed with small rather than large mills for the following reasons: (1) the favourable atmosphere created for any type of enterprise, large or small, by the protection afforded to industry, the shortage of foreign currency, and a domestic market on which production could not meet demand; (2) the difficulty of obtaining equipment during the last war, when the industry was in full development; and (3) the fact that the majority of the industrial enterprises were undertaken by social groups that preferred a closed circle of investors, such as is contained in a family, or, alternatively, individual investments; this naturally provides more limited resources than if they had resorted to the money market.

222. The third cause of low productivity consists of certain manufacturing conditions which affect only the weaving mills to any great extent. The most outstanding are the deficient preparation of the warp, that is the cone-winding, slashing and drawing-in operations, which increase labour consumption by at least 5 per cent; and defects in the twist and winding of the filling, which must be attributed to the spinning mills and which increase the consumption of labour by approximately 3 per cent.

223. The excessive speeds of the machinery, both in spinning and weaving mills, raise productivity but probably lower the quality of the products and affect efficiency in the processes. This is also true of the abnormal weight per unit of length of the intermediate products in the card room. Moreover, as already mentioned, high machinery outputs were obtained in the spinning mills, as a result of the application of an excessive amount of labour per machine. Taken together, these factors increase the production of the spinning mills by 33 per cent, and of the weaving mills by 4 per cent.

224. As the small size of the mills is the only cause of low productivity which cannot be corrected, at least over the short period, it may be said, in summarizing the foregoing, that the modern spinning mills could increase productivity 91 per cent by eliminating superfluous labour, training the remainder and normalizing both the speed of the machinery and the organization of the processes. The weaving mills could, in a preliminary phase, eliminate superfluous workers, which would increase productivity by 61 per cent. An additional increase of 42 per cent would follow the completion of the workers' training and the correction of certain manufacturing conditions, such as the defects in the warp and the filling yarn.

225. In addition to all these, another factor also of great importance to productivity was observed in most factories; this was the lack of interest in the development

[70] This relationship was calculated, in the case of Chile, on the basis of 18 pesos per man-hour and 22 pesos per metre. In the United States, it was based on 0.982 dollars per man-hour and 0.23 dollars per metre. The fabrics compared were approximately 36"—32 x 36—2.95 yds./lb.

[71] The price of the loom-hour includes the loom and all the equipment for spinning and weaving preparation necessary to feed that loom in a mill manufacturing popular fabrics.

[72] The figures for the United States were calculated with a depreciation of 0.073 dollars per loom-hour and a cost of 0.982 dollars per man-hour, and for Chile at 6.5 pesos per loom-hour and 18 pesos per man-hour.

of appropriate methods for the control of efficiency in the processes, and the quality of the intermediate and final products. Nor was it usual to find rational systems for determining the number of machines to be assigned to each tender according to the type of product and the manufacturing conditions. These administrative measures are absolututely essential to determine and correct systematically the causes affecting productivity. It was also noted that, generally speaking, no adequate system was used to control cotton wastage which, in a country where raw material is imported and expensive, is indispensable to reduce costs.

II. Comments, results and analysis of the modern spinning mills of Chile

A. *General comments*

226. The individual productivity of the modern Chilean spinning mills, included in the sample, appears in graph 5, together with the general averages, the productivity of the standard mills which served as norms of comparison, and the results of the three old spinning mills which were added to the observations of the general Latin-American study.

227. A general examination of the curves of the graph referring to the modern spinning mills (marked "M") reveals no apparent correlation between the size of the mills and their productivity. The mill showing the greatest productivity (1-KM) is one of the smallest, and the lowest productivity of all was recorded in the largest mill of the sample (5-KM). This lack of correlation is due to the fact that the managers of the larger mills have not made the best use of the flexibility for work specialization afforded by a high mill capacity. Mill no. 6-KM, however, is so small (1,900 spindles) in comparison with the others that it could not eschew a lower level of productivity, since theoretically, it must have an excess labour consumption of 75 per cent, even if all other conditions were perfect.

228. It is interesting to note that while the general average of the results is low, the productivity of at least one spinning mill (1-KM) is higher than the standard for mills of its size.[73] This indicates that whatever they may be, the factors affecting productivity do not involve insuperable difficulties.

229. Mill no. 4-KA is equipped with old machinery purchased in 1934, though it has some new machines for spinning preparation, one-process pickers, and approximately 20 per cent of its spindles are modern. Mill no. 7-KA imported old machinery during the last war, but its pickers are modern (1949). The productivity of these two factories is higher than that of some of the completely modern mills, and comparison shows that in the spinning mills the type of equipment is not as important as other factors which depend on the distribution of the personnel and the management of the operations.

230. The extremes of productivity observed were found in mill no. 1-KM, where, with 20's, it was 103 per cent of the standard for its size,[74] and in mill no. 5-KM where the lowest result was only 25 per cent of the standard productivity.[75]

231. Generally speaking, mill conditions are fairly good, with the exception of two circumstances. There are more workers than necessary and attempts to obtain greater production are based on speeds which are higher than normal and on intermediate products of a greater weight than is recommended for the best quality. The workers' training appears to be incomplete, and only in few mills are there adequate controls for the quality of the products, the efficiency of the processes, and for cotton wastage. The work-loads are not determined rationally, that is according to the number of elementary functions assigned to the workers and the normal time spent in performing them.

B. *Analysis of the results*

232. Table 29 is the summary of the analysis of the influences, that is, of the indices of importance of the factors affecting productivity in the modern spinning mills.[76] The total influence and its principal components—the influences of operation and size of the mills—are the averages of the influences corresponding to each yarn count, which were obtained in table 30, by means of comparisons between the actual and the standard consumption of labour per kilogramme of yarn.

233. The influence of size is of the greatest importance (1.20) because it reflects the extent of a structural flaw—the small size of the units—inherent to the modern textile industry since its inception. Table 31 reveals that nearly 60 per cent of the spinning mills, old and modern, is made up of mills of 5,000 spindles or less. These will always be affected by an excess of labour consumption per kilogramme manufactured, however perfect the other manufacturing conditions and the organization of personnel. Only one of the Chilean spinning mills, which has 32,400 spindles, is completely unaffected by this influence.

234. The influence of operation (1.91) was broken down into the influences of the draft schedule, speed, efficiency and excess of direct, indirect and miscellaneous labour. This was done by analysing mills "B" and "C" (tables 32 and 33) in which productivity is respectively higher and lower than the general averages. Since the average influence of operation of the small sample was exactly equal to that obtained from the observations of all the spinning mills, no adjustment was necessary to extend the results of the small to the general sample (table 38).

[73] To avoid confusion only the standard productivity for mills of 25,000 spindles has been shown on the graph. If the small size of the mills is to be taken into account in the comparisons, the standard productivity must be divided by the influences of size which appear in the chapter on methodology. The influence of size of mill no. 1-KM, manufacturing 20's, is approximately 1.32.

[74] There are no standards of comparison for the observations made of yarn counts 12 and 14, but the corresponding productivities can be estimated as at least 10 per cent higher than the standard.

[75] The extremes of productivity of the old mills are approximately 71 per cent (no. 4-KA) and 14 per cent (no. 9-KA) of the standard for mills of the same size and manufacturing the same product.

[76] If these influences are subtracted from 1 and multiplied by 100, they become the actual percentages of excess labour per kilogramme manufactured, or the potential increases of productivity, expressed as a percentage of present productivity, which could be obtained by the elimination of the causes affecting it. The component or partial influences have the same significance as the total influences, but refer to a specific cause. When two or more influences are multiplied together the product is the influence of the combination of these causes. The reciprocal of an influence, subtracted from 1 and multiplied by 100, is the loss of productivity, expressed as a percentage, originating from the cause of that influence.

235. The total influence of excess labour was attributed partly to lack of training and partly to superfluous personnel (table 29). This allocation was made taking into account the slowness with which certain important operations—such as piecing of broken ends, doffing, and the starting of the roving frames—were carried out, in comparison with other countries. The value of 1.20 given to the influence of lack of training is therefore only an estimate which was expressed in figures to facilitate the discussion and the comparisons.

III. Comments, results and analysis of the modern weaving mills of Chile

A. *General comments*

236. The individual productivity of the modern Chilean weaving mills included in the sample is shown in graph 6, together with the general average and the productivity of the standard mill which served as a norm of comparison.

237. Examination of the graph reveals a certain parallelism between standard productivity and that of some of the mills. This indicates that in these cases the work-loads are rational in relation to the amount of human effort needed to manufacture the fabrics; even so, they are all below the limit which might be assigned without affecting the efficiency of the processes. A study of the cases which do not reveal such parallelism brings to light several interesting points concerning the causes of low productivity. Mill no. 5-M shows different productivities for almost equivalent fabrics; according to the investigation, this appears to arise from the fact that the looms are not assigned in proportion to the number of loom-stops per hour which can be expected for each of the fabrics.[77] Mill no. 1-M should have had the same productivity for the two fabrics of approximately 130 counts, since they are of almost equal construction. The difference in the results arises from the fact that in one (sheeting) quality is of less importance than in the other (shirting), a fact which has enabled a larger assignment of looms per weaver to be made in the former (20) than in the latter (16).

238. There is no apparent correlation between the size of the mills and their productivity, as is evident from the fact that productivity is high in very small mills (5-M) and low in others which are very large (3-M). As in the case of the spinning mills, this means that productivity is more affected by other factors, independent of size, which overshadow the influence of the smallness of the mills.

239. If the effects of the small size of the mills are set aside, the extremes of productivity may be found in the same weaving mill, where the results vary between 73 per cent and 24 per cent of the productivity considered normal for a mill of equivalent size.

240. The following conditions were observed in most of the weaving mills.

(*a*) An excessive number of mechanical stops per loom per hour, indicates that the loom-fixers have probably not yet acquired sufficient experience to determine the causes of the stops and correct them rapidly;

(*b*) The training of the weavers and cone-winder tenders is also deficient, though it is relatively better than that of the loom-fixers;

(*c*) The control of efficiency is practically non-existent in the majority of the mills, while the control of quality, where it exists, is limited to the separation of the products according to categories or degrees of perfection, without keeping statistical records which would permit the systematic discovery of the cause of the imperfection;

(*d*) The work-loads are low, even taking into account other abnormal conditions such as the workers' lack of training. In some mills, on the other hand, there is a shortage of auxiliary labour, which compels the tenders to carry out tasks which would not fall to them in a more economically organized mill;[78]

(*e*) In most mills the work-loads are not determined by rational methods. That is to say, there is no systematic measurement of the number of loom-stops, or yarn breakages, in order to assign machines to the tenders according to the actual time needed to carry out their work;

(*f*) Frequent observations were made of cone-winders, warpers and looms working at speeds greater than those considered normal;

(*g*) In some mills, defects were found in the warp yarn, which had not been eliminated in the cone-winders because the slub-catchers of these machines have purposely been left very open in order to obtain greater production. Defects were also observed in the drawing-in and slashing of the warp, and in the twist and winding of the filling.

B. *Analysis of the results*

241. Table 34 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity. The total influence and its principal components, the influences of operation and size, are the averages of the influences corresponding to each fabric count which were obtained in table 35, by comparisons between the actual and the standard consumption of labour per kilogramme of fabric.[79]

242. As regards the influence of size, the comments made concerning the spinning mills are equally true of the weaving mills, as the small size of the mills also increases average consumption of labour considerably (13 per cent) in the mills included in the sample. Table 36 shows the concentration of the total industry, old and modern, in small mills.

243. The influence of operation (2.29) was broken down into the influences of speed, efficiency and excess of direct, indirect and miscellaneous labour, by the analysis of mill "D" (table 37), where productivity is higher than the general average. The influences of all the processes of this mill were adjusted, in table 38, so that the

[77] Data recording the frequency of stops, which should determine the allocation of looms, are not available in this mill. However, an indication of the lack of balance lies in the fact that fabrics of high, medium and low productivity were assigned 64,000, 41,000 and 25,000 warp ends per weaver, respectively. The differences between these assignments should not be so great; had the work-loads been related to the frequency of loom stops, the three products could probably have been manufactured with at least the highest productivity obtained.

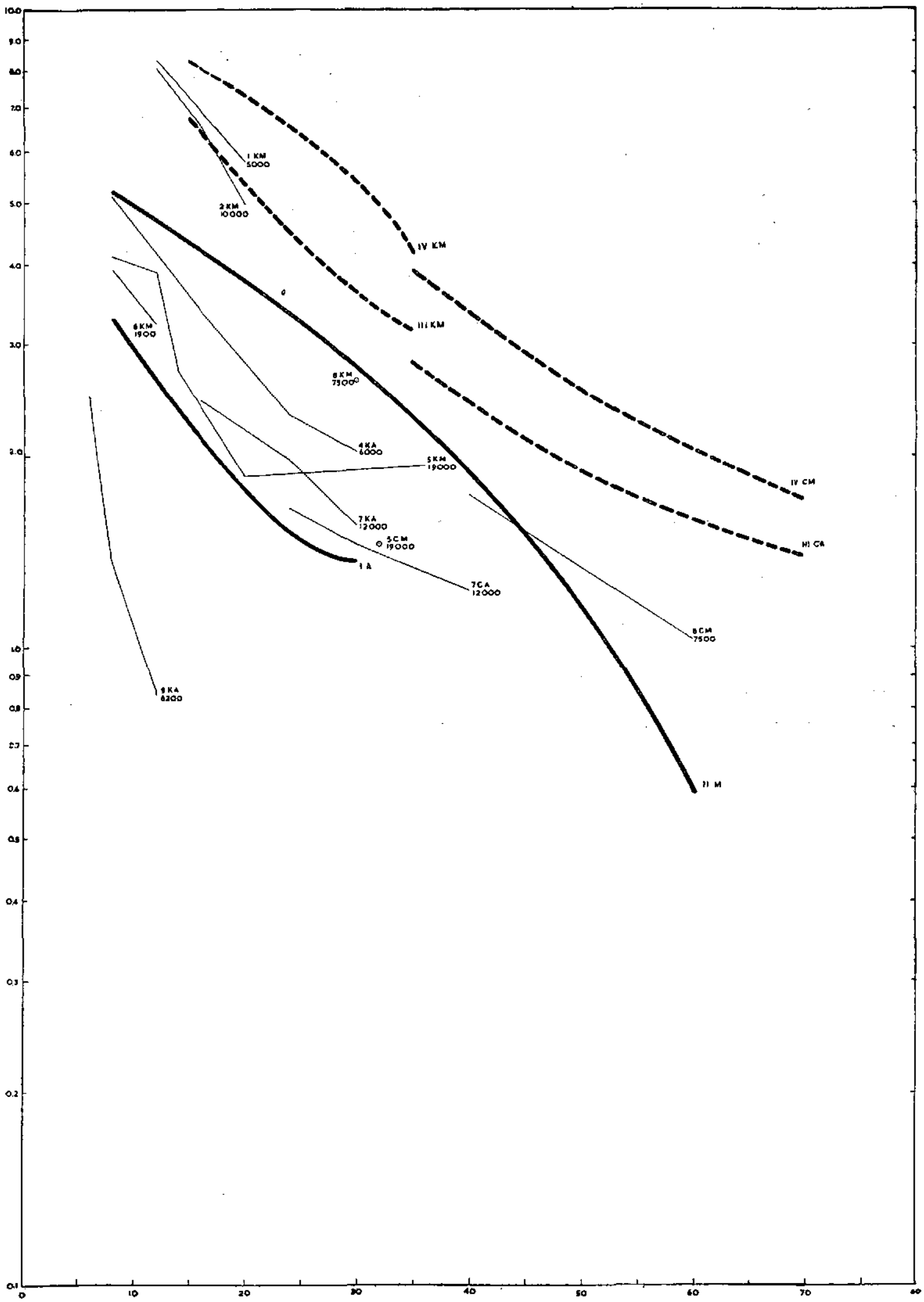
[78] An extreme case was found where weavers attended only four looms and loaded their own batteries.

[79] For the corresponding values of productivity, and the relevant charts, see chapter I of this report, where a comparative summary covering all the countries is given.

Graph No. 5

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Chile



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill

K—Means carded yarn
C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in spindles.

result should equal the influence of operation which had already been determined by means of the general sample.

244. The redistribution of the influences as shown in table 34 was made in the light of the following considerations, drawn after a study of the analysis of mill "D" and the general observations made in the industry.

245. A study of the origin of loom stops made in some mills led to the conclusion that the lack of efficiency (estimated influence value of 1.18) is principally due to mechanical causes which could be attributed to the lack of experience of loom fixers,[80] and, to a lesser extent, to defects in the warp and the filling. The lack of skill on the part of the weavers and cone-winder tenders, reflected by their slowness, was considered more important than the defects in the warp and the filling, but of much less consequence in the determination of efficiency than the mechanical stops. These opinions were expressed numerically by sub-dividing the influence of efficiency into a very high influence value (1.10) attributable to the lack of skill and progressively lower values for other causes (1.04, 1.02 and 1.01).

246. As a result of these observations of loom stops and slow work, it was estimated that under present conditions the mills could continue to work at their present efficiency, with a maximum excess of labour equivalent to not more than 26 per cent of the standard staffing. This percentage (infl. 1.26) was divided amongst the same causes as in the case of the low efficiency and in about the same proportion (1.13; 1.06; 1.03 and 1.02). The remainder of the total influence of excess labour was attributed to the presence of absolutely superfluous labour which could be eliminated, even under the present conditions of inadequate training and of defects in the warp and filling.

247. In the lower part of table 34, the influences have been rearranged into groups corresponding to causes which require managerial action in order to reduce superfluous labour, train the workers, correct manufacturing conditions and normalize the speeds. A separate column shows the influence attributable to the spinning mills which supplied the raw material. A division has also been made into groups of remediable causes, the correction of which would increase productivity by 129 per cent, and causes which cannot be corrected, at least within a short time, and which cause an excess labour consumption of 13 per cent per kilogramme in the mills.

IV. Results obtained in the old spinning mills of Chile

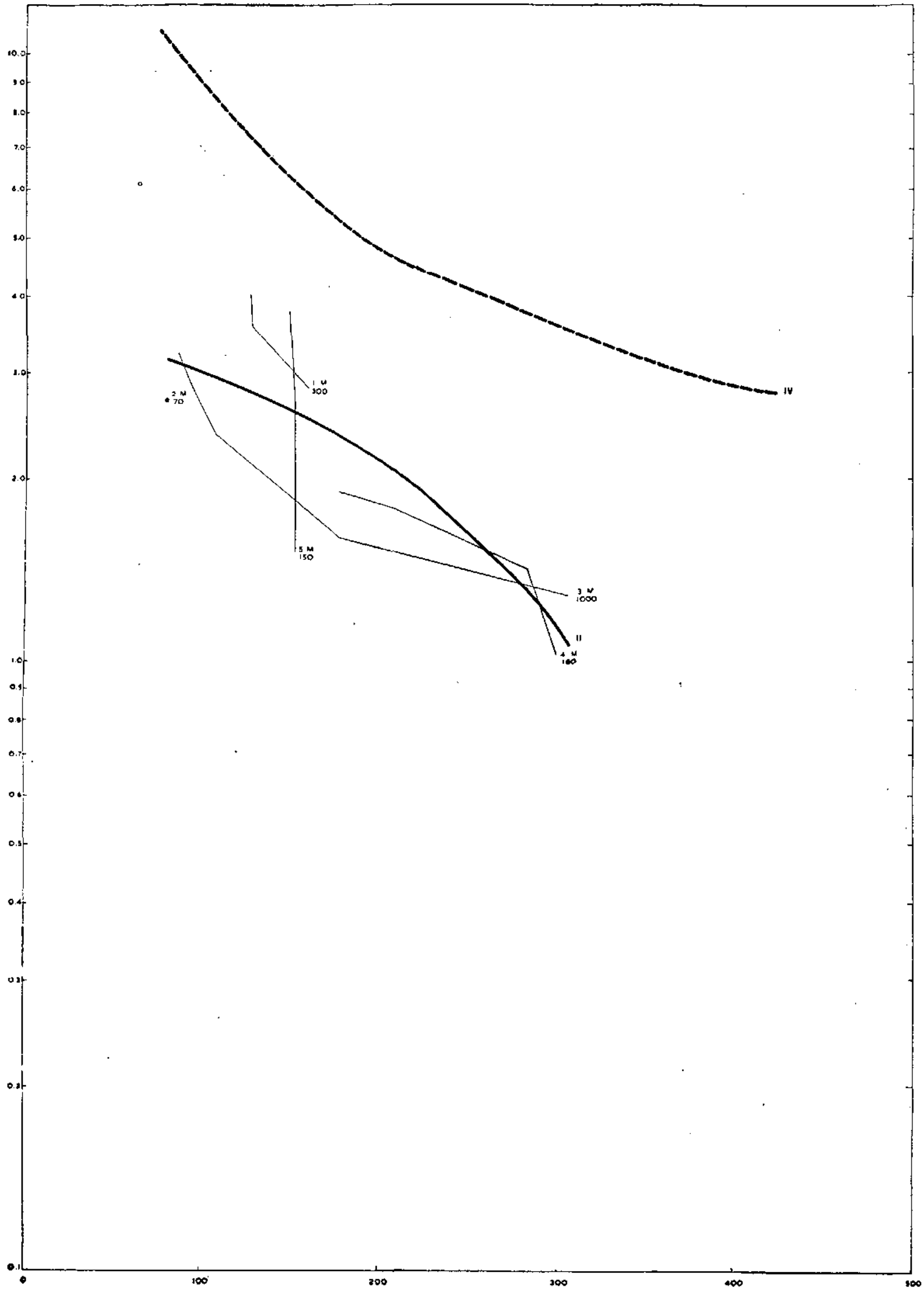
248. As already stated, the old mills are not important within Chilean industry as a whole and they are therefore not discussed in detail in this report. The observations made in three spinning mills gave the results recorded in graph 6 (curves "A") and in tables 38, 40 and 41. In order to use these data in the general discussion on the Latin-American textile industry, they were analysed, by the same procedure as was used for the old industries of other countries. The summary made in table 39 shows that this industry, likewise, is principally affected by the excess of labour and the small size of the mills, and that an effort is made to obtain the highest possible output at the expense of labour productivity.

[80] Mechanical stops may also be caused by variations of humidification, which throws parts made of wood or of leather out of adjustment. This factor was not considered important, as it was observed that in most mills the air conditioning system worked well.

Graph No. 6

PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE

Chile



X—Fabric count
Y—Productivity in kilograms per man-hour
II—Average of the modern mills
IV—Standard productivity of a modern 500-loom mill

M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms.

Table No. 29

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Chile
Industry: Spinning
Type of mills: Modern

Analysis of the total influence (*data of the general sample*)		*Analysis of the influence of operation* (*data of the small sample, extended to the general sample*)			*Redistribution of the influences*: *Excess labour, after allowing for incomplete training*	*Lack of training of the workers*	*Above normal production improving productivity but probably affecting quality*	*Size*			
Total influence 2.29	*Influence of operation 1.91*	*Production*	Draft Sch.	0.96							
			Speed	0.74							
			Efficiency	0.95							
			Total	0.67			0.67				
		Excess labour	Direct	4.91							
			Indirect	0.79							
			Miscel.	0.73							
			Total	2.85	2.37	1.20					
	Size 1.20							1.20			
	Type of equipment			—							
TOTALS					2.37	1.20	0.67	1.20			
Action to reduce and train labour					2.85						
Action to standardize machine production							0.67				
Causes that can be eliminated						1.91					
Causes that cannot be eliminated except by enlarging the mills								1.20			

Table No. 30

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Chile
Industry: Spinning
Type of mills: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences* Size (S)	Operation (O)	Total (T)
	a	c	d	d/c	a/d	a/c
15 card.	23.15	12.02	14.90	1.24	1.55	1.93
20 card.	26.67	13.62	15.80	1.16	1.69	1.96
25 card.	31.06	15.75	18.27	1.16	1.70	1.97
30 card.	42.19	18.69	21.87	1.17	1.93	2.26
35 card.	43.86	24.10	28.20	1.17	1.56	1.82
35 comb.	43.86	25.44	29.76	1.17	1.47	1.72
40 comb.	50.76	29.50	34.81	1.18	1.46	1.73
45 comb.	67.11	34.36	40.89	1.19	1.64	1.95
50 comb.	86.21	39.52	47.42	1.20	1.82	2.18
55 comb.	116.28	44.44	54.22	1.22	2.14	2.62
60 comb.	169.49	49.02	60.78	1.24	2.79	3.46
Averages	—	—	—	1.20	1.91	2.29

Table No. 31

CHILE: SIZE DISTRIBUTION OF THE SPINNING MILLS

Size (spindles)	*Number of mills*	*Percentage of total number of mills*	*Number of spindles*	*Percentage of total spindles*
Up to 2,000	4	21.05	5,804	3.34
2,000– 5,000	7	36.84	27,076	15.60
5,000–10,000	1	5.26	8,712	5.02
10,000–15,000	2	10.53	27,182	15.66
15,000–25,000	4	21.05	72,360	41.70
25,000–50,000	1	5.27	32,400	18.68
TOTALS	19	100.00	173,534	100.00
Up to 5,000	11	57.89	32,880	18.94
5,000–15,000	3	15.79	35,894	20.68
15,000 or more	5	26.32	104,760	60.38

Source: Data from Ministerio de Economía y Comercio expanded through the survey.
Note: The table includes old and modern mills.

Table No. 32

Yarn count: 30 carded
Actual productivity: 2.61 kg/m-h
Standard productivity: 4.57 kg/m-h
Operational influences: 1.75

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Chile
Type of mill: Modern
Mill: "B"

Process	Name of the unit of equipment	Hourly production in kg. per unit: Actual	Hourly production in kg. per unit: Standard	Units of equipment per tender (work-load): Actual	Units of equipment per tender (work-load): Standard	Labour consumption in man-hours per 100 kg.: Actual	Labour consumption in man-hours per 100 kg.: Standard	Operational influences — Production influence: Draft schedule	Production influence: Rate of delivery of material	Production influence: Process efficiency	Production influence: Total	Labour influence: Direct	Labour influence: Indirect	Labour influence: Miscellaneous	Labour influence: Total	TOTAL	Excess in m-h 100 kg.	Percentage of total excess
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	100.0	125.0	1	2	2.75	1.12	1.037	1.113	1.069	(1.250)	2.000	0.982	1.000	(1.963)	2.455	1.63	9.7
Carding	Cards	5.00	3.63	7	35	3.35	1.68	0.893	0.790	1.030	(0.726)	5.000	0.549	1.000	(2.745)	1.994	1.67	10.1
Drawing	Delivery	9.00	5.86	11	40	1.18	1.26	0.847	0.850	0.903	(0.651)	3.636	1.190	0.333[a]	(1.438)	0.936	−0.08	—
Drawing	Delivery	8.50	5.22	11	48	1.26	0.42	0.893	0.850	0.808	(0.614)	4.363	1.120	1.000	(4.890)	3.000	0.84	5.1
Roving	Spindle	0.352	0.151	108	422	3.32	1.68	0.500	0.800	1.072	(0.429)	3.907	1.179	1.000	(4.610)	1.976	1.64	9.9
Spinning	Spindle	0.0156	0.0119	312	2500	26.43	15.70	1.000	0.793	0.960	(0.762)	8.010	0.468	0.589[b]	(2.214)	1.685	10.73	65.2
Totals and averages						38.29	21.86	0.945	0.815	0.967	(0.745)	6.800	0.530	0.652	(2.345)	1.75	16.43	100.0

[a] Represents a sliver-lap machine in the standard mill.
[b] Represents general labour existing only in the standard mill.

Table No. 33

Yarn count: 35 carded
Actual productivity: 1.92 kg/m-h
Standard productivity: 3.94 kg/m-h
Operational influences: 2.05

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Chile
Type of mill: Modern
Mill: "C"

Process	Name of the unit of equipment	Hourly production in kg. per unit: Actual	Hourly production in kg. per unit: Standard	Units of equipment per tender (work-load): Actual	Units of equipment per tender (work-load): Standard	Labour consumption in man-hours per 100 kg.: Actual	Labour consumption in man-hours per 100 kg.: Standard	Operational influences — Production influence: Draft schedule	Production influence: Rate of delivery of material	Production influence: Process efficiency	Production influence: Total	Labour influence: Direct	Labour influence: Indirect	Labour influence: Miscellaneous	Labour influence: Total	TOTAL	Excess in m-h. 100 kg.	Percentage of total excess
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	184.0	125.0	1	4	0.55	0.96	0.922	0.783	0.941	(0.680)	4.000	0.210	1.000	(0.842)	0.573	−0.40	—
Carding	Cards	6.61	3.63	9	41	2.04	1.82	0.834	0.682	0.966	(0.549)	4.560	2.230	1.000	(2.045)	1.121	0.22	0.9
Lap winding	Machine	116.5	131.8	1	2	0.83	0.37	0.924	1.062	1.153	(1.132)	2.000	0.990	1.000	(1.980)	2.244	0.46	1.6
Drawing	Delivery	11.1	5.86	15	48	0.19	0.74	0.834	0.773	0.821	(0.528)	3.200	0.304	0.500[a]	(0.486)	0.256	−0.55	—
Roving	Spindle	0.061	0.097	256	416	23.63	2.17	1.000	1.500	1.060	(1.590)	1.624	4.220	1.000	(6.860)	10.900	21.45	77.6
Spinning	Spindle	0.0196	0.00928	851	3000	24.75	19.25	1.000	0.534	0.910	(0.473)	3.521	1.164	0.664[b]	(2.720)	1.287	5.52	19.9
Totals and averages						51.99	25.31	0.966	0.666	0.930	(0.599)	2.980	1.432	0.802	(3.440)	2.05	26.70	100.0

[a] Represents a second drawing process in the standard mill.
[b] Represents general labour existing only in the standard mill.

Table No. 34

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Chile
Industry: Weaving
Type of mills: Modern

<table>
<tr><th rowspan="2" colspan="2">Analysis of the total influence
(data of the general sample)</th><th rowspan="2" colspan="3">Analysis of the influence of operation
(data of the small sample, extended to the general sample)</th><th colspan="7">Redistribution of the influences</th></tr>
<tr><th>Excess labour, after allowing for incomplete training</th><th>Lack of training of loom fixers</th><th>Lack of training of weavers and cone-winder tenders</th><th>Defective warp preparation</th><th>Above-normal speeds, increasing productivity</th><th>Defective twist and winding of the warp</th><th>Size</th></tr>
<tr><td rowspan="10">Total influence
2.58</td><td rowspan="8">Influence of operation
2.29</td><td rowspan="4">Production</td><td>Draft Sch.</td><td>—</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Speed</td><td>0.95</td><td></td><td></td><td></td><td></td><td>0.96</td><td></td><td></td></tr>
<tr><td>Efficiency</td><td>1.18</td><td></td><td>1.10</td><td>1.04</td><td>1.02</td><td></td><td>1.01</td><td></td></tr>
<tr><td>Total</td><td>1.13</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Excess labour</td><td>Direct</td><td>7.21</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Indirect</td><td>1.00</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Miscel.</td><td>0.28</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>2.03</td><td>1.61</td><td>1.13</td><td>1.06</td><td>1.03</td><td></td><td>1.02</td><td></td></tr>
<tr><td colspan="4">Size 1.13</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1.13</td></tr>
<tr><td colspan="4">Type of equipment —</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">TOTALS</td><td>1.61</td><td>1.24</td><td>1.10</td><td>1.05</td><td>0.96</td><td>1.03</td><td>1.13</td></tr>
<tr><td colspan="5">Action to reduce labour</td><td>1.61</td><td colspan="6"></td></tr>
<tr><td colspan="5">Action to train labour</td><td></td><td colspan="2">1.36</td><td colspan="4"></td></tr>
<tr><td colspan="8">Action to correct manufacturing conditions</td><td>1.05</td><td colspan="3"></td></tr>
<tr><td colspan="9">Action to standardize speeds</td><td>0.96</td><td colspan="2"></td></tr>
<tr><td colspan="10">Attributable to spinning mills</td><td>1.03</td><td></td></tr>
<tr><td colspan="5">Causes that can be corrected</td><td colspan="6">2.29</td><td></td></tr>
<tr><td colspan="11">Causes that cannot be corrected except by enlarging the mills</td><td>1.13</td></tr>
</table>

Table No. 35

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Chile
Industry: Weaving
Type of mills: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences* Size (S)	*Influences* Operation (O)	*Influences* Total (T)
	a	*c*	*d*	*d/c*	*a/d*	*a/c*
100	33.22	11.01	11.56	1.05	2.87	3.02
125	35.59	13.46	14.54	1.08	2.45	2.64
150	38.31	15.92	17.83	1.12	2.15	2.41
175	41.84	18.52	21.11	1.14	1.98	2.26
200	46.30	20.83	23.75	1.14	1.95	2.22
225	52.08	22.73	25.91	1.14	2.01	2.29
250	59.88	24.45	27.87	1.14	2.15	2.45
275	71.43	26.11	29.50	1.13	2.42	2.74
300	87.72	27.86	31.48	1.13	2.79	3.15
Averages	—	—	—	1.13	2.29	2.58

Table No. 36

CHILE: SIZE DISTRIBUTION OF THE WEAVING MILLS

Size (looms)	*Number of mills*	*Percentage of total number of mills*	*Number of looms*	*Percentage of total looms*
10– 20	22	59.46	396	7.90
20– 50	3	8.11	107	2.13
50– 100	3	8.11	200	3.99
100– 200	2	5.41	252	5.03
200– 300	1	2.70	230	4.59
300– 500	3	8.11	1,067	21.29
500– 700	—	—	—	—
700–1,000	2	5.40	1,600	31.92
1,000–1,500	1	2.70	1,160	23.15
TOTALS	37	100.00	5,012	100.00
Up to 100	28	75.68	703	14.02
100–300	3	8.11	482	9.62
300 or more	6	16.21	3,827	76.36

Source: Data from Ministerio de Economía y Comercio expanded through the survey.
Note: The table includes old and modern mills.

Table No. 37

Actual fabric: No. 128.3; 57/12 x 40/6; 2180 w.e.
Standard fabric: No. 127.9; 48/13 x 48/13; 1940 w.e.
Actual productivity: 4.47 kg/m-h [a]
Standard productivity: 7.13 kg/m-h
Influence of operation: 1.594

ANALYSIS OF THE
OPERATIONAL INFLUENCE
IN SELECTED WEAVING MILLS

Country: Chile
Type of mill: Modern
Mill: "D"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence: TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Winding	Spindle	650	600	60	70	25	30	16/16	18/18	51.80	1.930	0.923	1.168	(1.078)	1.200	1.000	1.000	(1.200)	1.292	0.54	5.7
Warping	Warper	600	500	73	60	1	1	3/6	2/9	103.70	0.965	0.833	0.822	(0.685)	1.000	0.444	1.000	(0.444)	0.304	−0.67	—
Slashing	Slasher	30	36	64.4	65	2	2	2/5	2/4	233.00	0.429	1.200	1.010	(1.212)	1.000	1.250	1.000	(1.250)	1.515	0.22	2.4
Weaving	Loom	198	192	79	90	20	72	12/45	12/100	9.31	10.730	0.970	1.140	(1.106)	3.600	1.000	0.450 [b]	(1.620)	1.790	8.48	91.9
Totals and averages										7.13	14.054	0.960	1.121	(1.078)	3.060	0.995	8.490	(1.487)	1.599	8.57	100.00

[a] Excluding the filling-winding section.
[b] Represents general labour existing only in the standard mill.

Table No. 38

CHILE

SUMMARY OF THE ANALYSES OF THE INFLUENCE OF OPERATION, AND EXTENSION OF THE RESULTS TO THE GENERAL SAMPLE

Industry	*Mill*	*Actual labour consumption m-h/100 kg.*	*Standard labour consumption m-h/100 kg.*	*Influences of operation*								
				Production				*Excess of labour*				*Total*
				Draft schedule	*Speed*	*Process efficiency*	*Total*	*Direct*	*In-direct*	*Miscel-laneous*	*Total*	
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Old spinning mills	A	64.88	30.22	0.956	0.884	1.140	(0.968)	5.050	0.561	0.782	(2.208)	2.140
	Extension to the general sample	60.44	23.09	0.94	0.85	1.15	(0.92)	7.83	0.48	0.76	(2.85)	2.62
Modern spinning mills	B	38.29	21.86	0.945	0.815	0.967	(0.745)	6.800	0.530	0.652	(2.345)	1.750
	C	51.99	25.31	0.966	0.666	0.930	(0.599)	2.980	1.432	0.802	(3.440)	2.050
	Averages	45.14	23.58	0.956	0.736	0.947	(0.666)	4.959	0.791	0.731	(2.868)	1.910
	Extension to the general sample	63.69	33.36	0.96	0.74	0.95	(0.67)	4.91	0.79	0.73	(2.85)	1.91
Modern weaving mills	D	22.46	14.05	—	0.960	1.121	(1.078)	3.060	0.995	0.490	(1.487)	1.599
	Extension to the general sample	51.82	22.62	—	0.96	1.18	(1.13)	7.21	1.00	0.28	(2.03)	2.29

Table No. 39

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Chile
Industry: Spinning
Type of mills: Old

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended tot he general sample)*			*Redistribution of the influences:* *Excess labour, after allowing for present conditions*	*Humidification, machine maintenance, cleanliness, lighting*	*Above normal speeds and unit weights*	*Size*	*Type of equipment*
Total influence 4.02	*Influence of operation 2.62*	*Production*	Draft Sch.	0.94			0.94		
			Speed	0.85			0.85		
			Efficiency	1.15		1.05	1.10		
			Total	0.92					
		Excess labour	Direct	7.83					
			Indirect	0.48					
			Miscel.	0.76					
			Total	2.85	2.85				
	Size 1.11							1.11	
	Type of equipment 1.38								1.38
TOTALS					2.85	1.05	0.88	1.11	1.38
Action to reduce labour					2.85				
Action to correct manufacturing conditions						0.92			
Causes not requiring modernization for correction					2.62				
Causes requiring modernization								1.53	

Table No. 40

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Chile
Industry: Spinning
Type of mills: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size:* *Old (m-h/100 kg.)*	*Modern (m-h/100 kg.)*	*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences:* *Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
15 card.	44.25	14.66	12.02	15.69	1.22	1.07	2.82	3.68
20 card.	56.50	18.15	13.62	19.60	1.33	1.08	2.90	4.15
25 card.	68.03	22.68	15.75	25.40	1.44	1.12	2.68	4.32
30 card.	72.99	27.78	18.69	31.67	1.49	1.14	2.30	3.91
Averages	—	—	—	—	1.38	1.11	2.62	4.02

Table No. 41

Yarn count: 30 carded
Actual productivity: 1.541 kg/m-h
Standard productivity: 3.31 kg/m-h
Operational influences: 2.143

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Chile
Type of mill: Old
Mill: "A"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influences									Excess in m-h. 100 kg.	Percentage of total excess
								Production influence				Labour influence						
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	131.0	175.71	2	3	1.000	1.898	0.966	1.142	1.212	(1.340)	1.500	0.262	1.000	(0.394)	0.527	−0.89	—
Carding	Cards	7.27	4.22	10	29	2.570	1.898	0.833	0.708	0.983	(0.680)	2.900	0.804	1.000	(2.337)	1.353	0.67	1.2
Drawing	Delivery	9.09	5.82	24	38	0.420	0.472	0.833	0.834	0.925	(0.641)	1.582	0.877	1.000	(1.388)	0.890	−0.05	—
Drawing	Delivery	9.09	5.82	24	38	0.420	0.472	0.833	0.834	0.925	(0.641)	1.582	0.877	1.000	(1.388)	0.890	−0.05	—
Slubber rov. (I)	Spindle	0.230	0.985	72	124	6.390	0.943	0.909	1.300	3.435	(4.060)	1.722	0.970	1.000	(1.670)	6.780	5.40	14.7
Interm. rov. (II)	Spindle	0.168	0.298	96	200	6.660	0.943	0.828	1.150	1.863	(1.774)	2.085	1.800	1.000	(3.755)	7.070	5.72	16.1
Speeders (III)	Spindle	0.118	0.057	160	498	5.670	2.830	0.800	0.673	0.898	(0.483)	3.110	1.335	1.000	(4.150)	2.002	2.83	7.9
Spinning	Spindle	0.01150	0.0106	260	1728	41.800	20.760	1.000	0.922	1.000	(0.922)	6.650	0.471	0.698[a]	(2.185)	2.015	21.04	59.1
Totals and averages						64.88	30.216	0.956	0.884	1.140	(0.968)	5.05	0.561	0.782	(2.208)	2.140	34.67	100.00

[a] Represents general labour existing only in the standard mill.

Chapter IV

ECUADOR

I. Summary and conclusions

A. *Productivity of the industry*

248a. In order to measure the labour productivity of the cotton textile industry in Ecuador, four spinning mills and four weaving mills were chosen, which together represent 66 per cent of the country's total capacity. Mills were visited in Quito, the principal textile centre, and in the north and south, where there are also several relatively important factories. With the exception of one semi-modern spinning mill, the mills examined were old, dating from the beginning of the century, and are typical of the industry as a whole.

249. The results of the investigation reveal that conditions in Ecuador's textile industry are extremely poor. At present 6.11 times as many man-hours per kilogramme of yarn and 18.56 times as many man-hours per kilogramme of fabric are employed as would be necessary if its mills satisfied required standards of modernity, size, organization and quality of cotton, in order to obtain the highest possible yield from the workers, without causing excessive effort on their part or affecting the quality of the products.

250. An idea of the deficiencies caused by the lack of modern machinery, adequate raw material and modern working methods in this textile industry may be gleaned from the following figures: the present total production of cotton fabrics, manufactured by more than 4,000 workers in nine mills with 37,286 spindles and 1,454 looms, could be produced by 500 workers in one modern mill of 19,000 spindles and 500 looms.

B. *Causes of low productivity*

251. To begin with, the causes of low productivity were divided into two groups. The first consisted of causes which could be corrected without involving modernization of the machinery; it includes absolutely superfluous labour, defects of the cotton in the spinning mills, the quality of the yarn in the weaving mills, deficient working methods, and certain manufacturing conditions which can be corrected without incurring great expense. The second group consists of causes which can only be eliminated by acquiring modern machinery and includes the old type of equipment, the small size of the mills, excessive wear on machinery and certain other manufacturing conditions which cannot be corrected without substantial investments in the industry.

252. The analysis of the spinning mills shows the first group to be 1.89 times more important[81] than the second, since they increase labour consumption per kilogramme of yarn by 198 per cent and 105 per cent respectively. In the weaving mills, the causes which can be corrected without modernization are 1.95 times as important as those which can only be eliminated with new machinery and a radical modification of the installations. The increases of labour consumption per kilogramme of fabric resulting from these two groups amount to 456 per cent and 234 per cent respectively.

253. The predominant factor conducive to low productivity, within the group of causes which can be corrected forthwith, is the presence of superfluous labour, even taking into account the small size of the mills, the age and worn-out condition of the machinery, the poor quality of the cotton and other deficient conditions which call for more workers than would be required if it were possible to eliminate these sources of waste. The study of the mills revealed that this superfluous labour increased labour consumption per kilogramme by 93 per cent in the spinning mills and 420 per cent in the weaving mills. This means that productivity could be improved to this extent by a preliminary reorganization of labour, even though no further effort were made to correct other defective conditions.

254. The presence of absolutely superfluous labour can be chiefly attributed to the fact that since the beginning, the Ecuadorian mills have been organized with an abundance of workers, as a result of the very low cost of labour. As one manufacturer said: "it mattered little if one had a hundred extra men." Although the wage-level may have increased more than textile prices, at the time of writing, the price of a man-hour is still relatively low, compared to that of a metre of popular fabrics. The ratio between these two values is 0.37 in Ecuador and 3.55 in the United States.[82] In other words, an Ecuadorian mill could have ten times as many workers as a United States mill, without there being any difference in the relation of the cost of labour to that of the finished product.

255. At present, the manufacturers would like to eliminate superfluous labour but they are faced with strong opposition on the part of the workers, who refuse to accept more machine units per tender. As in Mexico, they demand a direct relation between wages and production; thus, if two looms are assigned per person instead of one as at present, they expect double wages. Moreover, for legal reasons superfluous labour cannot easily be displaced in reorganizations of this kind. For instance, the laws of the country guarantee all workers

[81] The importance of one cause of low productivity in relation to another is expressed as the relationship between the percentages of increase of consumption of labour per kilogramme produced, resulting from those causes.

[82] In the case of Ecuador, this relationship was calculated on the basis of 1.90 sucres per man-hour and 5.2 sucres per metre, while for the United States it was based on 0.982 dollars per man-hour and 0.276 dollars per metre.

their jobs for one year as from the date on which any legal strike[83] is ended; they generally manage to call strikes of their own, or act in sympathy with other strikers, at least once a year.

256. Labour resistance, however, should not be regarded as the fundamental cause of low productivity or backwardness in the industry. It is rather a symptom of the original and much more important reason, namely the abundance of the potential labour supply, in relation to the scarcity of available funds in the country for investment in occupations which would absorb the labour surplus. This lack of balance between available capital and available labour precludes the displacements of workers required if the administration of the industry is to be reorganized without replacing textile equipment, or if both the equipment and the organization are to be entirely modernized. This problem arises together with the need for replacing machinery, which cannot last indefinitely, and which does not produce goods of the quality necessary to compete with foreign fabrics that are legally or illegally brought into the country.

257. Unlike other Latin-American countries faced with this problem, Ecuador can still widen the market for local fabrics. This may be achieved both by substituting local production for foreign goods, which at present amount to 40 per cent of total consumption, and by increasing *per capita* consumption, which is extremely low[84] and which can be stimulated by improving the quality and lowering prices. There would therefore be a considerable room for improvement if any investment the industry could make were used to increase production of the fabrics at present imported, absorbing labour drawn from the old mills for this purpose.

258. Next in order of importance within the group of causes of low productivity which can be corrected without modernization, is the poor quality of the Ecuadorian cotton; 70 per cent of the industry's total consumption of raw material is of domestic origin. It is cultivated by small farmers, on plots of 4 or 5 hectares; seeds are not selected; no use is made of pesticides or ploughs; there is no crop rotation nor any adequate general administration to produce strong fibres of a uniform length. Consequently, the raw material causes a higher percentage of waste in the machines and considerably reduces the efficiency of the processes and the quality of the products. In the spinning mills, it leads to an increase of approximately 33 per cent in labour consumption per kilogramme. In the weaving mills, the quality of the yarn, which depends to a great extent on the quality of the cotton used in the spinning mills, causes an increase of 39 per cent in the consumption of man-hours per kilogramme of fabric.

259. The third of the group of causes which can be corrected without modernization consists of certain manufacturing conditions such as defective maintenance of the machinery, the lack of humidification systems, and deficiencies in cleanliness and lighting, which, taken as a whole, bring about increases in labour consumption per kilogramme amounting to 25 per cent in the spinning mills and 15 per cent in the weaving mills.

260. It was found in studying the industry that in both the spinning mills and the weaving mills the machines were worked at speeds higher than normal, probably in order to obtain more metres or more kilogrammes of product. In some cases, however, this affects quality and nearly always involves the application of more labour per machine. The abnormal speeds produce apparent decreases in labour consumption equivalent to 7 per cent in the spinning mills and 33 per cent in the weaving mills. This tendency to raise machine productivity, even at the cost of excessive labour, was also observed in other countries, where as in Ecuador, labour is cheap and profits are more likely to rise as a result of increased production than because of a reduction in the cost of labour.

261. The causes of low productivity which can only be eliminated by a substantial capital investment are: (1) the type of equipment, that is, the use of old instead of modern machinery, which increases labour consumption in the spinning mills and weaving mills by 23 per cent and 196 per cent respectively; (2) excessive wear of the equipment, lack of space, and deficient room and machine lay-out, which result in increases of 27 per cent in the spinning mills and 10 per cent in the weaving mills; and (3) the small size of the mills in relation to the optimum size, which raises the consumption of man-hours per kilogramme of yarn and of fabric by 31 per cent and 3 per cent respectively.

262. Closely connected with all these causes of low productivity, it was observed that control systems of efficiency, quality, costs and waste of cotton, were lacking in nearly all the mills. In the event of reorganization, these systems would be absolutely essential in order to discover and eliminate systematically the factors of low productivity which can be corrected by management action. If labour were to be reduced to normal levels, it would also be necessary to introduce methods for the rational determination of work-loads, that is, the number of machines to be assigned to each worker according to manufacturing conditions, the degree of skill, and the product in question.

II. Comments, results and analysis of the old spinning mills of Ecuador

A. *General comments*

263. The individual productivity of the four Ecuadorian spinning mills included in the sample is shown in graph 7 together with the general averages of the typically old mills and the standard productivity used as a norm of comparison.

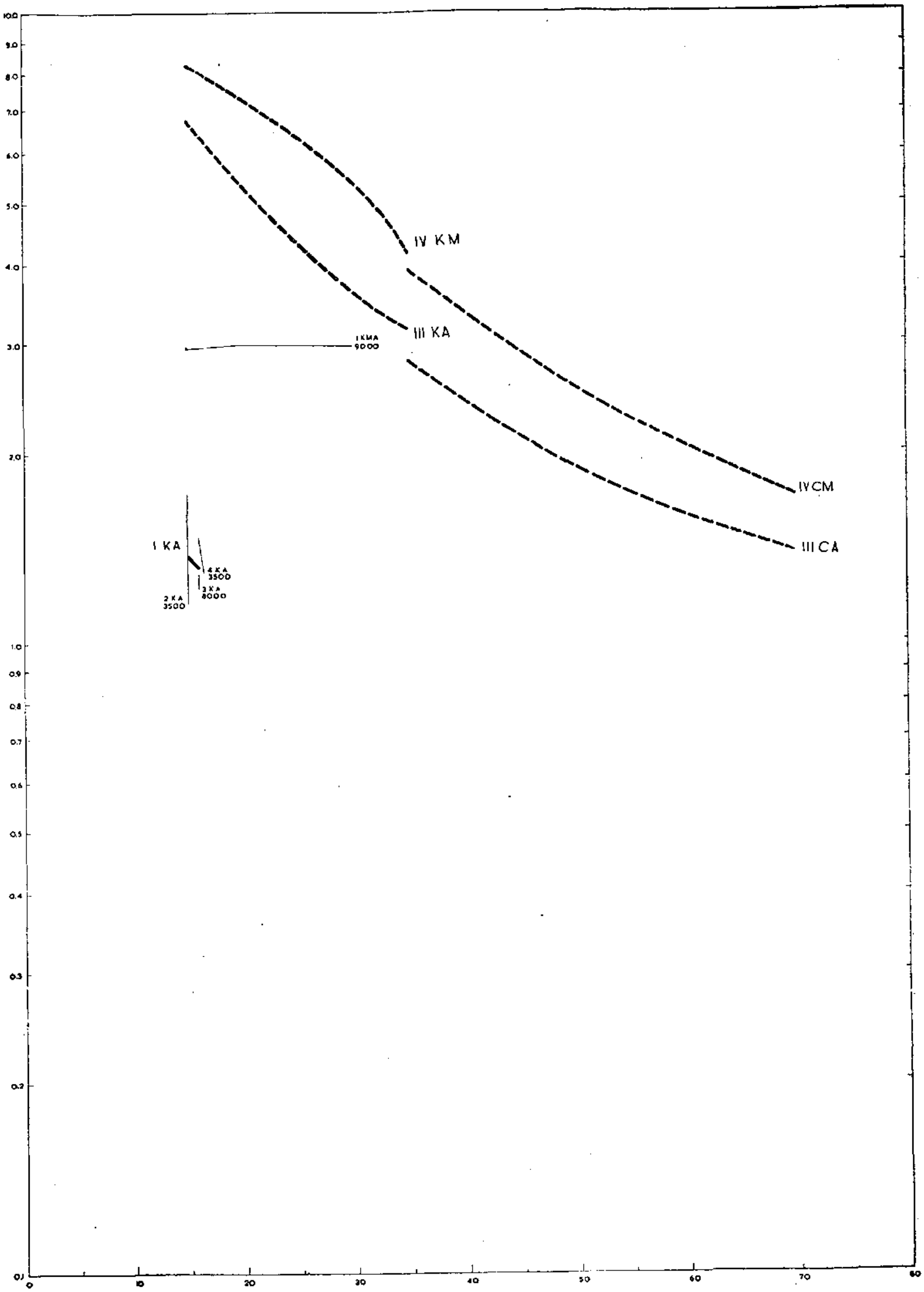
[83] Article 396 of Ecuador's labour laws stipulates that: "Provided the strike is not illegal, at its close the workers must return to their former employments, which shall be guaranteed for the period of one year, during which they cannot be dismissed except on the grounds specified in Article 107." This article establishes the legal causes for dismissal: unpunctuality, absenteeism, undisciplined behaviour, serious disobedience, immoral behavior, dishonesty, insults and proven incapacity.

[84] The *per capita* annual consumption of cotton textiles by the white and "mestizo" population is 1.53 kilogrammes, whereas that of the Indian population is 0.67 kilogrammes. These figures are based on the following estimates: of the 4.5 million kilogrammes of cotton textiles consumed in the country, 60 per cent goes to the coastal region which is inhabited entirely by whites and "mestizos". The remaining 40 per cent, consumed by the mountain region, is divided into 15 per cent for the Indians and 25 per cent for the whites and "mestizos". The country has approximately 1 million Indians, 1 million "mestizos" and 1.5 million whites.

Graph No. 7

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Ecuador



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill
K—Means carded yarn
C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in spindles.

264. Mill no. 1-KMA was excluded from the average, as it is not typical of the general conditions found in Ecuador. Approximately half its machinery is completely new; more than 50 per cent of the cotton used is imported, and it manufactures yarns of higher counts than the other spinning mills.

265. An examination of the graph reveals that with the exception of mill no. 1-KMA, the characteristics of the spinning mills are very similar both as regards the average level of productivity and the range of yarn counts manufactured. Production is limited to very low counts, as the shortness and the irregularity of the cotton fibre do not permit the manufacture of counts higher than no. 20.[85]

266. The verticality of the productivity curve of spinning mill no. 2-KA can be ascribed to the fact that, in addition to its old equipment, this mill possesses four modern spinning frames and two long draft roving frames, so that yarn no. 15 is manufactured by means of three different methods using processes of one, two or three roving frames. The productivity of this mill should be higher in the yarns produced with modern machinery, but the work-loads are extremely low.

267. The following general observations were made in the industry:

(*a*) Some of the mills are situated within the city of Quito, in premises that are too small for their present capacity and which could not be enlarged except by the investment of substantial sums. The mills situated in villages far from Quito are too small to work economically in places isolated from the centres of public and private services. They are consequently burdened with heavy general expenses, which include special transport and communication services, production of their own electric power, provision of complete repair shops and other extraordinary expenses arising from their responsibilities to the community;

(*b*) The majority of the mills are not only small in relation to the size requirements for optimum productivity, but also with regard to the type of product manufactured. Very small mills are also found in the industries of other countries, but elsewhere they are generally engaged in the production of very fine yarns or fancy fabrics; in these cases labour productivity is relatively unimportant, since the wide margin existing between costs and prices is covered by people whose standard of living is higher than the average. In Ecuador, on the other hand, the very small mills manufacture articles of popular consumption which should normally be produced on a larger scale and with a narrower margin of profit per metre or per kilogramme, since they provide the clothing of the classes with the lowest standard of living. This explains, in a measure, the extremely low *per capita* consumption of cotton textiles and points to the possibility of a great elasticity of the market to price reductions;

(*c*) The administrative conditions of the mills, including the supervision of the textile operations, the control of quality, costs, efficiency and cotton waste, were found to be extremely deficient. The backwardness of the methods is revealed even in the use of archaic units of measurement, such as the Spanish pound and the "vara" (approx. 2.8 ft.);

(*d*) The maintenance of the equipment and the cleaning of the machines and rooms could be very greatly improved;

(*e*) Humidification systems are practically non-existent and lighting is deficient;

(*f*) Due to the lack of guidance, means of cultivation, seed selection, and cotton classification in the ginning machines, the fibre of the domestic-grown cotton is short, irregular and has little strength. According to reports of the manufacturers, Ecuadorian cotton produces 17 to 20 per cent waste, while that of Brazilian cotton is only 12 to 15 per cent;

(*g*) As a general rule, the in-process products, such as the card web and the roving, are of poor quality. The yarn is irregular, nappy and weak.

B. *Analysis of the results*

268. Table 42 is a summary of the average values of the influences, that is, of the indices of the importance of the factors affecting productivity.[86] The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences of each yarn count which were obtained, in table 43, by means of comparisons between the actual and the standard consumptions of labour per kilogramme of yarn.

269. The influence of size in the mills of the sample (1.31), which is almost equal to that of the weighted average for the whole country (1.33), is very important because it reveals a structural deficiency in the industry. This causes labour consumption, even under the best administrative conditions, to be 31 per cent greater than if the mills were of a suitable size. Table 44 shows that all the spinning mills have less than 10,000 spindles, two-thirds of them have less than 5,000, while the lower limit of the optimum size is 25,000.

270. Only one of the mills included in the general average productivity has modern pieces of machinery. For this reason, in calculating the influence of the type of equipment (1.23) it was assumed that all the mills were entirely old; the influence may therefore be considered representative of the machinery of the Ecuadorian spinning mills.

271. The influence of operation (3.79), the most important component of the total influence, was broken down into the influences of the draft schedule, speed, efficiency, and excess of direct, indirect and miscellaneous labour by making use of the analysis of mill "A" (table 45) in which productivity for the yarn count under consideration almost coincides with the average of all the old mills. This spinning mill is equipped with

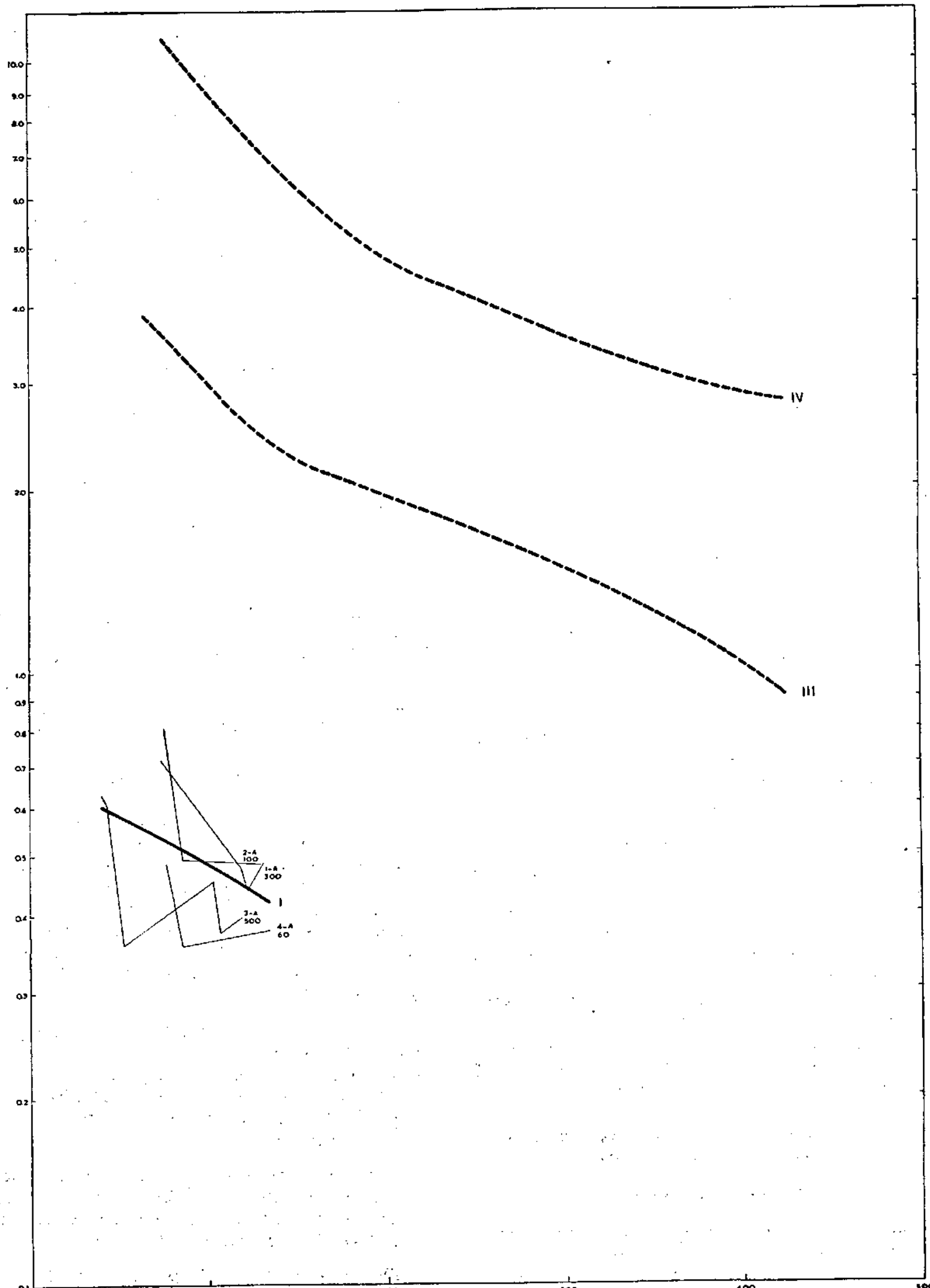
[85] It should be recorded, however, that in a spinning mill which was not included in the sample, equipped with modern spinning frames, experiments were being made to produce yarn no. 30 with local cotton. The results appeared to be good.

[86] If these influences are subtracted from 1 and multiplied by 100, they become the actual percentages of excess labour per kilogramme produced, or the potential increases of productivity expressed as a percentage of actual productivity, which could be obtained by eliminating the causes affecting it. The component or partial influences have the same significance as the total influences but refer to specific causes. When the influences of two or more causes are multiplied together, the product is the influence of the combination of these causes. The reciprocal of an influence, subtracted from 1 and multiplied by 100, is the loss of productivity as a percentage, originating from the cause corresponding to that influence.

Graph No. 8

PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE

Ecuador



X—Fabric count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
III—Standard productivity of an old 500-loom mill
IV—Standard productivity of a modern 500-loom mill

A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms.

machinery dating from 1900 to 1925, with a few 1929 machines, and it can therefore be considered as typically old.

272. The averages of the influences of the processes of this mill were adjusted (last line of table 45) so that the result should equal the influence of operation which had already been determined by the general sample.

273. The redistribution of the influences, in table 42, was made in the light of the following considerations, which derived from the analysis of mill "A" and the general observations made in the Ecuadorian textile industry and the mills of other countries.

274. On the basis of the observations made of yarn breakage frequency in the spinning frames and the conditions of the card web and roving, it was estimated that only twice the labour employed in the standard mills would be needed to maintain present standards of efficiency in the processes. The total influence of excess labour (3.87) could therefore be divided into that part corresponding to absolutely superfluous labour (1.93) and another part caused by other deficient operating conditions (2.00). The values 1.23 and 1.25 which appear in columns 2 and 5 respectively, of the redistribution of the influences, were estimated by comparing conditions in the Ecuadorian industry with those of other countries not greatly affected by the quality of the cotton, and bearing in mind the values assigned these conditions in those industries. The remainder of the total influence of excess labour (1.30) was assumed to be caused by the defects of the cotton grown in Ecuador.

275. The influence of low efficiency (1.06) was divided equally between the three groups of its causes, as the small value involved did not warrant further calculations.

276. In the lower part of table 42 the influences have been rearranged into groups corresponding to: (1) the causes requiring management action to reduce labour, assuming that the labour displacement problem can be solved by its absorption into other activities; (2) causes requiring preliminary management action in order to improve certain manufacturing conditions; (3) causes of productivity increases which probably affect quality and indirectly diminish the efficiency of the processes, and which can be corrected by management action; (4) the poor quality of the cotton, which must be remedied by effective government action and the co-operation of the industrialists, especially the ginners; (5) causes which can be corrected without modernization; and (6) causes which can only be eliminated by modernizing the industry, increasing the size of its mills, and in some cases, moving the mills to better locations.

III. Comments, results and analysis of the old weaving mills of Ecuador

A. *General comments*

277. The individual productivity of the four old weaving mills of Ecuador which were included in the sample is shown in graph 8, together with the general average and the standard productivities which were used as a norm of comparison.

278. With the exception of some modern machinery in mill no. 1-A, the equipment of all the weaving mills may be considered as typically old, dating from 1870 to 1923.[87]

279. An examination of the graph shows very little disparity between the results of the mills discussed, and no apparent correlation between their productivity and size, the effect of their smallness being overshadowed by other more important factors.

280. The majority of the fabrics manufactured are of very coarse yarns (counts 15's and 16's) with densities of 50 to 100 warp ends plus picks per square inch, and weights of 115 to 300 grammes per square metre.

281. Most of the general comments made in the weaving industry coincide with those already made in the section relating to the spinning mills, as all the mills visited are of the type which include both spinning and weaving. Only the following need be added:

(*a*) The yarn used in the weaving mills is, in general, very irregular, nappy and weak, giving rise to a great number of loom stops as a result of breakages in the warp and filling;

(*b*) Very similar fabrics are manufactured under different names. The small differences existing, however, establish a factor of additional cost and waste of labour. Though neither the styles nor the yarn counts are very numerous, it was considered that there may still be a wide margin for simplifying the variety of products;

(*c*) In the only mill equipped with a mechanical printing machine, difficulties arise from the fact that the engraving of the copper rolls is very expensive, because the market can absorb only small quantities of each style of fabric. In this case, an attempt might be made to exchange rolls with other small countries, the industries of which do not compete with those of Ecuador.

B. *Analysis of the results*

282. Table 46 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity. The total influence and its principal components—the influence of operation, type of equipment and size—are the averages of the influences corresponding to the yarn counts examined and were obtained, in table 47, by comparisons between the real and the standard consumptions of labour per kilogramme of fabric.

283. The influence of size corresponding to the sample (1.03) is less than the weighted average for the influences of the whole industry (1.06) because the sample did not include several very small Ecuadorian weaving mills.[88] Table 48 shows the distribution of weaving mills, according to size.

284. As there is scarcely any modern machinery in Ecuador, the influence of the type of equipment (2.96), calculated for entirely old machines, is sufficiently representative of all the mills in Ecuador.

285. The influence of operation (6.08), the most important component of the total influence, was broken down into the influences of speed, efficiency and the

[87] At the time of the investigation, at least two mills had placed orders for some automatic looms.

[88] The influence of size of the weaving mills is very much less than that of the spinning mills principally because the fabrics manufactured with coarse yarns demand relatively few spindles per loom.

excess of direct, indirect and miscellaneous labour, by the analysis of mill "B" (table 49), the productivity of which (for the fabric count under consideration) almost coincides with the average of all the mills of the sample. This weaving mill is entirely equipped with ordinary looms and weaving preparation machines manufactured in 1900 and 1920.

286. The averages of the influences of the processes of this mill were adjusted (last line of table 49) so that the result should be equal to the influence of operation already determined by means of the general sample.

287. The redistribution of the influences in table 46 was made in the light of the following considerations, derived from the analysis of mill "B" and the general observations made in the Ecuadorian industry and in the mills of other countries.

288. On the basis of the observation of stops in the loom section, which is responsible for nearly all the excess labour consumption (see column 22 of the analysis of mill "B"), it was estimated that to maintain the present efficiency it would not be necessary to employ more than 1.3 times the number of workers demanded by the work-loads of standard mills. The total influence of excess labour (6.75) could therefore be divided into one part corresponding to absolutely superfluous labour (5.20) and another corresponding to other deficient conditions of operation (1.30). This last part was distributed among the items noted in columns 2, 3 and 5; the greatest importance was ascribed to the quality of the yarn (1.20), since it was observed to be the cause of most of the loom stops; relatively little importance was given to the conditions of humidification, maintenance of machinery, cleanliness and lighting (1.05), and to those of excessive wear of the equipment and defficient room layout (1.03).

289. The influence of efficiency (1.35) was distributed between the groups of causes affecting it (columns 2, 3 and 5), greater importance being given to the quality of the yarn (1.16) and progressively less to the other two groups of conditions.

290. The lower part of table 46 shows the rearrangement of the influences in groups corresponding to: (1) causes requiring management action to reduce labour, assuming that the problem of labour displacement could be solved by its absorption into other activities; (2) causes requiring preliminary management action to improve certain manufacturing conditions, including the quality of the yarn, since in Ecuadorian mills those responsible for the weaving are also in charge of the spinning; (3) causes of increases in productivity, which probably affect quality and indirectly diminish efficiency in the processes and which could be corrected by management action; (4) causes which can be corrected without modernization; and (5) causes which can only be eliminated by modernizing the industry.

Table No. 42

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Ecuado
Industry: Spinni
Type of mills: O

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences*: *Superfluous personnel, after allowing for the bad quality of the cotton and other manufacturing conditions*	*Humidification, machine maintenance, lighting, cleanliness*	*Higher-than-normal speeds, increasing production*	*Quality of the cotton*	*Excessive wear of machines, poor machine and room layout*	*Type of equipment*	*Size*
Total influence 6.11	*Influence of operation 3.79*	*Production*	Draft Sch.	1.00							
			Speed	0.93			0.93				
			Efficiency	1.06		1.02		1.02	1.02		
			Total	0.98							
		Excess labour	Direct	8.44							
			Indirect	0.59							
			Miscel.	0.78							
			Total	3.87	1.93	1.23		1.30	1.25		
	Size 1.31										1.31
	Type of equipment 1.23									1.23	
TOTALS					1.93	1.25	0.93	1.33	1.27	1.23	1.31
Action to reduce labour					1.93						
Action to improve conditions						1.25					
Action to standardize speeds							0.93				
Joint action of industry and government								1.33			
Causes not requiring modernization for correction					2.98						
Causes requiring modernization										2.05	

Table No. 43

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Ecuador
Industry: Spinning
Type of mills: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*		*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences*			
		Old (m-h/100 kg.)	*Modern (m-h/100 kg.)*		*Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
15 card.	72.99	14.66	12.02	20.08	1.22	1.37	3.63	6.07
16 card.	75.76	15.31	12.32	19.14	1.24	1.25	3.96	6.15
Averages	—	—	—	—	1.23	1.31	3.79	6.11

Table No. 44

ECUADOR: SIZE DISTRIBUTION OF THE SPINNING MILLS

Size (spindles)	*Number of mills*	*Percentage of total number of mills*	*Number of spindles*	*Percentage of total spindles*
Up to 2,000	3	33.33	3,826	10.26
2,000– 5,000	3	33.33	9,720	26.07
5,000–10,000	3	33.34	23,740	63.67
TOTALS	9	100.00	37,286	100.00
Up to 5,000	6	66.66	13,546	36.33
5–15,000	3	33.34	23,740	63.67

Source: Data from Asociación de Industriales Textiles del Ecuador (December, 1949).

Table No. 45

Yarn count: 16 carded
Actual productivity: 1.28 kg/m-h
Standard productivity: 5.71 kg/m-h
Operational influence: 4.46

ANALYSIS OF THE OPERATIONAL INFLUENCE
IN SELECTED SPINNING MILLS

Country: Ecuador
Type of mill: "A"
Mill: Old

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence									Man-hours per 100 kg. added by the influences	Percentage of total excess
								Production influence				Labour influence						
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Opening and picking	A picker plus necessary opening units	202.0	175.7	1	3	3.10	1.23	1.091	0.889	0.898	(0.870)	3.000	0.944	1.000	(2.895)	2.520	1.87	3.1
Carding	Cards	7.00	6.82	7	30	1.88	1.04	1.000	0.957	1.028	(0.984)	4.280	0.429	1.000	(1.839)	1.808	0.84	1.3
Drawing	Delivery	8.95	7.41	15	27	1.34	0.516	0.765	0.882	1.229	(0.829)	1.800	1.762	1.000	(3.178)	2.600	0.83	1.3
Drawing	Delivery	5.69	7.41	12	27	2.99	0.516	0.920	0.882	1.607	(1.310)	2.250	1.389	1.418[a]	(4.420)	5.790	2.47	4.1
Slubber (I)	Spindle	0.870	1.407	78	144	1.43	0.516	1.225	1.100	1.200	(1.618)	1.848	0.927	1.000	(1.712)	2.765	0.91	1.4
First	Spindle	0.152	0.184	108	300	7.08	1.548	1.000	1.000	1.210	(1.210)	3.335	0.369	3.080[b]	(3.780)	4.580	5.54	9.2
Intermed. spinning	Spindle	0.0212	0.0194	96	1440	60.52	12.140	1.000	0.915	1.000	(0.915)	15.000	0.525	0.694[c]	(5.460)	5.000	48.56	79.6
Totals and averages						78.34	17.500	1.000	1.930	1.060	(0.987)	10.620	0.560	0.762	(4.53)	4.47	61.02	100.0
Extension to the general sample						74.40	19.62	1.00	0.93	1.06	(0.98)	8.44	0.59	0.78	(3.87)	3.79	—	—

[a] Represents a third drawing process of the actual mill.
[b] Represents a third roving process of the actual mill.
[c] Represents general labour existing only in the standard mill.

Table No. 46

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Ecuador
Industry: Weaving
Type of mills: Old

Analysis of the total influence (data of the general sample)	*Analysis of the influence of operation (data of the small sample, extended to the general sample)*				*Redistribution of the influences*: *Superfluous personnel after allowing for defective manufacturing conditions*	*Humidification, machine maintenance, cleanliness, lighting*	*Quality of the yarn*	*Higher-than-normal speeds, increasing production*	*Excessive wear of the equipment, poor machine and room layout*	*Type of equipment*	*Size*
Total influence 18.56	*Influence of operation 6.08*	*Production*	Draft Sch.	—							
			Speed	0.67				0.67			
			Efficiency	1.35		1.10	1.16		1.06		
			Total	0.90							
		Excess labour	Direct	4.56							
			Indirect	2.02							
			Miscel.	0.73							
			Total	6.75	5.20	1.05	1.20		1.03		
	Size 1.03										1.03
	Type of equipment 2.96									2.96	
TOTALS					5.20	1.15	1.39	0.67	1.10	2.96	1.03
Action to reduce labour					5.20						
Action to improve conditions						1.60					
Action to standardize speeds								0.67			
Causes not requiring modernization for correction					5.56						
Causes requiring modernization									3.34		

Table No. 47

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Ecuador
Industry: Weaving
Type of mills: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*		*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences*			
		Old (m-h/100 kg.)	*Modern (m-h/100 kg.)*		*Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
75	188.68	25.91	9.21	27.46	2.81	1.06	6.87	20.49
80	192.31	27.32	9.53	29.23	2.87	1.07	6.58	20.18
85	196.08	28.90	9.87	30.63	2.93	1.06	6.40	19.87
90	200.00	30.30	10.22	31.82	2.96	1.05	6.28	19.57
95	204.08	31.64	10.60	32.59	2.98	1.03	6.26	19.25
100	208.33	33.11	11.01	33.77	3.01	1.02	6.17	18.92
105	208.33	34.48	11.45	34.48	3.01	1.00	6.04	18.19
110	212.76	35.84	11.93	36.20	3.00	1.01	5.88	17.83
115	217.39	37.04	12.45	37.78	2.98	1.02	5.75	17.46
120	222.22	38.46	12.99	39.61	2.96	1.03	5.61	17.11
125	227.27	39.68	13.46	41.27	2.95	1.04	5.51	16.88
Averages	—	—	—	—	2.96	1.03	6.08	18.56

Table No. 48

ECUADOR: SIZE DISTRIBUTION OF THE WEAVING MILLS

Size (looms)	*Number of mills*	*Percentage of total number of mills*	*Number of looms*	*Percentage of total looms*
10– 20	—	—	—	—
20– 50	3	30.00	108	7.43
50–100	3	30.00	245	16.85
100–200	2	20.00	265	18.22
200–300	—	—	—	—
300–500	2	20.00	836	57.50
TOTALS	10	100.00	1,454	100.00
Up to 100	6	60.00	353	24.28
100–300	2	20.00	265	18.22
300 and over	2	20.00	836	57.50

Source: Data from Asociación de Industriales Textiles del Ecuador (December, 1949).

Table No. 49

ANALYSIS OF THE OPERATIONAL INFLUENCES IN SELECTED WEAVING MILLS

Actual fabric: No. 87.3; 40/15/2 x 32/15; 1080 w.e.
Standard fabric: No. 79.6; 40/7.5 x 26 x 8.5; 1620 w.e.
Actual productivity: 0.542 kg/m-h
Standard productivity: 3.43 kg/m-h
Influence of operation: 6.33

Error=7.5%
Dif. counts=8.7%
Country: Ecuador
Type of mill: Old
Mill: "B"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence					Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Winding	Spindle	250	200	63.9	52	30	35	12/12	21/21	22.8	4.29	0.800	0.814	(0.651)	1.666	1.000	1.000	(1.166)	0.760	−1.03	—
Warping	Warper	120	80	75.3	71	1	1	6/6	3/7	70.5	1.42	0.666	0.943	(0.628)	1.000	0.429	1.000	(0.429)	0.269	−1.04	—
Slashing	Slasher	26	24	66.3	60	1	1	3/6	3/6	81.3	1.23	0.923	0.905	(0.835)	1.000	1.000	1.000	(1.000)	0.835	−0.20	—
Weaving	Loom	180	170	52.2	76	1	4	100/212	75/78 75/109	4.48	22.30	0.944	1.454	(1.372)	4.000	2.040	0.715[a]	(5.830)	8.000	156.1	100.00
Totals and averages										3.43	29.24	0.676	1.332	(0.900)	4.450	2.000	0.731	(6.500)	5.850	153.8	100.00
Extension to the general sample										2.94	34.00	0.67	1.35	(0.90)	4.56	2.02	0.73	(6.75)	6.08	—	—

[a] Represents general labour appearing only at the standard mill.

Chapter V

MEXICO

I. Summary and conclusions

A. *Productivity of the industry*

291. In order to measure the productivity of textile labour in Mexico, a sample was taken consisting of thirty-three spinning mills and twenty-four weaving mills which represented approximately 32 per cent of the capacity of the old industry and 75 per cent of that of the modern industry.[89] Nine of these mills were subsequently chosen for a detailed analysis of the factors affecting productivity, independently of the type of equipment and the small size of the mills.

292. The sample included the greatest possible number of mills in Puebla, Veracruz and the Distrito Federal, which are the principal textile centres; mills in Sonora, Coahuila, Nuevo León, Jalisco, Guanajuato, Tlaxcala and the State of Mexico were also examined. In so far as was possible, it was attempted to include in the sample various sizes of textile mills, and to measure the productivity corresponding to a wide variety of products of popular consumption.

293. The results of the investigation show that the old mills offer much room for improvement in labour productivity, since modernization of the equipment and of the working methods would represent an increase of productivity of 260 per cent in the spinning mills and of 281 per cent in the weaving mills. Conditions in modern industry, on the contrary, are very much closer to normal, the margin of possible betterment in productivity being only 12 per cent in the spinning mills and 28 per cent in the weaving mills. If the modern mills could be enlarged, the increase of productivity might be as much as 31 per cent in the spinning mills, and 42 per cent in the weaving mills.

294. The modernization of 800,000 spindles and 32,000 looms (85 and 95 per cent, approximately, of the total capacity of the industry), is an extremely complex problem. It requires not only the investment of over 100 million dollars, but it will mean the displacement of more than 15,000 workers who would have to be absorbed by other heavily capitalized activities, if the increase of productivity in the textile industry is to bring about a rise in real *per capita* income. The reduction of labour in the textile mills is limited by the pressure exerted by an excess of population on the relatively low capacity of the country to invest savings in industrial or agricultural enterprises. This pressure hampers the few efforts which are being made to improve productivity. It is principally revealed by the persistent resistance of the workers to the adoption of equipment and of working methods which increase productivity, but which might cause unemployment. The rigidity of the contract law governing labour-management relations in the old industry[90] is evidence of this resistance and of the conditions from which it originated. Even though some of the textile manufacturers attribute the present technological backwardness to such legislation, the crux of the problem is of a wider and more general nature. As was previously stated, it arises from the existence of a surplus of population in relation to the scanty capital which can be invested in industry and other activities.

295. Given these conditions, the modernization of the machinery implies not only the problem of obtaining capital with which to purchase new machinery, but also of creating other economic activities to absorb displaced labour. If investments could be made in the textile industry without involving the displacement of the workers, productivity would not be very greatly increased and capital would be diverted from other undertakings in which it could increase productivity and raise the real income level of the population. Furthermore, production costs would be increased by the depreciation charges of extremely expensive machinery; this would hinder a reduction of prices, which is considered necessary to stimulate the primary demand for textiles, and would prevent a future rise in wages.

296. On the other hand, if textile machinery is not modernized, the problems of the industry will daily become greater; progressively larger sums will have to be spent on the maintenance of equipment, now in use for nearly fifty years, and mechanical deficiencies would have to be offset by the employment of even greater numbers of workers. In brief, a given factory would gradually lose its capacity to reduce prices, raise wages, and compete in quality and costs with mills which were able to modernize and free themselves from the rigid provisions of contract law.

297. The ideal solution would be to raise production without reducing the present number of workers in the industry, but the potential increase of demand is extremely small, compared to that which should take place in productivity. According to the figures given, the sale of textile products would have to be four times greater; this could not be achieved over the short period, especially in view of the tendency of foreign markets to contract as a result of the efforts made by nearly

[89] The number of mills chosen, and the percentages of the capacity of the corresponding sector represented by each group, are as follows: twenty-four old spinning mills, 32 per cent; nine modern spinning mills, 77 per cent; seventeen old weaving mills, 31 per cent, and seven modern weaving mills, 73 per cent. The whole sample represents 38 and 34 per cent respectively of the country's spinning and weaving capacity.

[90] Modern mills have been able to avoid the rigidity of contract law, principally because they were established during the war and post-war periods when there was a large temporary demand for textile labour.

all countries toward self-sufficiency in textile products.[91]

298. Under these conditions, there seems to be no solution to the textile problem other than the organization of a gradual displacement of textile workers to industrial activities which are now expanding. Initially, this transfer would be effected in conjunction with such reorganizations of labour as do not require the modernization of machinery; this would be followed by the modernization of those sections of the mills where it is most urgent, and finally by the gradual modernization of the rest of the machinery, in a measure with the capital available for investment.

299. It is evident that a programme of this nature, carried out on a nation-wide scale, would require the utmost co-operation between labour, management and the labour authorities.

B. *Causes of low productivity in the old industry*

300. The causes of low productivity were first divided into two principal groups. The first is made up of those which have been termed causes which could be corrected without the necessity of modernizing machinery; these include the existence of absolutely superfluous labour, the lack of specialization of production, and certain manufacturing conditions which can be remedied without great expense. The second group consists of the causes which can only be eliminated by the acquisition of new machinery; they include the old type of equipment, the small size of the mills, the disparity of capacity between sections, the excessive wear of the machines and certain other manufacturing conditions which cannot be corrected without involving great expense.

301. The results of the investigation show that in the spinning mills, the inefficiencies which could be eliminated without modernization are three times as important[92] as those which require the purchase of new machinery, since the former is responsible for an increase of 144 per cent in labour consumption per kilogramme of yarn, while the latter accounts for an increase of only 48 per cent.

302. In the old weaving mills, on the other hand, the causes which depend for correction on the acquisition of new machinery are nearly seven times as important as those which can be eliminated without this great expense. In fact, the correction of certain defective manufacturing conditions, such as the quality of the yarn, the maintenance of the machinery and the lack of specialization increases labour consumption per kilogramme by 30 per cent, whereas the type of machinery, its excessive wear and the smallness of the mills give rise to a labour surplus of 192 per cent.

303. These facts indicate that even if it is impossible to invest in new machinery, there still exists a margin, wide in the case of spinning and narrow in that of weaving, for an increase of productivity by changing the conditions and systems of work and eliminating that fraction of labour which is not absolutely essential.[93] These data also show that the modernization of the weaving mills is more important than that of the spinning mills, though it must be pointed out that if the best possible use is to be made of modern looms, yarn of a very high quality is necessary and this cannot be supplied by spinning mills with outworn or insufficient machinery. It may therefore be inferred that the modernization of both sectors is of equal importance.

304. The factor which exercises the greatest influence on productivity in the old spinning mills is the existence of superfluous labour, even allowing for the fact that in order to maintain high process efficiency, more labour than normal is required to offset certain defective manufacturing conditions. It was estimated that, on the average, half the workers in the spinning mills could be eliminated without greatly affecting the present efficiency of the processes. If, after doubling productivity by these means, certain manufacturing conditions were corrected, such as the maintenance of machinery, cleaning, lighting and humidification, a further productivity increase of 22 per cent could be obtained as a result of the higher output of the machines (6 per cent) and a further reduction of labour (15 per cent).

305. On the whole, in the old weaving mills, there is no absolutely superfluous labour under present manufacturing conditions. Labour could only be reduced after the correction of deficiencies in the quality of the yarn, the humidification, maintenance of the machinery and lighting of the mills. It is estimated that productivity could be raised 16 per cent if the weaving mills were supplied with more uniform and resistant yarn which would enable the number of machine units per tender to be increased. Similarly, an increase of 6 per cent could be obtained by improving the other conditions just mentioned. Greater product specialization would probably result in an additional increase of 6 per cent, and this would not entail the displacement of workers, as it depends entirely upon improving the efficiency of the processes.

306. The most important of the causes of low productivity which can only be eliminated by large capital investments is the type of equipment installed, that is, the use of old instead of modern machinery. This is responsible for an increase of 32 per cent in the consumption of labour per kilogramme of yarn and of 161 per cent per kilogramme of fabric. Other causes included in this category are: (1) the excessive wear of the machinery and the bad distribution of equipment and of the rooms, which cause increases of 20 per cent and 5 per cent respectively in the consumption of labour in the spinning and weaving mills; and (2) the small size of the mills, which increases the consumption of labour in the spinning mills by 18 per cent and in the weaving mills by 6 per cent. As a result of the shortage of cards, drawing frames and other machinery used in the manufacture

[91] The growing population and the increasing proportion of the population with a higher standard of living, together with the reaction of the market to possible price reductions, will undoubtedly lead to a greater consumption of textiles. This expanding consumer demand, however, will not be sufficient within a short period of time, to serve as a basis for an improvement of productivity which does not incur any displacement of labour. The possible replacement of imports by local production is, at present, confined to small quantities of high-quality articles which are not of much importance in relation to total domestic consumption.

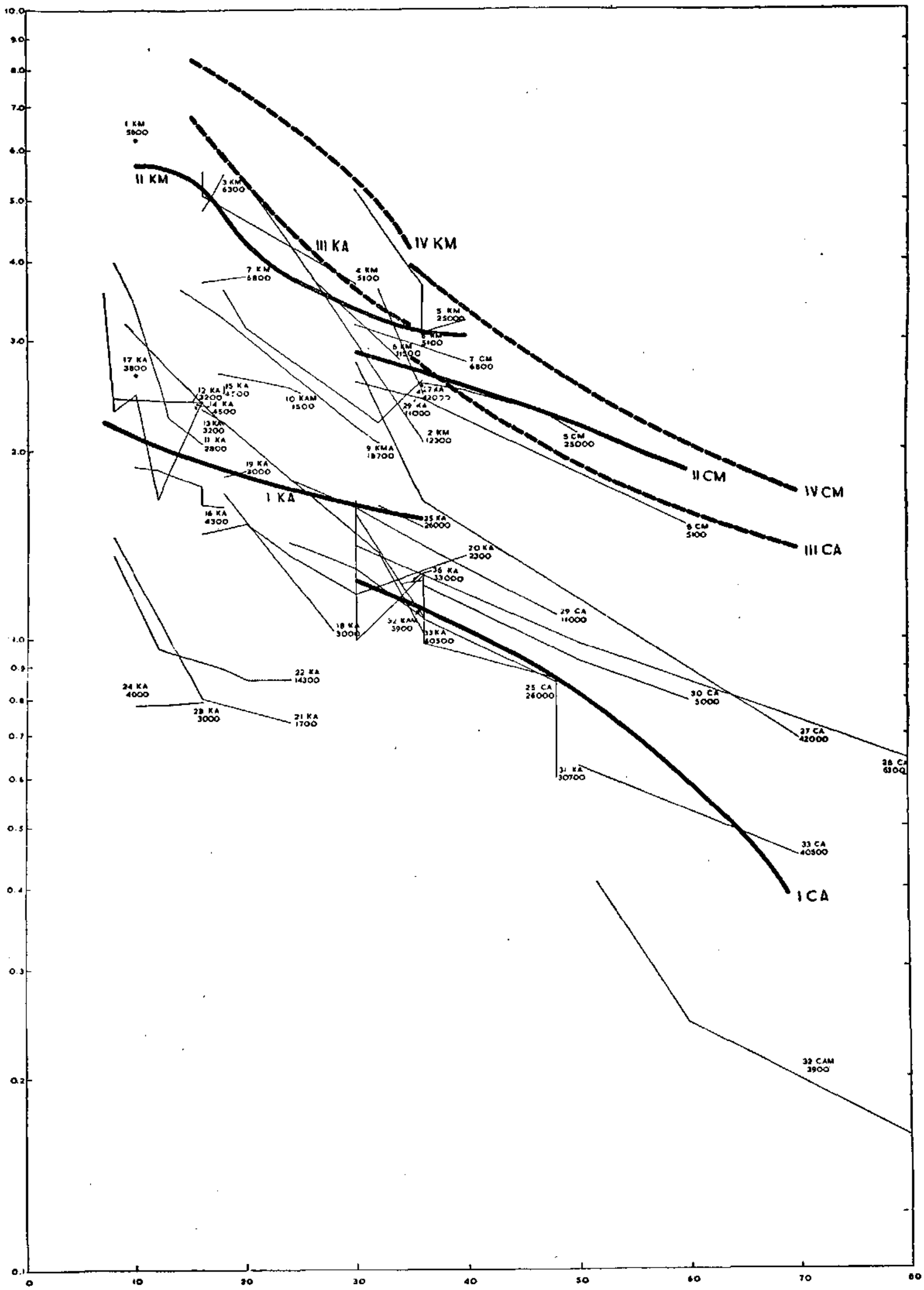
[92] The importance of one group of causes in relation to the other has been expressed as the relationship between the percentages of increase in the consumption of labour per kilogramme produced, originating from these causes.

[93] The percentages of potential increase of productivity equal the percentages of increase or of excess of labour consumption.

Graph No. 9

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Mexico



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill

K—Means carded yarn
C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in spindles.

of yarn, the speed of operation to which this equipment is subjected is higher than normal; this causes an average increase of 21 per cent in the productivity of the spinning mills, and considerably lowers the quality of the intermediate and final products.

307. As can be seen from the preceding figures, the reduction of the number of workers plays a very important part in the improvement of productivity of the old establishments. These reductions cannot be effected under the present contract legislation for the industry, which stipulates the number of workers to be employed in relation to the capacity of the mills, and establishes an inflexible basis for the proportion between production and wages. A typical example of the rigidity of the contract is found in the card section: since 1912 it has been ruled that a tender in the card section should attend no more than eight machines, instead of forty, as in other countries. If a Mexican manufacturer wanted to raise the work-load to forty cards, which would be possible by the installation of a few attachments and the reorganization of working methods, he would have to pay the card-tender five times his normal wage and compensate the four surplus tenders. As the investment in attachments and compensations would bring no reduction in the cost of labour, he prefers to carry on as before. Restrictions of this kind cause manufacturers to lose interest in the modernization of either the methods or machinery in the old mills. They prefer to set up new mills which are completely independent from the old ones having new workers and labour-management relations based on individual provisional agreements which are not governed entirely by contract law.

308. Labour and management groups for some years now have been discussing the basis for a new over-all labour contract which would take into account the technological progress of the industry and in which the number of machines per tender would be determined by rational methods based on the time taken by the workers to complete their tasks. So far no satisfactory agreement has been reached, due to a lack of co-operation on the part of both groups in dealing with the problem from a broader point of view, which would also take the national interest into account.

309. The reduction of the number of workers and the increase of process efficiency would require the installation of systems to control efficiency and quality, thus facilitating the systematic discovery and elimination of the factors affecting efficiency and causing labour wastage. It would also be necessary to give the workers a certain amount of supplementary training in order to adapt them to the new methods of work, and also to establish a rational procedure to determine the number of machine units which should be assigned to each tender.

C. *Causes of low productivity in the modern industry*

310. There are no important factors affecting productivity in the modern Mexican industry, with the exception of the small size of the mills, which increases the consumption of labour per kilogramme by 17 per cent in the spinning mills and by 11 per cent in the weaving mills, even though all other conditions were optimum. The fact that at the time of the investigation the new mills had just begun to operate is indicated by the small labour surpluses—12 per cent in the spinning mills and 22 per cent in the weaving mills. These surpluses can partly (7 to 8 per cent) be ascribed to the fact that the machines are still working at the low speeds recommended for the period of running-in and partly to labour's lack of skill.

311. It is thought that these causes of low productivity will shortly disappear and that there will be nothing to prevent the mills from achieving the best results obtainable in plants of their size.

II. Comments, results and analysis of the old spinning mills of Mexico

A. *General comments*

312. The individual productivity of the twenty-four old spinning mills of Mexico included in the sample is shown in graph 9, together with the general averages and the productivities of the standard mills which were used as norms for comparison.

313. In spite of the fact that the industry's contract legislation tends to standardize the number of workers employed, general observation of the graph reveals a great lack of consistency between the results of mills similar to each other in size and type of product. This indicates that a large part of productivity in the spinning mills depends on factors which are directly related to the output of the machinery.

314. Among the mills classified as old, the age of the equipment does not appear to be related to productivity, since that of spinning mills with machinery dating from 1899 (no. 27), 1909 (nos. 11 and 25) and 1900 (no. 13) is superior to that of the spinning mills of 1928 (no. 20) and of 1925 (no. 32). The productivity of some of those mills dating from the beginning of the century is even higher than that of completely modern mills (see the productivities corresponding to 36's yarn, which indicates that the management of a spinning mill may become more important than the age of its equipment).

315. Geographical location does not give rise to any palpable difference in the graph and the influence of the small size of the mills is overshadowed by the significance of other factors affecting productivity.

316. If the influence of the small size of the mills is taken into account, the extremes of productivity observed in mills equipped with machinery dating from the end of the last century are equivalent to 15 per cent (no. 22-KA) and 82 per cent (no. 27-KA), respectively, of the productivity which could be attained with the same type of equipment. One of the mills equipped with old machinery of the first quarter of the century (no. 29-KA) has achieved a productivity of 103 per cent of that established as the standard for old mills.

317. The following conditions were observed in most mills:

(*a*) The machinery is in a defective condition, chiefly owing to the lack of adequate maintenance. Examples of this are found in the poor condition of the card-clothing and the spinning-frame rolls, excessive vibration of the spindles of the roving frames, and the eccentricity of the spinning-frame spindles. Some of these deficiencies can be corrected by improving maintenance services, but others require costly repairs in which it is not worthwhile investing, unless partial modernization of the machinery is contemplated;[94]

(*b*) The cleaning of the air, machines and floors is poor;

(*c*) Quality control is non-existent or very defective. Most mills only possess the indispensable instruments for determining the weight and the resistance of the yarn;

(*d*) Control of efficiency practically does not exist;

(*e*) The lighting is defective;

(*f*) The work-loads are not determined by rational methods. They are almost entirely fixed by prevailing contract legislation;

(*g*) As a result of most of these conditions, the quality of the intermediate and final products is defective.

B. *Analysis of the results*

318. Table 50 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity.[95] The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences corresponding to each yarn count which were obtained, in table 51, by comparisons between the actual and standard consumption of labour per kilogramme of yarn.

319. The influence of size corresponding to the mills of the sample (1.18), is equal to the average weighted influence for the whole country, and is of considerable importance because it points to an innate deficiency of the industry, as a result of which, even under the best administrative conditions, the consumption of labour is always 18 per cent higher than would be necessary in mills of an adequate size. Table 52 shows that 90 per cent of the mills have fewer than 15,000 spindles and 62 per cent have fewer than 5,000, whereas the lower limit of optimum size has been estimated at 25,000 spindles.

320. Very few old mills possess any modern pieces of machinery. For this reason the influence of the type of equipment (1.32), calculated as if all the machinery were entirely old, is considered sufficiently representative of the machinery of the old Mexican spinning mills. The geographical distribution of the old and new machinery is shown in table 53.

321. The influence of operation (2.31), which is the most important component of the total influence, was broken down into the influences of the draft schedule, speed, efficiency and the excess of direct, indirect and miscellaneous labour. This was done by means of the analysis of mill "A" (table 54), the productivity curve of which almost coincides with the average of all the old mills, and of mill "B" (table 55) where the productivity closely approaches that established as standard. The machinery of the former dates from 1891-1899 and of the latter from 1908-1909.

322. The average was taken of the influences of all the processes of these two mills and they were adjusted, in table 70, so that the result would be equal to the influence of operation already determined by means of the general sample. In making this adjustment, the averages of the influences of excess labour were left unchanged. Observations made in the industry showed that these influences vary but little from one mill to another, due to the existence of a general standard distribution of work laid down by the contract legislation governing the textile industry.

323. The redistribution of the influences was made in the light of the following considerations, which arise from a study of the tables of analysis mentioned above and from the general observations made in the industry.

324. It was found, in most mills, that divergencies of the draft schedule from the established standard tend to increase productivity, the corresponding influence being less than 1. Mill "A" (column 9) shows an example of exaggerated favourable influences in all the preparatory processes. Even so, the average over-all influence was nearly 1, on account of the heavy weight of the spinning-frame section's influence—which is always 1.

325. The principal cause of the influence of the draft schedule lies in the fact that the mills must adapt a single organization of the preparatory processes to a great variety of yarn counts. For this reason, the average influence (0.96) was grouped with the influences which can be corrected. It should be pointed out, however, that in some mills, very heavy intermediate products are used in the preparatory processes in order to off-set the lack of balance between the capacity of the pickers, cards, drawing-frames and roving-frames, and that of the spinning frames.

326. The exaggeratedly low influences of the draft schedule cause increases in labour productivity but tend to affect the quality of the products and, therefore, to diminish efficiency in the subsequent processes.

327. In nearly all the mills, machinery was found working at speeds greater than those considered standard. This is principally due to the lack of balance between the capacity of the preparatory sections and that of the final spinning section, which in turn is caused (1) by the fact that the number of spindles has been increased with no corresponding change in the capacity of the pickers, cards and other preparatory machines, and (2) by the decrease of the average yarn count manufactured, in comparison with the count for which the balance of the mill was originally calculated.

328. In the redistribution of influences, the influence of speed (0.75) has been classified in the column corresponding to lack of equipment. It can be overcome only by modernization because it is not thought worthwhile

[94] This partial modernization has been started in some mills, where multiple-process pickers have been converted into single-process pickers, and the spinning frames have been fitted with long-draft systems. The managers and technicians of these mills appeared satisfied with the results obtained.

[95] If 1 is subtracted from these values and they are multiplied by 100, the result will equal the percentages of excess labour per kilogramme produced, or the potential increases of productivity, expressed as percentages of present productivity, which might be obtained by the correction of the conditions affecting it. The component or partial influences have the same significance as the total influence, but they refer to specific causes. When the influences of two or more causes are multiplied together, the product is the influence of the combination of these causes. The reciprocal of an influence, subtracted from 1 and multiplied by 100, is the loss of productivity expressed as a percentage, arising from the cause corresponding to that influence.

to make new investments on old machinery or to reduce the total capacity of the mills, unless strong competition, based on quality were to justify the balancing of capacity and the reduction of speeds.

329. The observation of the industry in general and of mills "A" and "B" in particular, leads one to the conclusion that the differences in productivity depend principally on differences in the efficiency of the processes; the influence of excess labour varies little from one mill to another, and the influences of the draft schedule and of speed appear indiscriminately in mills of high or low productivity.

330. The value of efficiency depends principally on the general conditions of the mill, that is, the state of the machinery, general cleanliness, adequate working speeds for the machines, control of humidity, the distribution of the machines and rooms, and the working methods employed. Many of the deficiencies of these factors result from the general lack of control of the operations. It was considered that most of the loss of efficiency was due to causes which can be corrected: many cases were noted of card-clothing and roving-frame and spinning-frame rolls in poor condition, uncontrolled lint collected on the machinery, and inactive machines waiting for doffers. Next in order of importance was the condition of the machinery and its distribution, which can be considered as a permanent deficiency since it would probably prove too costly to remedy, unless the whole sections are modernized; and finally, the effect of excessive speed of the machinery was taken into account, but given less importance. The relative importance of these three types of causes was expressed by the influence values of 1.10, 1.08 and 1.05, respectively.

331. It was estimated, on the basis of observations of end breakage frequencies in the spinning frames, that the maintenance of approximately normal efficiencies would require more than the standard number of tenders for an old mill. It was also estimated that, in a spinning mill representing the average conditions in the country, this excess would not be more than 60 per cent (infl. 1.60). From this figure it was assumed that the average efficiency observed in the industry (1.25) could probably be maintained with 28 per cent more labour than necessary in the standard mills.[96] The influence of this excess, that is 1.28, was roughly divided among the manufacturing conditions which caused it, in a manner similar to that used in the distribution of the influence of efficiency (1.15 and 1.11). The remainder of the influence of excess labour (2.00) was assumed to arise from the employment of absolutely superfluous labour which could be eliminated at once, without lowering efficiency any further.[97]

332. The lower part of table 50 shows the influences re-arranged into groups corresponding to (1) causes which require action on the part of the management to reduce labour; (2) causes which require preliminary action on the part of the management to improve certain manufacturing conditions; (3) causes which can be corrected without modernization; and (4) causes which can only be eliminated by means of modernization of the industry.

333. In order to obtain the highest productivity possible with the existing machinery, adequate systems must be installed to determine work-loads, and control efficiency and the quality of the products. It would also be necessary to make a selection of the best workers and retrain them in order to adapt them to the new conditions.

III. Comments, results and analysis of the modern spinning mills of Mexico

A. *General comments*

334. The individual productivity results of the nine spinning mills, included in the sample, are shown in graph 9, together with the general averages and the productivity of the standard mill used as a norm of comparison.

335. General observation of the graph reveals considerable consistency in the results obtained in mills of similar size and type of product. If the influence of size is taken into account, the productivity of most of the mills can be said to be almost normal. The extremes of high and low productivity of entirely new mills represent, however, 112 per cent (no. 8-CM) and 57 per cent (no. 7-KM) of the standard productivity corresponding to their size. Mill 9-KMA, with a productivity of approximately 45 per cent of that corresponding to its size, is equipped with machinery of modern type imported after many years' use in the United States.

336. It can be said, on the whole, that no deficiencies in manufacturing conditions were observed which could affect productivity to any great extent. Quality and efficiency are more or less well controlled in all the mills and, in most, an effort is being made to ensure that the labour contracts are governed by reasonable standards as regards the determination of work-loads.

B. *Analysis of the results*

337. Table 56 is a summary of the average values of the influences, that is the indices of the importance of the factors affecting productivity. The total influence and its principal components—the influences of operation and size—are the averages of the influences corresponding to each yarn count, which were obtained, in table 57, by comparisons between the actual and the standard consumption of labour per kilogramme of yarn.

338. The influence of size (1.17) is very important, not only because of its high value, but because it cannot be corrected. It shows that measures should be taken to ensure that larger mills are set up in the future.

339. The influence of operation (1.12) is small and will probably be eliminated in the near future. In order to ascertain its causes, analyses were made of mills "C", "D" and "E", and these appear in tables 58, 59 and 60. The productivity of the spinning mills "C" and "E" is near the average for the industry, while that of "D" is almost equal to the productivity determined as stand-

[96] The influence of 1.28 (28 per cent) was obtained by dividing 1.80 by 1.25. This method of calculating the excess labour necessary to maintain an efficiency is not strictly accurate, since there is no exact proportionability between the efficiency obtained and the number of tenders employed.

[97] As the spinning-frame section weighs more on productivity than all other sections together, the indices obtained by observations of the frequency of yarn breakages can apply to general results derived from all the sections, without giving rise to errors which might alter the general conclusions.

ard for mills of 25,000 spindles. The three mills are completely modern.

340. An average was taken of all the processes of these three mills and they were adjusted, in table 70, so that the result would equal the influence of operation already determined by means of the general sample.

341. The influences were redistributed in the light of the following considerations, which arise as a result of studying the tables of analysis for mills "C", "D" and "E", and of the general observations made in the industry.

342. The low speeds are principally due to the fact that a great deal of the machinery is still in the running-in period. In the case of the cards, some mills have a temporary excess capacity for spinning preparation; this is because the installation of all the spinning frames has not been completed and it is thought preferable to improve carding by decreasing doffer speeds. This situation will disappear shortly.

343. On the whole, the manufacturing conditions of the modern spinning mills—humidity, cleanliness, maintenance and lighting—can be described as excellent. The methods of control of quality and efficiency are adequate. The lack of efficiency indicated by the value 1.07 can be attributed entirely to the fact that the workers have not yet completed their training. This is being actively corrected, and it is expected to disappear very shortly, since the workers are well managed and there are no obstacles to impede the completion of their training.

IV. Comments, results and analysis of the old weaving mills of Mexico

A. *General comments*

344. The results of the measurements of productivity made in seventeen old Mexican weaving mills are shown in graph 10, together with the general average and the productivity of the standard mills used as norms of comparison.

345. The mills visited are approximately equal, as regards type of equipment and age of the machinery, though some are equipped with modern cone-winders.

346. The great inconsistency of results, even within a single mill, is principally due to the fact that the work-loads are assigned with little or no regard for the type of fabric produced, or the prevailing working conditions. In other words, the work-load is determined according to looms per weaver, regardless of the number of loom-stops the weaver must tend per unit of time. Chiefly for this reason, it is therefore possible to find cases where productivity is 50 per cent above standard (no. 15-A) and others which represent only 22 per cent of the standard (no. 19-A). Mill no. 33-A, for instance, manufactures ordinary and fine fabrics, with little difference in the consumption of man-hours per kilogramme; this can only be explained by the irrationality of the work-loads.

347. It is not possible to establish a definite correlation between productivity and the size of the mills; since the influence of size is very small in this type of installation, it is overshadowed by other more important influences. It should be noted, however, that all the mills of less than 100 looms are amongst those of lowest productivity. This is because they manufacture special articles, such as handkerchiefs or fancy fabrics, and as a result of a great variety of small orders, production is inefficient.

348. The relationship between the productivities of weaving mills nos. 6-M and 6-A (2.17), which manufacture the same fabric and belong to the same firm, is a practical demonstration of the importance of modernizing the weaving machinery, even though there is relatively more excess consumption of labour in the modern weaving mill than in the old section, if each of them is compared with its corresponding standard.

349. The following important conditions were observed in most mills:

(*a*) The maintenance of the machinery is deficient. It was found that the repair of the looms was effected in a rough and precarious manner; this without any doubt causes an excessive number of stops, which might otherwise be avoided. The spoolers are generally in such poor mechanical condition that they are not worth repair. These machines, like the warpers, will have to be replaced by modern equipment even though the rest of the machinery is not modernized;

(*b*) In many mills the control of humidity is deficient and in some there is no humidification. It is estimated that this has a great effect on the loom section and consequently reduces its productivity;

(*c*) With few exceptions the yarn used is irregular and nappy, which is probably the most important cause of low efficiency;

(*d*) The lighting is insufficient;

(*e*) With the exception of the mills which manufacture coarse fabrics for popular consumption,[98] the other mills generally produce a great variety of fabrics, many in very small quantities. This also reduces productivity by increasing the number of times the machines must stop for the changes of product;

(*f*) In most mills, the capacity and type of construction of the building are completely inadequate for efficient production. Loom sheds are found distributed over two floors, buildings are not sufficiently stable for the correct working of the machinery, and there is a general lack of space between the machines and space for storage and transport. As a rule the type of roof favours inside changes of temperature and hinders control of humidification;

(*g*) Few mills have any control of efficiency, that is, the systematic measurement of its value and the determination of the factors affecting it. There is no careful control of quality in mills manufacturing ordinary fabrics; the inspections made are in order to separate them into categories and not to determine the origin of their imperfections.

B. *Analysis of the results*

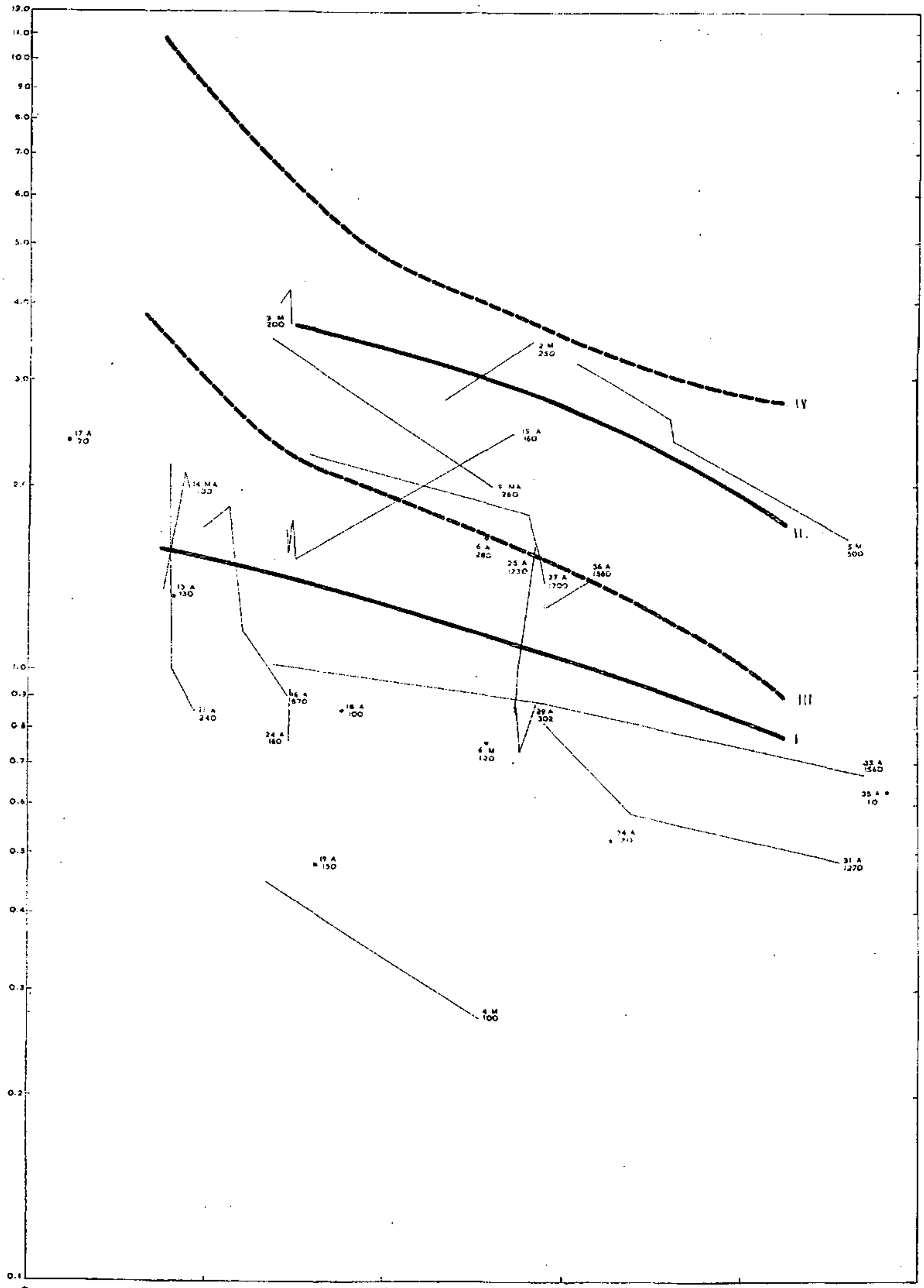
350. Table 61 is a summary of the average values of the influences, or the indices of importance of the factors affecting productivity. The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences

[98] Principally "manta", a coarse fabric similar to the South American "tocuyo".

Graph No. 10

PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE

Mexico



X—Fabric count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 500-loom mill
IV—Standard productivity of a modern 500-loom mill
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms corresponding to each yarn count which were obtained, in table 62, by means of comparisons between actual and standard consumptions of labour per kilogramme of yarn.

351. The influence of size in the mills included in the sample (1.06) is slightly higher than the weighted average of that influence for the whole industry (1.04). Its value is low, although 63 per cent of the mills have fewer than 100 looms (see table 63), because the smallness of the mills is not a factor which decreases productivity very much in old weaving mills.

352. The significance of the influence of the type of equipment (2.62) is due principally to the use of non-automatic rather than automatic looms, and indicates the vital importance of modernization in the weaving mills, in order to increase productivity.

353. The influence of operation (1.37) was broken down into the influences of speed, efficiency, and excess of direct, indirect, and miscellaneous labour. This was done by the analysis of mills "F" and "G" (tables 64 and 65), the productivity of which, in the fabrics selected, is respectively higher and lower than the general average. An average was taken of the influences of all the processes and they were adjusted, in table 70, so that the result was equal to the influence of operation which had already been determined by means of the general sample.

354. The influences were redistributed in the light of the following considerations, drawn from a study of the tables of analysis of mills "F" and "G" and of the general observations made in the mills.

355. In contrast with the old weaving mills of Brazil, in the old Mexican weaving mills there is a certain direct correlation between the efficiency of the processes and the number of tenders employed.[99] This probably indicates that the relatively small excess of labour is entirely used to offset certain manufacturing conditions, chiefly the poor quality of the yarn, which tend to lower efficiency. This opinion is borne out by the observations of the frequency of loom stops; these appear to indicate that in this section, at least, the excess of workers required in relation to the standard number is approximately equal to the average excess observed in the industry.

356. For this reason the influence of the excess labour (1.28) was distributed only in the columns representing manufacturing conditions. Generally, more influence (1.16) was attributed to the quality of the yarn, because it was noted that most of the stops were due to defects in the warp yarn. The remainder of the influence was distributed equally between the corrigible causes not requiring modernization (1.05) such as the maintenance of the machinery and the control of humidification, and the causes requiring modernization of the industry (1.05) such as the excessive wear of the equipment, the age of the machinery and the small size of the mills.

357. The differences of productivity existing between the mills shown in graph 10 are due to great variations of efficiency and small variations in the amount of labour employed per machine unit. The variations of efficiency derive principally from differences in manufacturing conditions, such as the quality of the yarn and control of humidification. Labour varies within the rigid limits of contract legislation, because of the irrationality of the work-loads in relation to the product manufactured.

358. It was estimated that the frequent stops caused by a lack of specialization of products decrease the number of available man-hours by at least 5 per cent. For this reason the corresponding value of efficiency (1.06) was attributed entirely to this cause.

359. The influence of speed (1.01) is not important. In the redistribution, it was grouped with the influences deriving from causes which can be corrected.

360. In the lower part of table 61 the influences have been rearranged into groups corresponding to the causes requiring the action of the management to improve the manufacturing conditions (1.23) and the causes which require the action of the industry as a whole to eliminate them (1.06). The influences have also been reclassified as not requiring modernization of the equipment for correction (1.30) and as requiring modernization (2.92).

361. As already said in connexion with other sectors of the industry, the improvement of productivity also requires the installation of modern methods to control both efficiency and quality, and rational methods to determine work-loads. The latter is less important in the old weaving mills than in the other sections of the industry; as the looms are not automatic, the work-loads are relatively inelastic in relation to the type of product and to manufacturing conditions, since there is a limit, probably of six looms, beyond which the weaver could not supervise production adequately.

V. Comments, results and analysis of the modern weaving mills of Mexico

A. *General comments*

362. The individual productivity of the seven modern weaving mills included in the sample is shown in graph 10, together with the general average and the productivity of the standard mill used as a norm of comparison. Two of the mills (nos. 14-MA and 9-MA) are equipped with used automatic looms that lack some modern features, especially the speed, of new machinery. One of them (no. 14-MA) works with yarn produced by a spinning mill of the old type, which is probably sufficient to explain its very low productivity. The other mills are entirely new.

363. If the influence of size is taken into account, and if mill no. 14-A is excluded for the reasons given above, the extremes of high and low productivity represent respectively, 103 per cent (no. 2-M) and 53 per cent (no. 6-M) of the productivity established as normal for mills equipped with the same type of machinery.

364. The general conditions of the industry are fairly normal. The few deficiencies observed which influence the productivity of the mills are almost entirely due to causes which can be considered as characteristic of the running-in period common to most mills at present. The most important deficiency is probably the

[99] The only two sections which exercise strong influence upon productivity are the looms and the cone-winders, as can be seen in column 22 of the analysis of mills "F" and "G". The same tables show (columns 11 and 19) that strong influences of efficiency correspond to weak influences of labour.

lack of skill of the loom fixers, which is apparent in the excessive frequency of mechanical stops of these machines. In many mills, a certain lack of balance was noted between the amount of direct and indirect labour which should be applied to production: few machines are assigned per tender, but on the other hand, there is not enough auxiliary labour to avoid the employment of tenders in auxiliary work. In very few mills were deficiencies observed in the yarn or in the preparation of the warp.

B. *Analysis of the results*

365. Table 66 is a summary of the average values of the influences, that is, of the indices of the importance of the factors affecting productivity. The total influence and its principal components—the influences of operation and size—are the averages of the influences corresponding to each fabric count, which were obtained, in table 67, by means of comparisons between the actual and standard consumption of labour per kilogramme of fabric.

366. The influence of size (1.11) is greater than the weighted average influence for all the weaving mills of the country (1.04), despite the fact that the sample included nearly all the important modern mills. Its relatively high value indicates that some action should be taken to prevent modern industry from continuing to develop with this structural deficiency which hinders it from attaining the best possible productivity.

367. The influence of operation (1.28) is relatively small compared to that in the modern weaving mills of other countries. It was broken down into influences of speed, efficiency and excess of direct, indirect and miscellaneous labour by an examination of mills "H" and "I" (tables 68 and 69) where productivity is higher and lower than the general average, respectively. An average was taken of the influences of all the processes of these mills and they were adjusted[100] (table 70) so that the result was equal to the influence of operation already determined by means of the general sample.

368. The influences were redistributed in the light of the following considerations, which arise from the study of the analysis of mills "H" and "I" and the general observations made in the industry.

369. In most of the mills the looms are working at reduced speeds as they are still in the running-in period. The influence deriving from this cause is consequently not important.

370. The greater part of the influence of efficiency (1.15) was attributed to the lack of skill of the loom-fixers, as it was noted that in all the mills, the loom stops were due to mechanical factors.[101] The remainder of the influence of efficiency (1.07) was attributed to the lack of specialization of work; it was observed in many mills that the machine tenders also carry out tasks of transport and cleaning which should be done by auxiliary workers. This undoubtedly detracts attention from the machines, and so affects efficiency.[102]

371. The total influence of excess labour (0.98) was favourable to productivity, due to the scarcity of auxiliary workers. For this reason, it was redistributed in the column corresponding to the lack of specialization of work.

372. In the lower part of table 66, the influences were rearranged into groups corresponding to (1) causes being actively corrected, such as low speeds, which will very shortly be normal, and the training of the fixers which, as far as could be seen, is well managed and will reach normal levels very soon; and (2) causes which require action on the part of the management, in order to improve the organization of labour, that is, to increase the work-loads and specialize labour operations.

373. In this case, the values of the influences which can and cannot be corrected without investing in new equipment coincide respectively with the influences of operation and mill size.

[100] The adjustment was of little importance because the average of the influence of operation observed in mills "H" and "I" was almost equal to the average influence of operation of all the modern weaving industry.

[101] Mechanical stops are also due, to a small extent, to the variations in humidification, which throw the parts of the looms made of wood and leather out of adjustment.

[102] In table 66, the lack of specialization will be seen in the combination of the strong influence of direct labour (2.00) and the weak influence of indirect labour (0.49), resulting in an insignificant total influence (0.98).

Table No. 50

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Mexico
Industry: Spinning
Type of mill: Old

Analysis of the total influence (*data of the general sample*)		*Analysis of the influence of operation* (*data of the small sample, extended to the general sample*)			*Redistribution of the influences*: *Excess labour, after allowing for some defective manufacturing conditions*	*Machine maintenance, cleanliness, lighting, humidification and other conditions which can be corrected*	*Excessive wear, poor machine and mill layout*	*Type of equipment*	*Size*	*Lack of equipment*
Total influence 3.60	*Influence of operation 2.31*	*Production*	Draft Sch.	0.96		0.96				
			Speed	0.75						0.75
			Efficiency	1.25		1.10	1.08			1.05
			Total	0.90						
		Excess labour	Direct	3.32						
			Indirect	1.06						
			Miscel.	0.73						
			Total	2.56	2.00	1.15	1.11			
	Size 1.18								1.18	
	Type of equipment 1.32							1.32		
TOTALS					2.00	1.22	1.20	1.32	1.18	0.79
Action to reduce labour					2.00					
Action to correct manufacturing conditions						1.22				
Causes which can be corrected without modernization					2.44					
Causes requiring modernization							1.48			

Table No. 51

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Mexico
Industry: Spinning
Type of mill: Old

Yarn or fabric count	Actual average labour consumption (m-h/100 kg.)	Standard labour consumption for a mill of optimum size: Old (m-h/100 kg.)	Standard labour consumption for a mill of optimum size: Modern (m-h/100 kg.)	Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)	Influences: Type of equipment (E)	Influences: Size (S)	Influences: Operation (O)	Influences: Total (T)
	a	b	c	d	b/c	d/b	a/d	a/c
15 card.	51.02	14.66	12.02	18.76	1.22	1.28	2.72	4.24
20 card.	54.64	18.15	13.62	24.14	1.33	1.27	2.37	4.01
25 card.	58.48	22.68	15.75	27.67	1.44	1.22	2.11	3.71
30 card.	61.35	27.78	18.69	32.22	1.49	1.16	1.90	3.28
35 card.	64.10	31.65	24.10	35.45	1.31	1.12	1.81	2.66
35 comb.	87.72	35.71	25.44	40.00	1.40	1.12	2.20	3.45
40 comb.	96.15	40.65	29.50	45.12	1.38	1.11	2.13	3.26
45 comb.	107.53	46.30	34.36	50.93	1.35	1.10	2.11	3.13
50 comb.	123.46	52.63	39.52	58.42	1.33	1.11	2.11	3.12
55 comb.	142.86	58.14	44.44	67.44	1.31	1.16	2.11	3.21
60 comb.	172.41	62.89	49.02	76.10	1.28	1.21	2.27	3.52
65 comb.	208.33	67.57	53.48	85.14	1.26	1.26	2.46	3.90
70 comb.	277.78	71.94	58.48	90.64	1.23	1.26	3.06	4.75
Averages	—	—	—	—	1.32	1.18	2.31	3.60

Table No. 52

MEXICO: SIZE DISTRIBUTION OF THE SPINNING MILLS

Size (spindles)	Number of mills	Percentage of total number of mills	Number of spindles	Percentage of total spindles
Up to 2,000	41	26.11	37,857	4.05
2,000– 5,000	57	36.31	185,557	19.83
5,000–10,000	29	18.47	176,999	18.92
10,000–15,000	14	8.92	154,811	16.55
15,000–25,000	10	6.37	180,014	19.24
25,000–50,000	6	3.82	200,344	21.41
Totals	157	100.00	935,582	100.00
Up to 5,000	98	62.42	223,414	23.88
5,000–15,000	43	27.39	331,810	35.47
15,000 and over	16	10.19	380,358	40.65

Source: Data from Consejo Nacional de Empresarios de la Industria Textil and regional trade associations, expanded through the survey.

Table No. 53

GEOGRAPHICAL DISTRIBUTION OF THE
MEXICAN TEXTILE INDUSTRY

States	*Number of spindles*			*Number of looms*			*Number of mills*[a]													*Total number of workers*[b]
							Spinning only				*Weaving only*				*Spinning-weaving only*				*All mills*	
	Old	*New*	*Total*	*Old*	*New*	*Total*	*Old*	*New*	*Mixed*	*Total*	*Old*	*New*	*Mixed*	*Total*	*Old*	*New*	*Mixed*	*Total*		
Coahuila	40,536	5,808	46,344	1,886	—	1,886	—	—	—	—	—	—	—	—	9	—	1	10	10	2,959
Chihuahua	11,290	—	11,290	396	—	396	—	—	—	—	—	—	—	—	3	—	—	3	3	244
Distrito Federal	97,904	16,340	114,244	2,435	475	2,910	21	—	—	21	30	—	—	30	8	3	1	12	63	10,520
Durango	1,562	—	1,562	—	—	—	2	—	—	2	—	—	—	—	—	—	—	—	2	70
Guerrero	1,500	—	1,500	50	—	50	1	—	—	1	—	—	—	—	1	—	—	1	2	230
Guanajuato	37,548	—	37,548	1,122	—	1,122	1	—	—	1	1	—	—	1	3	—	—	3	5	855
Hidalgo	17,164	—	17,164	663	—	663	1	—	—	1	—	—	—	—	2	—	—	2	3	935
Jalisco	46,408	7,144	53,552	2,228	100	2,328	1	—	—	1	3	—	—	3	4	1	1	6	10	3,836
Estado de México	844	49,900	50,744	973	830	1,803	2	—	—	2	6	—	—	6	7	2	—	9	17	2,473
Michoacan	17,832	—	17,832	583	—	583	—	—	—	—	—	—	—	—	3	—	—	3	3	423
Nuevo Léon	10,764	6,840	17,604	673	—	673	—	1	1	2	—	—	—	—	1	—	—	1	3	1,975
Nayarit	7,639	—	7,639	322	—	322	—	—	—	—	—	—	—	—	2	—	—	2	2	550
Puebla	285,629	23,916	309,545	11,579	264	11,843	18	1	—	19	80	—	—	80	27	—	1	28	127	16,895
Queretaro	29,480	—	29,480	818	—	818	1	—	—	1	1	—	—	1	2	—	—	2	4	1,688
San Luis Potosí	1,408	—	1,408	40	—	40	—	—	—	—	—	—	—	—	1	—	—	1	1	47
Sinaloa	3,704	—	3,704	136	—	136	—	—	—	—	—	—	—	—	2	—	—	2	2	269
Sonora	864	6,336	7,200	100	200	300	—	—	—	—	—	—	—	—	2	1	—	3	3	240
Tlaxacala	32,964	10,000	42,964	1,515	125	1,640	—	—	—	—	—	—	—	—	7	1	—	8	8	2,133
Veracruz	164,258	—	164,258	6,520	100	6,620	—	—	—	—	—	—	—	—	9	—	1	10	10	8,520
TOTALS	809,298	126,284	935,582	32,059	2,094	34,133	48	2	1	51	121	—	—	121	92	9	5	106	278	54,862

[a] Weaving mills under ten looms have not been taken into consideration.
[b] Number of workers for some states is estimated because no data was available.
Source: Data from Consejo Nacional de Empresarios de la Industria Textil and regional trade associations analysed and expanded through the survey.

Table No. 54

Yarn count: 36's carded
Actual productivity: 1.51 kg/m-h.
Standard productivity: 3.16 kg/m-h.
Operational influence: 2.09

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Mexico
Type of mill: Old
Mill: "A"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment: Actual	Standard	Units of equipment per tender (work-load): Actual	Standard	Labour consumption in man-hours per 100 kg.: Actual	Standard	Operational influence — Production influence: Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Labour influence: Direct labour	Indirect labour	Miscellaneous	Total	TOTAL	Man-hours per 100 kg. added by the influences	Percentage of total excess
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	175.62	136.38	1	3	3.32	1.57	0.875	1.11	0.804	(0.779)	3.00	0.779	1.000	(2.339)	1.870	1.365	3.96
Carding	Cards	5.43	3.72	8	31	4.04	1.89	0.761	0.632	1.425	(0.685)	3.878	0.805	1.000	(3.120)	2.139	2.150	6.25
Drawing (I)	Delivery	3.48	5.82	18	38	2.23	0.48	0.767	0.824	2.650	(1.672)	2.110	1.319	1.000	(2.780)	4.650	1.752	5.09
Drawing (II)	Delivery	3.48	5.82	24	38	4.75	0.48	0.755	0.824	2.690	(1.672)	1.582	1.756	2.134[a]	(5.930)	9.900	4.270	12.40
Slubber	Spindle	1.093	0.872	80	144	2.08	0.95	0.783	0.858	1.189	(0.798)	1.800	1.526	1.000	(2.744)	2.190	1.130	3.28
First intermediate	Spindle	0.476	0.259	184	240	1.78	0.95	0.744	0.738	0.991	(0.544)	1.305	2.642	1.000	(3.450)	1.875	0.832	2.41
Second intermediate	Spindle	0.107	0.049	300	336	5.56	2.82	0.655	0.666	1.046	(0.457)	1.120	3.850	1.000	(4.320)	1.970	2.735	7.93
Spinning	Spindle	0.011	0.0085	350	1,787	42.6	22.46	1.000	0.773	1.000	(0.773)	5.110	0.955	0.503[b]	(2.455)	1.899	20.200	58.68
Totals and averages						66.36	31.60	0.928	0.769	1.121	(0.800)	4.04	1.019	0.635	(2.610)	2.090	34.430	100.00

[a] Represents a third drawing process of the actual mill.
[b] Reflects the fact that the actual mill has its general labour distributed among the sections, while the standard mill has it as a separate item.

Table No. 55

Yarn count: 18's carded
Actual productivity: 3.560 kg/m-h.
Standard productivity: 6.240 kg/m-h.
Operational influence: 1.752

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Mexico
Type of mill: Old
Mill: "B"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment: Actual	Standard	Units of equipment per tender (work-load): Actual	Standard	Labour consumption in man-hours per 100 kg.: Actual	Standard	Operational influence — Production influence: Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Labour influence: Direct labour	Indirect labour	Miscellaneous	Total	TOTAL	Man-hours per 100 kg. added by the influences	Percentage of total excess
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	177.00	175.71	1	3	2.74	1.134	1.133	0.874	1.005	(0.993)	3.000	0.812	1.000	(2.436)	2.415	1.605	9.83
Carding	Cards	6.05	6.82	9	31	5.34	1.134	1.048	1.133	0.950	(1.128)	3.440	1.215	1.000	(4.180)	4.710	4.210	25.48
Drawing (I)	Delivery	12.45	7.41	25	34	0.922	0.413	1.040	0.609	0.940	(0.595)	1.360	2.760	1.000	(3.755)	2.235	0.510	3.11
Drawing (II)	Delivery	12.35	7.41	25	34	1.860	0.413	1.048	0.607	0.940	(0.600)	1.360	2.740	2.018[a]	(7.510)	4.510	1.440	8.82
Slubber (I)	Spindle	0.904	1.407	80	176	2.51	0.413	1.750	1.039	0.857	(1.558)	2.200	1.776	1.000	(3.910)	6.080	2.100	12.97
First intermediate	Spindle	0.335	0.184	124	372	7.90	1.442	1.250	0.439	1.000	(0.549)	3.000	1.580	2.105[b]	(9.980)	5.480	6.460	39.79
Spinning	Spindle	0.0277	0.0194	1000	1440	6.85	11.070	1.000	0.707	0.992	(0.701)	1.440	0.805	0.761[c]	(0.881)	0.619	−4.218	—
Totals and averages						28.122	16.019	1.010	0.763	0.977	(0.754)	1.930	1.080	1.110	(2.325)	1.752	12.107	100.00

[a] Reflects a third drawing process of mill "B".
[b] Reflects a second intermediate process of mill "B".
[c] eflects t e ac a mil " " s s g eral l s ri e mo g t e sections ile the standard ill s as separ e i em.

Table No. 56

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Mexico
Industry: Spinning
Type of mill: Modern

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Reduced speeds during break-in periods*	*Lack of training of the workers*	*Unimportant influences favouring productivity*	*Size*			
Total influence 1.31	*Influence of operation 1.12*	*Production*	Draft Sch.	0.99			0.99				
			Speed	1.08	1.08						
			Efficiency	1.07		1.07					
			Total	1.14							
		Excess labour	Direct	1.52							
			Indirect	0.91							
			Miscel.	0.71							
			Total	0.98			0.98				
	Size 1.17							1.17			
	Type of equipment 1.00										
Totals					1.08	1.07	0.97	1.17			
Causes in active process of correction						1.12					
Causes that cannot be eliminated except by enlarging the mills								1.17			

Table No. 57

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Mexico
Industry: Spinning
Type of mill: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences:* *Size (S)*	*Operation (O)*	*Total (T)*
	a	*c*	*d*	*d/c*	*a/d*	*a/c*
15 card.	18.62	12.02	14.54	1.21	1.28	1.55
20 card.	23.70	13.62	17.02	1.25	1.39	1.74
25 card.	27.10	15.75	19.37	1.23	1.40	1.72
30 card.	30.03	18.69	22.43	1.20	1.34	1.61
35 card.	31.95	24.10	28.44	1.18	1.12	1.32
35 comb.	37.45	25.44	30.02	1.18	1.25	1.48
40 comb.	40.00	29.50	34.52	1.17	1.16	1.36
45 comb.	42.92	34.36	39.86	1.16	1.08	1.25
50 comb.	46.08	39.52	45.45	1.15	1.01	1.16
55 comb.	50.00	44.44	51.11	1.15	0.98	1.13
60 comb.	54.35	49.02	56.37	1.15	0.96	1.10
Averages	—	—	—	1.17	1.12	1.31

Table No. 58

Yarn count: 18's carded
Actual productivity: 5.960 kg/m-h.
Standard productivity: 7.140 kg/m-h.
Operational influence: 1.198

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Mexico
Type of mill: Modern
Mill: "C"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence									Man-hours per 100 kg. added by the influences	Percentage of total excess
								Production influence				Labour influence						
		Actual	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*	*Draft schedule influence*	*Rate of delivery of material*	*Process efficiency*	*Total*	*Direct labour*	*Indirect labour*	*Miscellaneous*	*Total*	TOTAL		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Opening and picking	A picker plus necessary opening units	152.6	125.0	1	4	1.414	0.805	1.081	0.854	0.889	(0.820)	4.000	0.536	1.000	(2.140)	1.758	0.610	12.64
Carding	Cards	2.067	4.54	48	49	2.500	1.450	0.917	1.500	1.595	(2.195)	1.021	0.770	1.000	(0.786)	1.725	1.106	22.90
Drawing	Delivery	7.61	6.36	48	32	1.369	0.966	0.914	0.915	1.000	(0.836)	0.667	2.540	1.000	(1.692)	1.417	0.403	8.30
Roving	Spindle	0.145	0.340	240	600	3.236	0.483	1.654	1.200	1.180	(2.324)	2.500	1.151	1.000	(2.880)	6.700	2.705	56.16
Spinning	Spindle	0.0232	0.0207	1,260	1,666	8.260	10.300	1.000	0.900	0.991	(0.892)	1.321	0.690	1.000	(0.899)	0.802	−2.049	—
Totals and averages						16.779	14.004	1.001	1.051	1.012	(1.064)	1.495	0.753	1.000	(1.125)	1.198	2.775	100.00

Table No. 59

Yarn count: 30's carded
Actual productivity: 5.221 kg/m-h.
Standard productivity: 5.350 kg/m-h.
Operational influence: 1.025

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SPINNING MILLS

Country: Mexico
Type of mill: Modern
Mill: "D"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence									Man-hours per 100 kg. added by the influences	Percentage of total excess
								Production influence				Labour influence						
		Actual	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*	*Draft schedule influence*	*Rate of delivery of material*	*Process efficiency*	*Total*	*Direct labour*	*Indirect labour*	*Miscellaneous*	*Total*	TOTAL		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Opening and picking	A picker plus necessary opening units	80.7	125.0	2	4	0.84	0.67	0.942	1.567	1.066	(1.572)	2.000	0.399	1.000	(0.798)	1.253	0.169	4.15
Carding	Card	2.61	3.63	40	42	2.18	1.46	1.000	1.428	0.974	(1.390)	1.050	1.022	1.000	(1.075)	1.493	0.720	17.80
Lap winding	Machine	49.43	131.8	2	2	0.98	0.33	1.000	1.245	2.120	(2.665)	1.000	1.115	1.000	(1.115)	2.970	0.650	16.05
Drawing	Delivery	5.32	5.86	28	54	1.01	1.00	0.976	0.931	1.210	(1.100)	1.928	1.442	0.330[a]	(0.917)	1.010	0.010	0.24
Roving	Spindle	0.1536	0.175	280	526	3.82	1.34	0.889	1.000	1.288	(1.143)	1.878	1.328	1.000	(2.495)	2.860	2.490	61.76
Spinning	Spindle	0.00932	0.0119	2400	2780	10.32	13.87	1.000	1.121	1.139	(1.278)	1.158	0.744	0.676	(0.573)	0.745	−3.400	—
Totals and averages						19.15	18.76	0.984	1.141	1.160	(1.301)	1.262	0.853	0.733	(0.788)	1.025	0.639	100.00

[a] Reflects the fact that the standard mill has one process more of drawing.

Table No. 60

Yarn count: 30's carded
Actual productivity: 3.650 kg/m-h.
Standard productivity: 3.750 kg/m-h.
Operational influences: 1.028

ANALYSIS OF OPERATIONAL INFLUENCES
IN SPINNING MILLS

Country: Mexico
Type of mill: Modern
Mill: "E"

								Operational influence										
								Production influence				Labour influence						
Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment: Actual	Standard	Units of equipment per tender (work-load): Actual	Standard	Labour consumption in man-hours per 100 kg.: Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL	Man-hours per 100 kg. added by the influences	Percentage of total excess
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	138.0	125.0	1	1	0.998	1.111	1.038	0.882	1.000	(0.906)	1.000	0.991	1.000	(0.991)	0.899	0.010	—
Carding	Cards	3.30	3.63	21	36	2.187	2.220	0.903	1.138	1.071	(1.100)	1.711	0.523	1.000	(0.896)	0.987	−0.028	—
Drawing	Delivery	4.04	5.86	48	36	0.506	1.111	0.903	1.200	1.340	(1.451)	0.750	0.837	0.500[a]	(0.314)	0.456	−0.605	—
Drawing	Delivery	4.04	5.22	48	36	0.509	0.555	0.903	1.200	1.340	(1.451)	0.750	0.843	1.000	(0.632)	0.918	−0.045	—
Roving	Spindle	0.159	0.153	216	428	2.907	1.668	1.000	0.962	1.000	(0.962)	1.981	0.916	1.000	(1.814)	1.744	1.140	84.5
Spinning	Spindle	0.01145	0.0119	1500	2500	20.22	20.00	1.000	1.039	1.000	(1.039)	1.666	1.111	0.527[b]	(0.975)	1.012	0.210	15.5
Totals and averages						27.327	26.665	0.985	1.040	1.037	(1.060)	1.580	1.037	0.593	(0.972)	1.028	0.662	100.0

[a] Represents a lap-winder in the standard mill.
[b] General labour is distributed among the sections of the actual mill, while in the standard mill it has been considered as a separate item.

Table No. 61

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Mexico
Industry: Weaving
Type of mill: Old

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Humidification, machine maintenance, lighting*	*Quality of the yarn*	*Lack of product speciali-zation*	*Excessive wear of the equipment, lack of space*	*Type of equipment*	*Size*	
Total influence 3.81	*Influence of operation 1.37*	*Production*	Draft Sch.	—							
			Speed	1.01	1.01						
			Efficiency	1.06			1.06				
			Total	1.07							
		Excess labour	Direct	1.26							
			Indirect	1.02							
			Miscel.	1.00							
			Total	1.28	1.05	1.16		1.05			
	Size 1.06									1.06	
	Type of equipment 2.62								2.62		
TOTALS					1.06	1.16	1.06	1.05	2.62	1.06	
Action to improve manufacturing conditions					1.23						
Action of the industry as a whole							1.06				
Causes not requiring modernization for correction						1.30					
Causes requiring modernization									2.92		

Table No. 62

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Mexico
Industry: Weaving
Type of mill: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*		*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences*			
		Old (m-h/100 kg.)	*Modern (m-h/100 kg.)*		*Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
75	63.57	25.91	9.21	26.69	2.81	1.03	2.38	6.90
100	66.22	33.11	11.01	34.43	3.01	1.04	1.92	6.01
125	68.96	39.68	13.46	41.66	2.95	1.05	1.66	5.12
150	72.20	44.44	15.92	46.66	2.79	1.05	1.55	4.54
175	75.47	48.31	18.52	50.72	2.61	1.05	1.49	4.08
200	79.00	51.55	20.83	54.13	2.47	1.05	1.46	3.79
225	82.99	54.64	22.73	57.37	2.40	1.05	1.45	3.65
250	87.03	58.48	24.45	60.82	2.39	1.04	1.43	3.56
275	91.74	62.50	26.11	65.00	2.39	1.04	1.41	3.51
300	96.52	67.57	27.86	72.98	2.42	1.08	1.32	3.46
325	101.52	72.99	29.67	81.75	2.46	1.12	1.24	3.42
350	107.76	80.00	31.64	88.00	2.53	1.10	1.22	3.40
375	114.28	87.72	33.44	94.74	2.62	1.08	1.21	3.42
400	121.51	98.04	35.09	102.94	2.79	1.05	1.18	3.46
425	129.87	109.89	36.10	113.19	3.04	1.03	1.15	3.60
Averages	—	—	—	—	2.62	1.06	1.37	3.81

Table No. 63

MEXICO: SIZE DISTRIBUTION OF THE WEAVING MILLS

Size (looms)	*Number of mills*	*Percentage of total number of mills*	*Number of looms*	*Percentage of total looms*
10–20	62	27.31	761	2.23
20–50	60	26.43	1,713	5.02
50–100	21	9.25	1,402	4.11
100–200	35	15.42	4,915	14.40
200–300	19	8.37	4,366	12.79
300–500	11	4.85	3,765	11.03
500–700	8	3.52	4,598	13.47
700–1,000	4	1.76	3,106	9.10
1,000–1,500	4	1.76	4,673	13.69
1,500 and over	3	1.33	4,834	14.16
TOTALS	227	100.00	34,133	100.00
10–100	143	62.99	3,871	11.36
100–300	54	23.79	9,821	27.19
300 and more	30	13.22	20,976	61.45

Source: Data from Consejo Nacional de Empresarios de la Industria Textil and regional trade associations, expanded through the survey.
Note: Weaving mills under ten looms have not been taken into consideration.

Table No. 64

Actual fabric: 137's; 54/18 x 50/16; 2118 w.e.; 166.3 g/sq.m.
Standard fabric: 128's; 48/13 x 48/13; 1940 w.e.; 174.3 g/sq.m.
Actual productivity: 1.020 kg/m-h
Standard productivity: 2.480 kg/m-h
Influence of operation: 2.430

ANALYSIS OF THE
OPERATIONAL INFLUENCE
IN SELECTED WEAVING MILLS

Country: Mexico
Type of mill: Old
Mill: "F"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*			*Speed*	*Process efficiency*	*Total*	*Direct*	*Indirect*	*Miscellaneous*	*Total*	TOTAL		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Cone winding	Spindle	140	200	50	56	19	50	54/57	30/30	26.55	3.77	1.430	1.120	(1.600)	2.625	1.058	1.000	(2.775)	4.440	12.993	22.5
Warping	Warper	90	80	46.5	65	1	1	13/14	20/31	77.0	1.30	0.889	1.398	(1.242)	1.000	0.695	1.000	(0.695)	0.865	−0.175	—
Slashing	Slasher	20	25.4	63.5	62	1	1	7/18	17/26	91.80	1.09	1.270	0.976	(1.240)	1.000	1.682	1.000	(1.682)	2.085	1.182	2.0
Weaving	Loom	170	170	80	78	2	5	490/621	600/815	293	34.140	1.000	0.975	(0.975)	2.500	0.934	1.000	(2.335)	2.275	43.500	75.5
Totals and averages										2.480	40.300	1.042	1.008	(1.052)	2.410	0.955	1.000	(2.310)	2.43	57.500	100.0

Table No. 65

Actual fabric: 79.5's; 69/8 x 38/13; 2000 w.e.; 314.0 g/sq.m.
Standard fabric: 79.6's; 40/7.5 x 26/8.5; 1620 w.e.; 192.5 g/sq.m.
Actual productivity: 2.17 kg/m-h
Standard productivity: 3.53 kg/m-h
Influence of operation: 1.63

ANALYSIS OF THE
OPERATIONAL INFLUENCE
IN SELECTED WEAVING MILLS

Country: Mexico
Type of mill: Old
Mill: "G"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Operational influence	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*			*Speed*	*Process efficiency*	*Total*	*Direct*	*Indirect*	*Miscellaneous*	*Total*	TOTAL		
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Cone winding	Spindle	450	200	74	52	8	35	19/22	42/42	27.0	3.70	0.444	0.703[a]	(0.302)	4.380	1.159	1.000	(5.650)	1.765	2.830	15.7
Warping	Warper	60	80	40	71	1	1	5/5	7/12	84.6	1.18	1.332	1.775	(2.365)	1.000	0.583	1.000	(0.583)	1.380	0.448	2.5
Slashing	Slasher	12	24	50	60	1	1	2/4	6/9	108.8	0.92	2.000	1.200	(2.400)	1.000	1.333	1.000	(1.333)	3.200	2.022	11.3
Weaving	Loom	170	170	55	76	3.75	4	16/22.5	150/214	4.44	22.50	1.000	1.382	(1.382)	1.142	0.985	1.000	(1.127)	1.560	12.600	70.5
Totals and averages										3.53	28.30	0.975	1.375	(1.340)	1.222	0.995	1.000	(1.218)	1.63	17.900	100.0

[a] Modern cone winders.

Table No. 66

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Mexico
Industry: Weaving
Type of mill: Modern

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Reduced speeds during break-in period*	*Lack of training of loom-fixers*	*Lack of speciali-zation of work*	*Size*
Total influence 1.42	*Influence of operation 1.28*	*Production*	Draft Sch.	—				
			Speed	1.06	1.06			
			Efficiency	1.23		1.15	1.07	
			Total	1.30				
		Excess labour	Direct	2.00				
			Indirect	0.49				
			Miscel.	1.00				
			Total	0.98			0.98	
	Size 1.11							1.11
	Type of equipment —							
TOTALS					1.06	1.15	1.05	1.11
In process of correction					1.22			
Action to reorganize personnel							1.05	
Causes which can be eliminated					1.28			
Causes which cannot be eliminated except by enlarging the mills								1.11

Table No. 67

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Mexico
Industry: Weaving
Type of mill: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences:* *Size (S)*	*Operation (O)*	*Total (T)*
	a	*c*	*d*	*d/c*	*a/d*	*a/c*
150	27.18	15.92	19.10	1.20	1.42	1.71
175	28.17	18.52	22.59	1.22	1.25	1.52
200	29.55	20.83	25.62	1.23	1.15	1.42
225	30.86	22.73	28.18	1.24	1.10	1.36
250	32.54	24.45	30.81	1.26	1.06	1.33
275	34.60	26.11	30.81	1.18	1.12	1.32
300	36.82	27.86	30.65	1.10	1.20	1.32
325	39.52	29.67	30.86	1.04	1.28	1.33
350	42.68	31.64	32.59	1.03	1.31	1.35
375	46.51	33.44	34.44	1.03	1.35	1.39
400	51.47	35.09	35.79	1.02	1.44	1.47
425	57.47	36.10	36.46	1.01	1.58	1.59
Averages	—	—	—	1.11	1.28	1.42

Table No. 68

Actual fabric: 137's; 43/18 x 44/14; 1880 w.e.; 148 g/sq.m.
Standard fabric: 128's; 48/13 x 48/13; 1940 w.e.; 174 g/sq.m.
Actual productivity: 3.47 kg/m-h
Standard productivity: 6.350 kg/m-h
Influence of operation: 1.83

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Country: Mexico
Type of mill: Modern
Mill: "H"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cone winding	Spindle	600	600	68.5	70	18	30	4/5	12/12	51.70	1.94	1.000	1.021	(1.021)	1.666	1.250	1.000	(2.08)	2.126	2.18	15.8
Warping	Warper	300	500	47.7	60	1	1	1/2	1/7	88.80	1.12	1.668	1.259	(2.095)	1.000	0.286	1.000	(0.286)	0.599	−0.67	—
Slashing	Slasher	21	36	62	65	1	2	3.9/9.1	3/6	103.60	0.96	1.713	1.048	(1.797)	2.000	1.168	1.000	(2.336)	4.190	3.06	22.2
Weaving	Loom	155	192	70	90	21	72	8.1/20.8	9/73	8.52	11.73	1.240	1.285	(1.593)	3.430	0.316	1.000	(1.083)	1.728	8.52	62.0
Totals and averages										6.350	15.750	1.270	1.221	(1.550)	2.950	0.401	1.000	(1.182)	1.835	13.090	100.0

Table No. 69

Actual fabric: 308's; 62/30 x 58/36; 2760 w.e.; 90.81 g/sq.m.
Standard fabric: 332's; 80/30 x 80/40; 3144 w.e.; 111.75 g/sq.m.
Actual productivity: 3.199 kg/m-h
Standard productivity: 3.311 kg/m-h
Influence of operation: 1.034

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Country: Mexico
Type of mill: Modern
Mill: "I"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				TOTAL	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Cone winding	Spindle	750	600	65	70	30	50	10/10	18/18	33.56	2.97	0.800	1.076	(0.860)	1.666	1.000	1.000	(1.666)	1.432	1.28	42.8
Warping	Warper	450	500	70	60	1	1	2/2	3/10	59.70	1.67	1.110	0.858	(0.952)	1.000	0.300	1.000	(0.300)	0.285	−1.19	—
Slashing	Slasher	35	34	80	65	1	2	2/2	3/8	74.00	1.35	0.971	0.812	(0.788)	2.000	0.374	1.000	(0.748)	0.588	−0.55	—
Weaving	Loom	198	192	69	90	47	63	15/54	24/142	4.15	24.09	0.969	1.304	(1.263)	1.340	0.615	1.000	(0.824)	1.042	1.011	57.2
Totals and averages											30.08	0.964	1.231	(1.188)	1.369	0.627	1.000	(0.859)	1.020	0.551	100.0

Table No. 70

MEXICO

SUMMARY OF THE ANALYSES OF THE INFLUENCE OF OPERATION, AND EXTENSION OF THE RESULTS TO THE GENERAL SAMPLE

Industry	*Mill*	*Actual labour consumption (m-h/100 kg.)*	*Standard labour consumption (m-h/100 kg.)*	*Influence of operation* — *Production* — *Draft Schedule*	*Production* — *Speed*	*Production* — *Process efficiency*	*Production* — *Total*	*Excess of labour* — *Direct*	*Excess of labour* — *In-direct*	*Excess of labour* — *Miscel-laneous*	*Excess of labour* — *Total*	TOTAL
		(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*
Old spinning mills	A	66.36	31.60	0.928	0.769	1.121	(0.800)	4.040	1.019	0.635	(2.610)	2.090
	B	28.12	16.02	1.010	0.763	0.970	(0.754)	1.930	1.080	1.110	(2.325)	1.752
	Averages	47.24	23.81	0.957	0.765	1.060	(0.775)	3.320	1.060	0.732	(2.560)	1.980
	Extension to the general sample	115.83	50.16	0.96	0.75	1.25	(0.90)	3.32	1.06	0.73	(2.56)	2.31
Modern spinning mills	C	16.78	14.00	1.001	1.051	1.012	(1.064)	1.495	0.753	1.000	(1.125)	1.198
	D	19.15	18.67	0.984	1.141	1.160	(1.301)	1.262	0.853	0.733	(0.788)	1.025
	E	27.33	26.66	0.985	1.037	1.040	(1.060)	1.580	1.037	0.593	(0.972)	1.028
	Averages	21.09	19.78	0.988	1.075	1.071	(1.137)	1.447	0.914	0.710	(0.939)	1.067
	Extension to the general sample	36.56	32.65	0.99	1.08	1.07	(1.14)	1.52	0.91	0.71	(0.98)	1.12
Old weaving mills	F	97.93	40.30	—	1.042	1.008	(1.052)	2.410	0.955	1.000	(2.310)	2.430
	G	46.13	28.30	—	0.975	1.375	(1.340)	1.222	0.995	1.000	(1.218)	1.630
	Averages	72.30	34.30	—	1.014	1.154	(1.170)	1.744	1.026	1.000	(1.789)	2.094
	Extension to the general sample	95.08	66.07	—	1.01	1.06	(1.07)	1.26	1.02	1.00	(1.28)	1.37
Modern weaving mills	H	28.90	15.75	—	1.270	1.221	(1.550)	2.950	0.401	1.000	(1.182)	1.835
	I	31.42	30.08	—	0.964	1.231	(1.188)	1.369	0.627	1.000	(0.859)	1.020
	Averages	30.16	22.92	—	1.069	1.228	(1.313)	2.012	0.492	1.000	(0.990)	1.299
	Extension to the general sample	32.66	29.83	—	1.06	1.23	(1.30)	2.00	0.49	1.00	(0.98)	1.28

Chapter VI

PERU

I. Summary and conclusions

A. *Productivity of the industry*

374. The Peruvian cotton textile industry differs from those of the other Latin-American countries visited in that nearly every degree of modernity of equipment can be found in its mills. This is because the Peruvian manufacturers have mainly attempted to modernize the old mills, gradually equipping them with modern sections; elsewhere, the practice generally followed was to build new mills which are entirely independent of the old ones, though the latter continue in operation.[103]

375. For this reason, instead of dividing old, modern and semi-modern mills into three separate groups, as in the other countries, the samples contain the productivity results gathered in the processes which more or less correspond to these three groups.

376. A total of thirty-eight observations[104] were made in five spinning mills and three weaving mills which together represent 35 per cent of the spindles and 28 per cent of the looms in the country.

377. The measurements in a completely modern weaving process could only be made in a mill which had just recently installed its looms and which was still working irregularly. The productivity results observed appear in the analysis, but they are not discussed in relation to the general conditions of the Peruvian textile industry, as they are not considered representative of it.

378. The results of the investigation in the old processes show that productivity could be substantially improved, but that the margin for improvement is not as great as in other countries (with the exception of the Mexican weaving mills) because manufacturing conditions and the organization of labour are better. Productivity could be increased by 53 per cent in the old spinning processes without modernizing the equipment and by 166 per cent if all the machinery were changed, the mills enlarged and provided with the best possible labour organization. In the old weaving mills, an increase of 85 per cent could be achieved without the need for large investments and of 411 per cent, if the installations were converted into well-organized modern mills.

379. Productivity is also relatively high in the weaving processes which have been termed "semi-modern" because they use old, low-speed automatic looms; the margin for improvement would only be 74 per cent if no investment in machinery is made and 124 per cent if the looms were replaced by completely new machines.

380. The margin for improvement in the modern spinning processes is small, but judging from the sample, the present possibilities of obtaining optimum productivity are considerably reduced by the small size of the mills. Productivity could be raised 60 per cent without increasing the present capacity of the modern spinning mills, whereas if they were able to obtain all the conditions necessary for high productivity, including optimum size, the total increase would be 146 per cent.

381. The above figures show that, contrary to what occurs in the corresponding sectors of other countries, in the old processes in Peru the causes of low productivity which could be corrected by better administrative action are less important than those which cannot be corrected without investing considerable amounts in modernization, that is, those deriving from the type of equipment, size, and wear of machinery. In other words, the maintenance of the machinery, the quality of the products and other conditions indicating effective administration, are better in Peru than in the majority of the old mills of the other countries.

382. The explanation of this contrast with the rest of the old Latin-American textile industry can perhaps be found in various factors which influenced the development of the Peruvian textile mills. In the first place, these mills were originally installed with less labour; most of the technicians were brought from more industrialized countries (United States and England) and labour organization was patterned on that adopted by regions where wages are high and machinery cheap. Secondly, as opposed to the policy adopted by many other Latin-American countries, the Peruvian textile industry was never granted much protection, chiefly because the country exported cotton and was consequently compelled to accept the textiles manufactured by its customers.[105] Thus, the manufacturers were undoubtedly encouraged to produce better qualities at lower costs—a step which could only be taken by gradual improvement of the equipment, of the technical and administrative methods, and of labour utilization. Thirdly, almost half the country's present capacity (43 per cent of the spindles and 48 per cent of the looms) was developed after 1933, during a period of active

[103] It is estimated that in Peru 25 per cent of the spindles are new and 35 per cent of the looms automatic.

[104] The distribution of the observations was as follows: eleven in old spinning processes; fifteen in modern spinning processes; three in old weaving processes; five in semi-modern weaving processes with old automatic looms; and four in modern weaving processes with modern automatic looms.

[105] Foreign competition reached a critical stage in 1935, when the volume of Japanese fabrics seriously endangered Peru's industry. The Government accordingly issued a decree, establishing import quotas which limited the amount of manufactured cotton goods to be imported from various countries.

growth of certain economic activities (principally urbanization, public works, mining, oil and its derivatives). This, likewise in contrast with the other Latin-American countries, gave rise to a demand for labour, which favoured the establishment of mills along better lines of organization, as regards the working systems and a greater economy of labour. Complete freedom to organize labour in the most advantageous manner may no longer prevail, since, for reasons not discussed in this report, the textile industry has had to reduce the rate of production and even shorten its work-shifts; this has created a surplus of textile labour and has put the workers on the defensive against improvements in methods or machines which might involve their dismissal. As has already been stated, however, the important point to notice is that at its inception and during its development, the industry was set up on the basis of economy of labour, which in turn demanded much stricter systems of technical and administrative control, than those employed in other Latin-American countries.

383. The foregoing reasons may to a great extent explain why organization and manufacturing conditions in Peru are relatively better, and also why relatively less labour is required than in the majority of the textile industries of other Latin-American countries. The existing excess of workers, however, though small, is probably largely due, as in other countries, to the proportionately low average wages of textile workers in relation to average prices of the fabrics. The ratio of the average cost per man-hour to the price per metre of fabric in Peru is 0.57, whereas it is 3.56 in the United States.[106] This indicates, even if only in relation to other countries, that the incentives to better organization in Peruvian industry were partly weakened by the comparative insignificance of a moderate excess of labour.

B. *Causes of low productivity in the old processes*

384. Amongst the causes which it is considered could be corrected without modernizing the machinery, the only one of importance is the employment of superfluous labour; this increases the consumption of labour per kilogramme produced by 48 per cent in the spinning, and 85 per cent in the weaving processes. This excess of workers, as was already pointed out, is relatively small in comparison with the corresponding excess in other countries; it arises simply because the work-loads, or machine units assigned per tender, are generally lower than what could be considered normal, without demanding too great an effort from the worker, or affecting the quality of the products.

385. This group includes other less important causes, such as the general lack of humidity control systems affecting both the spinning and the weaving processes, and the defects in the quality of the yarn, which lower the productivity of the weaving mills. The former probably increases labour consumption by 10 per cent in the spinning mills and by 5 per cent in the weaving mills. This estimate was based on observations made in countries of a similar climate, where the output of a mill was compared before and after the installation of humidity control equipment. The quality of the yarn is higher than in most of the old Latin-American mills, but in any case it is estimated to cause an increase of 12 per cent in labour consumption per kilogramme of fabric.

386. In addition to these causes, certain machines were found to be working at higher speeds than is normal, thus probably decreasing labour consumption by 6 per cent in the spinning mills, and 3 per cent in the weaving mills, though in some cases this may affect the quality of the products.

387. As already stated, this group of causes which can be principally corrected by administrative action (though entailing some expenses such as the installation of systems to control humidification), is less important than the group which can only be eliminated by large investments in machinery and by increasing the capacity of the mills. The most important in this latter group is the type of equipment, that is, the use of old machinery instead of modern, which increases labour consumption by 34 per cent in the spinning mills and 161 per cent in the weaving mills. There is relatively little wear on the equipment in Peru as, on the whole, the maintenance services are satisfactory, though it is estimated to cause labour consumption increases equivalent to 7 per cent in the spinning mills and 5 per cent in the weaving mills.

388. Judging from the sample, small size is of no importance in the weaving mills, but in the spinning mills it raises labour consumption per kilogramme by 21 per cent.

C. *Causes of low productivity in the semi-modern weaving processes*

389. In the semi-modern (with old automatic looms), as in the old weaving processes, the most important of the low productivity causes which can be corrected by management action is the employment of superfluous labour; this increases labour consumption per kilogramme of fabric by 40 per cent. The increases in labour consumption arising from the poor quality of the yarn and the lack of humidification control are the same as in the case of the old processes. The low speeds of the weaving preparation machines cause an increase of 5 per cent in the total consumption of labour per kilogramme of fabric.

390. The group of causes which can only be corrected by the purchase of new machinery and the enlargement of the factories, includes the difference of speed between the old and the modern automatic looms, the normal wear of the equipment after many years of use, and the small size of the mills. The increases in the consumption of labour arising from those causes are 15, 5 and 9 per cent respectively.

D. *Causes of low productivity in the modern weaving processes*

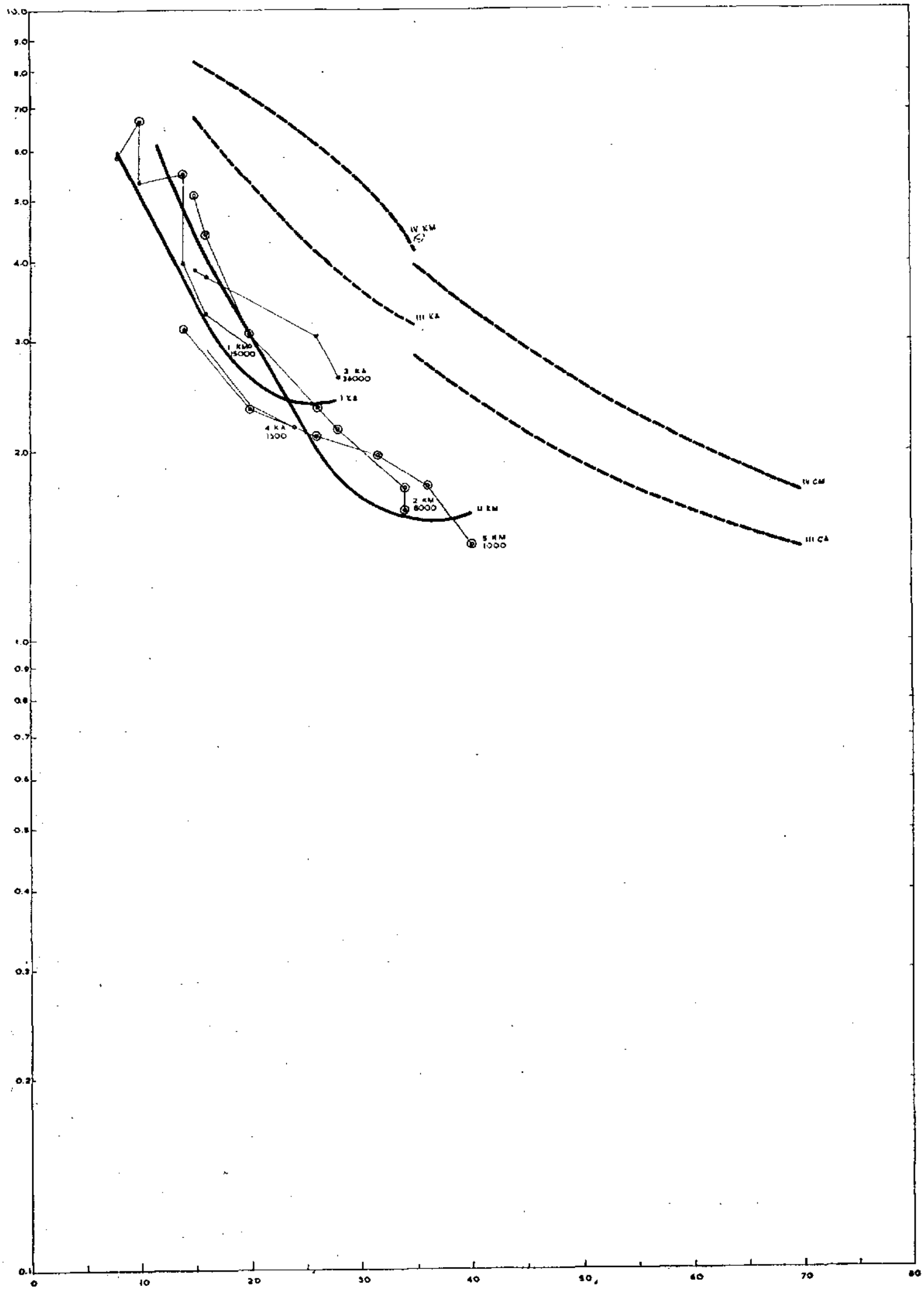
391. The employment of superfluous labour is again the most important of the causes that can be corrected by management action. It increases labour consumption by 48 per cent, and it is also due, as in the old mills, to the relatively low work-loads. The lack of humidity con-

[106] In the case of Peru this relationship was based on values of 1.56 soles per man-hour and 2.75 soles per metre of fabric, while for the United States the corresponding values were 0.982 dollars per man-hour and 0.276 dollars per metre.

Graph No. 11

PRODUCTIVITY OF THE SPINNING MILLS INCLUDED IN THE SAMPLE

Peru



X—Yarn count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 25000-spindle mill
IV—Standard productivity of a modern 25000-spindle mill

K—Means carded yarn
C—Means combed yarn
A—Means an old mill
M—Means a modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in spindles.

trol, as in other cases, accounts for an increase of 10 per cent, while the high speeds reduce the consumption of labour by 2 per cent.

392. The only cause which could not be corrected solely by management action is the small size of the mills which, judging by the sample, increases the number of man-hours required to produce a kilogramme of yarn by 54 per cent.

II. Comments, results and analysis of the spinning mills of Peru

A. *General comments*

393. The individual productivity of the Peruvian spinning mills, included in the sample, is shown in graph 11, together with the general averages of the results for old and modern processes and the productivities of the standard mills which were used for comparison.

394. The points on the curves marked with a ring correspond to old processes and those marked with two rings correspond to modern processes. Mill no. 1-KMA has a completely modern card-room and both old (1925) and modern (1948) spinning frames; mill no. 2-KM is completely modern (1940); mill no. 2-KA is old (1901-1928), with semi-modern opening and picking equipment (1901-1928); mill no. 4-KA is typically old and has reconditioned machinery; and spinning mill no. 5-KM is equipped with modern European machinery (1944).

395. The following observations can be made from graph 11.

(*a*) There is considerable similarity between the productivity results in the old and the modern processes, and the average curves are fairly close together; this indicates that the modern processes have not derived all the potential advantages of the new machinery, principally because labour is organized in much the same way as in the old processes;

(*b*) A certain correlation between the size of the mills and their productivity indicates that, generally speaking, labour has been organized with a view to attaining an optimum level of specialization for a mill of a specific size;

(*c*) The fact that the average curves and the curves representing standard productivity are almost parallel indicates that the work-loads have been determined by fairly rational methods, that is, that the type of product was taken into consideration, when assigning the number of machines or machine units per tender;

(*d*) The position of curve 3-KA shows practically the decided advantage of an old large spinning mill over several modern spinning mills of smaller capacity and less perfected organization.

(*e*) Spinning mills nos. 4-KA (1,500 spindles) and 5-KM (1,000 spindles) are at a definite disadvantage, in comparison with other mills, owing to their extremely small size. Even under the best possible administrative conditions, the consumption of labour in these mills would always be more than double that of mills of optimum size.

396. The following general observations were made in the Peruvian spinning mills:

(*a*) The cleaning, lighting, and maintenance of the machinery are good (most mills have installed, or are installing, fluorescent lighting).

(*b*) Few mills have adopted humidification control systems, because it is considered that the climate (of Lima) provides the necessary humidity for textile processes. Probably not enough importance is given to maintaining humidity within the limits suitable for production in each of the sections of the mills. During this investigation it was not possible to determine the precise effect of this lack of humidity control upon productivity. The figures given in this report are merely estimates, based upon the experience of manufacturers in other countries, and should be replaced by technical data supplied from a careful study of the Peruvian textile industry.

(*c*) Though most of the mills have efficiency controls, and have adopted the means of checking the quality of the products and the waste of raw material, there is still much room for improvement. The same applies to the methods of determining work-loads.

(*d*) The working condition of the machinery, whether old or modern, is fairly good, due chiefly to careful maintenance. Two of the mills visited had imported second-hand machinery and appeared satisfied with the results.

B. *Analysis of the results in the old spinning processes*

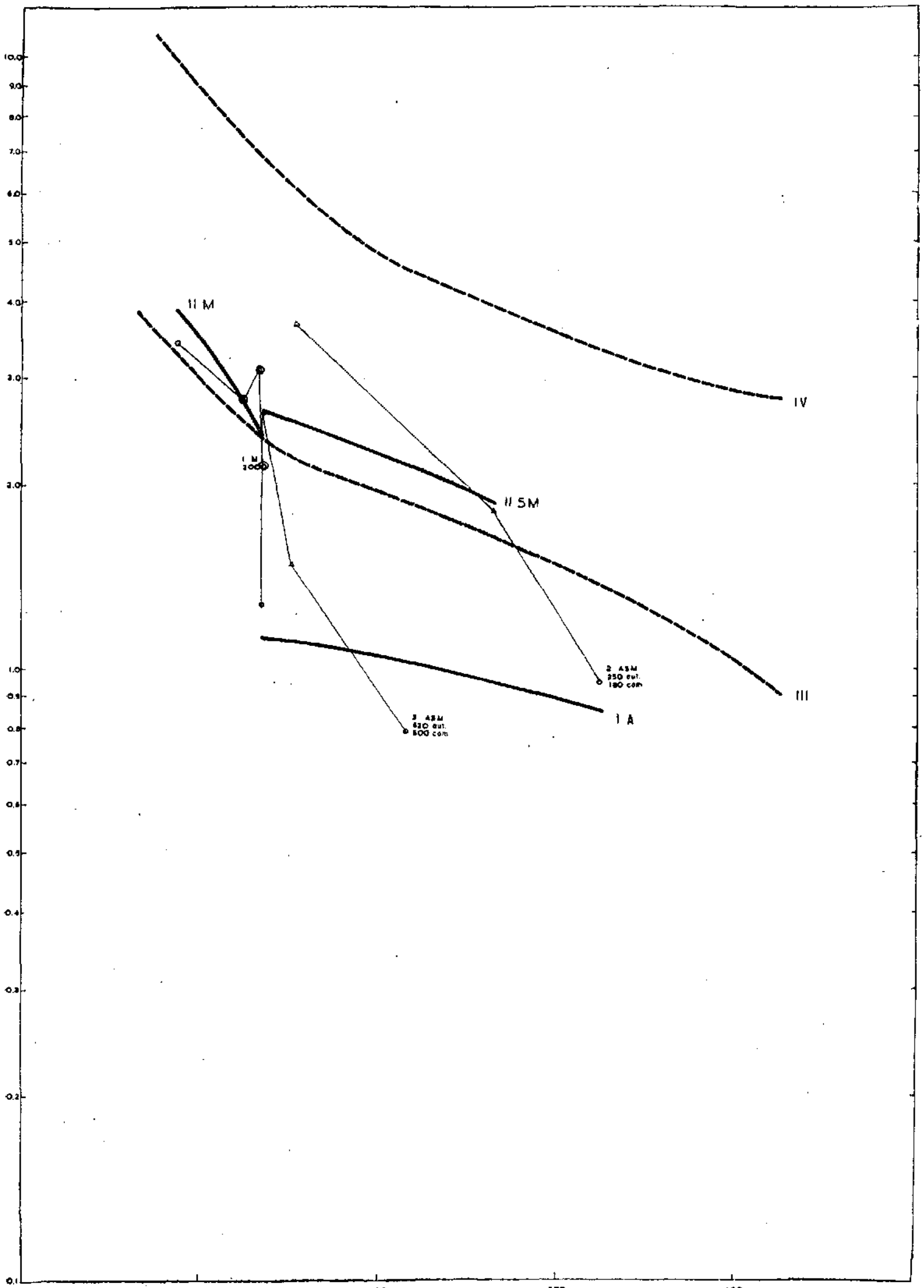
397. Table 71 is a summary of the average values of the influences, that is, of the indices of the importance of the factors affecting the productivity of the spinning processes.[107] The total influences and its principal components—the influences of operation, type of equipment and size—are the averages of the influences of each yarn which were obtained in table 72, by means of comparisons between actual and standard labour consumption per kilogramme of yarn.

398. The influence of size in the mills included in the sample (1.21) is greater than that of the weighted average for the whole country (1.16) because the sample contained a higher proportion of small mills than actually exists in the industry. Both these values, however, indicate the presence of a structural deficiency which has a considerable effect upon productivity. Table 73 shows that over 50 per cent of the spinning mills have less than 5,000 spindles and that between the limits established for optimum size, there is only one mill.

399. The influence of the type of equipment (1.34) was calculated on the assumption that all the machinery was old. This in fact is not the case, as there are a few modern pieces, or sections, of machinery in nearly all the processes considered as old; the value shown is therefore slightly higher than the actual influence.

[107] If these influences are subtracted from 1 and multiplied by 100, they become the present percentages of excess labour per kilogramme produced, or the potential increases of productivity, expressed as a percentage of present productivity, which could be obtained by eliminating the causes affecting it. The component or partial influences have the same significance as the total influences, but refer to specific causes. When the influences of two or more causes are multiplied together, the product is the influence of the combination of these causes. The reciprocal of an influence, subtracted from 1 and multiplied by 100, is the loss of productivity, as a percentage, originating from the cause corresponding to that influence.

Graph No. 12
PRODUCTIVITY OF THE WEAVING MILLS INCLUDED IN THE SAMPLE
Peru



X—Fabric count
Y—Productivity in kilograms per man-hour
I—Average of the old mills
II—Average of the modern mills
III—Standard productivity of an old 500-loom mill
IV—Standard productivity of a modern 500-loom mill

A—Means an old mill
M—Means a modern mill
SM—Means a semi-modern mill

The first number of a mill's key number is a reference. The number underneath is the size of the mill in looms.

400. The influence of operation (1.64) was broken down into the influences of the draft schedule, speed, efficiency and the excess of direct, indirect and miscellaneous labour, by means of the analysis of mill "A" (table 74), which can be considered as typically old. The averages of the influences of all the processes of this spinning mill were adjusted (last line of table 74) so that the result equals the influence of operation already determined by the general sample.

401. The redistribution of the influences, shown in table 71, was made in the light of the following considerations:

(*a*) The influence of excessive wear of the machinery was computed as being 1.07, based on the average time probably lost in machine repairs. As this figure coincides with the value of the influence of efficiency, the total of the latter was attributed to wear of the machinery, in order to simplify the distribution;

(*b*) Part of the excess labour (1.71) is undoubtedly employed in offsetting the effect of the lack of control of humidification and the excessive speeds of the machinery on efficiency. The former is estimated to cause an excess labour consumption equivalent to 10 per cent; this calculation was based on comparisons made with and without humidification control, in the same mill and in a climate similar to that of Lima. An estimated value of 1.05 was attributed to the influence of higher-than-normal speeds. The excess labour remaining (1.48) after these two causes of low productivity were discounted, was assumed to be entirely superfluous labour that could be eliminated by better organization of the work.

402. The lower part of table 71 shows the rearrangement of the influences in groups corresponding to the causes requiring management action to reduce labour and to improve certain manufacturing conditions. The influences were also grouped according to causes which could be eliminated, without involving modernization of the mills and causes which could only be corrected by changing the machinery and enlarging the capacity of the mills.

C. *Analysis of the results in the modern spinning processes*

403. Table 75 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting productivity in the modern spinning processes. The total influence and its principal components—the influences of operation and size—are the averages of the influences of each yarn count which were obtained in table 76, by means of comparisons between actual and standard labour consumptions per kilogramme.

404. The samples do not include a sufficient number of mills of each size to be entirely representative of the industry; notwithstanding, the contrast between the influence of size in the modern (1.54) and in the old spinning mills (1.21) indicates a tendency to build smaller units.

405. The influence of operation (1.60) was broken down into the influence of the draft schedule, speed, efficiency and excess of direct, indirect and miscellaneous labour, by the analysis of mill "B" (table 77), which is completely modern. The averages of the influences of all the processes of this spinning mill were adjusted (last line of table 77) so that the result should equal the influence of operation, already determined by the general sample.

406. The redistribution of the influences, which appears in table 75, was based on the same considerations as in the case of the old spinning mills, except that in the modern processes, there was no influence caused by wear of machinery.

407. The lower part of table 75 shows the rearrangement of the influences into groups of causes (1) which require management action to reduce labour; (2) which require the improvement of manufacturing and operating conditions; (3) which can be corrected by administrative action; and (4) which cannot be eliminated without enlarging the mills.

III. Comments, results and analysis of the weaving mills of Peru

A. *General comments*

408. The individual productivity of the Peruvian weaving mills, included in the sample, is shown in graph 12, together with the general averages of the results of the old, semi-modern and modern processes, and the productivity of the standard mills which served as models of comparison.

409. The points of the curves marked with a ring correspond to the old processes; those with two rings denote modern processes; and those with a triangle refer to the processes designated as "semi-modern", because old automatic looms (1917) are used together with both old and modern machines for weaving preparation. Weaving mill 1-M is entirely modern (1948), and the yarn used is manufactured by both old and modern processes; mill 2-ASM has non-automatic and old automatic looms, but uses yarn manufactured by an absolutely modern spinning-mill; weaving mill 3-ASM also has non-automatic and old automatic looms and uses yarn produced in a typically old mill.

410. The following observations can be made from graph 12:

(*a*) The contrast between the productivity of weaving mill 2-ASM, consuming yarn from a modern spinning mill, and that of 3-ASM, which obtains its material from an old mill, indicates that the quality supplied by modern spinning processes has a very important effect upon the productivity of the weaving mills. As other manufacturing conditions in these two mills are approximately the same, the average relationship between their productivities duly adjusted to allow for discrepancies in labour organization was then taken as a basis for estimating the average influence of the yarn quality on productivity;

(*b*) The difference in productivity between the two observations made in mill 3-ASM, which manufactures fabrics of similar counts (approximately 135) but employing different types of looms, is a practical demonstration of the highly beneficial results to be obtained as regards productivity by the use of automatic looms.

411. The general observations relating to the weaving mills are the same as those made in the case of the

spinning mills. Furthermore, it was found that the quality of the fabrics produced in most of the mills is excellent; this is due not only to the high grade local cotton, but also to a traditional effort to perfect both the workers' skill and manufacturing conditions. It is curious to note that one of the mills had recently installed new English looms of the ordinary type (non-automatic); this probably reflects the influence of the English belief that automatic looms do not produce the best quality.

B. *Analysis of the results in the old weaving processes*

412. Table 78 is a summary of the average values of the influences, that is, the indices of the importance of the factors affecting the productivity of the old weaving processes. The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences corresponding to each yarn count and were obtained in table 79, by comparisons between actual and standard labour consumptions per kilogramme of fabric.

413. The influence of size in the mills included in the sample (1.01) almost coincides with the average weighted influence for the whole industry (1.02); it is of no great importance since, as shown in table 80, 33 per cent of the weaving mills (77 per cent of the total loom capacity) consists of mills of over 300 looms; theoretically, their productivity could reach a level approximate to that of optimum size mills.

414. The influence of the type of equipment (2.61) was calculated as though all the machinery were completely old. As this is not the case, since in all the preparatory processes (cone-winding, warping and slashing) there are some pieces or sections of modern machinery, the value given is in fact slightly higher than that of the actual influence.

415. The influence of operation (1.94) was broken down into the influences of speed, efficiency and excess of direct, indirect and miscellaneous labour by the analysis of the old process of mill "C" (table 81), which is supplied with yarn from its own old spinning mill and which is equipped with cone-winders dating from 1930, warpers dating from 1934, slashers dating from 1904, and ordinary looms built at the beginning of the century. The averages of the influences of all the sections of this weaving mill were adjusted (last line of table 81) so that the result should equal the influence of operation which had already been determined by the general sample.

416. The redistribution of the influences, shown in table 78, was made in the light of the following considerations:

(*a*) The influences of the lack of humidification control and of the wear of machinery were estimated as in the case of the old spinning mills;

(*b*) The influence of the quality of the yarn (1.12) was estimated, bearing in mind the comparisons of productivity made in Peruvian mills where conditions, management and machinery were approximately equivalent though the yarn was supplied by old and modern spinning mills. This estimate, after adjustment to allow for differences in the organization of labour, was checked against the values attributed to this influence in other countries, which in most cases were based on observations of the frequency of loom stops per unit of time;

(*c*) The product of the estimated influences of humidity, quality of the yarn and wear of the machinery coincided approximately with the value of the influence of efficiency, which was calculated by extending the results of the small sample to the general sample. It was therefore assumed that the total excess labour (1.62) was due entirely to superfluous personnel, which could be eliminated without lowering present efficiency.

417. As in the analyses of the other sectors of the industry, the influences were rearranged in the lower part of table 78 in order to show the importance of the groups of causes: (1) which require management action to reduce labour; (2) which require similar action to improve manufacturing and operating conditions; (3) which can be corrected without modernizing the machinery; and (4) which can only be eliminated by acquiring new looms.

C. *Analysis of the results in the semi-modern weaving processes*

418. Table 82 is a summary of the average values of the influences, that is, of the indices of the importance of the factors affecting productivity in the semi-modern weaving processes. The total influence and its principal components—the influences of operation, type of equipment and size—are the averages of the influences corresponding to each fabric count which were obtained in table 83, by comparisons between actual and standard labour consumption per kilogramme of fabric.

419. Although in the mills included in the sample the influence of size was assigned a value of 1.07, it must be pointed out that in mills containing both old and semi-modern processes it is impossible to separate entirely the organizations of personnel corresponding to each type, since several sections and a number of workers are common to both. As the value given was calculated on the assumption of completely independent organization, it is slightly higher than in reality.

420. The influence of the type of equipment stems almost entirely from the difference in speeds between old and modern automatic looms. Its value (1.15) was calculated as the weighted average of the influences of speed of all the processes of mill "D" (table 84), considering the influence in each of the preparatory sections (cone-winders, warpers and slashers) as unity, and using as weights the standard labour consumptions of the sections.

421. The influence of operation (1.82) was broken down into the influence of speed (of the preparatory processes), efficiency and the excess of direct, indirect and miscellaneous labour, by means of the analysis of the semi-modern process of mill "D" (table 84). The averages of the influences of all the sections of this weaving mill were adjusted (last line of table 84), so that the result should equal the influence of operation, already determined by the general sample.

422. The redistribution of the influences, which appears in table 82, was based on the same considerations as in the case of the old weaving mills. The lower part of the table also includes the rearrangement of the influences showing the importance of the causes of low productivity, that is, those which can be eliminated by management action, those which can be corrected without modernization, and those which can only be eliminated by changing the old automatic looms for new ones and enlarging the capacity of the mills.

Table No. 71

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Peru
Industry: Spinning
Type of mill: Old

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Superfluous personnel, after allowing for present conditions*	*Humidification*	*Higher-than-normal speeds*	*Wear of the machinery*	*Type of equipment*	*Size*
Total influence 2.66	*Influence of operation 1.64*	*Production*	Draft Sch.	1.00						
			Speed	0.90			0.90			
			Efficiency	1.07				1.07		
			Total	0.96						
		Excess labour	Direct	2.22						
			Indirect	0.82						
			Miscel.	0.94						
			Total	1.71	1.48	1.10	1.05			
	Size 1.21									1.21
	Type of equipment 1.34								1.34	
TOTALS					1.48	1.10	0.94	1.07	1.34	1.21
Action to reduce labour					1.48					
Action to improve conditions						1.03				
Causes not requiring modernization for correction						1.53				
Causes requiring modernization									1.74	

Table No. 72

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE AND OPERATION

Country: Peru
Industry: Spinning
Type of mill: Old

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size*		*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences*			
		Old (m-h/100 kg.)	*Modern (m-h/100 kg.)*		*Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
15 K	27.94	14.66	12.02	17.15	1.22	1.17	1.63	2.32
20 K	38.33	18.15	13.62	22.32	1.33	1.23	1.72	2.81
25 K	43.82	22.68	15.75	27.67	1.44	1.22	1.58	2.78
Averages	—	—	—	—	1.34	1.21	1.64	2.66

Table No. 73

PERU: SIZE DISTRIBUTION OF THE SPINNING MILLS

Size (spindles)	*Number of mills*	*Percentage of total number of mills*	*Number of spindles*	*Percentage of total spindles*
Up to 2,000	4	18.2	4,312	2.4
2,000– 5,000	8	36.4	22,112	12.5
5,000–10,000	5	22.7	34,488	19.6
10,000–15,000	—	—	—	—
15,000–25,000	4	18.2	79,589	45.1
25,000–50,000	1	4.5	35,831	20.4
TOTALS	22	100.0	176,332	100.0
Up to 5,000	12	54.6	26,434	14.9
5,000–15,000	5	22.7	34,488	19.6
15,000 and over	9	22.7	115,420	65.5

Source: Basic data for July 1950, given by Banco Industrial del Perú.

Table No. 74

Yarn count: 26 carded
Actual productivity: 2.030 kg/m-h.
Standard productivity: 4.520 kg/m-h.
Operational influence: 2.225

ANALYSIS OF THE OPERATIONAL INFLUENCE IN THE SPINNING MILLS

Country: Peru
Type of mill: Old
Mill: "A"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment		Units of equipment per tender (work-load)		Labour consumption in man-hours per 100 kg.		Operational influence: Production influence				Operational influence: Labour influence				Operational influence	Man-hours per 100 kg. added by the influences	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Draft schedule influence	Rate of delivery of material	Process efficiency	Total	Direct labour	Indirect labour	Miscellaneous	Total	TOTAL		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Opening and picking	A picker plus necessary opening units	100.0	114.0	1	3	5.18	1.385	1.000	1.000	1.140	(1.140)	3.000	1.093	1.000	(3.280)	3.740	3.89	14.3
Carding	Cards	4.70	3.63	10	33	3.98	2.155	0.926	0.722	1.157	(0.773)	3.330	0.717	1.000	(2.392)	1.849	1.83	6.7
Drawing	Delivery	5.90	5.31	13	41	1.00	0.462	0.926	0.885	1.100	(0.900)	3.160	0.736	1.000	(2.400)	2.162	0.52	1.9
Drawing	Delivery	5.90	5.31	13	41	1.02	0.462	0.926	0.885	1.100	(0.900)	3.160	0.777	1.000	(2.455)	2.210	0.51	1.8
Slubber	Spindle	0.620	0.940	76	176	2.84	0.616	1.510	1.090	0.920	(1.516)	2.315	1.302	1.000	(3.040)	4.610	2.22	8.1
Roving intermediate	Spindle	0.149	0.330	135	396	5.76	0.769	0.931	1.200	2.000	(2.215)	2.935	1.147	1.000	(3.360)	7.500	5.00	18.3
Roving	Spindle	0.062	0.066	342	820	5.15	1.849	0.852	1.134	1.100	(1.063)	2.400	1.092	1.000	(2.620)	2.790	3.31	12.1
Jack rov. Spinning	Spindle	0.015	0.013	400	1,584	24.48	14.452	1.000	0.800	1.082	(0.867)	3.960	0.585	0.844 [a]	(1.958)	1.697	10.08	36.8
Totals and averages						49.41	22.15	0.989	0.866	1.119	(0.957)	3.505	0.725	0.915	(2.320)	2.225	27.36	100.0
Extension to the general sample						36.70	22.35	1.00	0.90	1.07	(0.96)	2.22	0.82	0.94	(1.71)	1.64	—	—

[a] Represents general labour existing only in the standard mill.

Table No. 75

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Peru
Industry: Spinning
Type of mill: Modern

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences*						
					Superfluous personnel, after allowing for present conditions	*Humidification*	*Higher-than-normal speeds*	*Size*			
Total fluence 2.46	*Influence of operation 1.60*	*Production*	Draft Sch.	1.00							
			Speed	0.95			0.95				
			Efficiency	1.00							
			Total	0.95							
		Excess labour	Direct	3.00							
			Indirect	0.75							
			Miscel.	0.75							
			Total	1.68	1.48	1.10	1.03				
	Size 1.54							1.54			
	Type of equipment —										
OTALS					1.48	1.10	0.98	1.54			
ction to reduce labour					1.48						
ction to improve conditions						1.08					
auses that can be eliminated						1.60					
auses that cannot be eliminated except by enlarging the mills								1.54			

Table No. 76

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Peru
Industry: Spinning
Type of mill: Modern

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a modern mill of optimum size (m-h/100 kg.)*	*Standard labour consumption adjusted for size (m-h/100 kg.)*	*Influences* Size (S)	Operation (O)	Total (T)
	a	c	d	d/c	a/d	a/c
15 K	22.42	12.02	15.02	1.25	1.49	1.86
20 K	31.95	13.62	17.84	1.31	1.79	2.34
25 K	45.45	15.75	22.84	1.45	1.99	2.88
30 K	59.88	18.69	30.65	1.64	1.95	3.20
35 K	64.94	24.11	42.19	1.75	1.54	2.69
40 K	55.25	29.50	46.32	1.57	1.19	1.87
Averages	—	—	—	1.54	1.60	2.46

Table No. 77

Yarn count: 35 carded
Actual productivity: 1.725 kg/m-h.
Standard productivity: 3.680 kg/m-h.
Operational influence: 2.135

ANALYSIS OF THE OPERATIONAL INFLUENCE IN THE SPINNING MILLS

Country: Peru
Type of mill: Modern
Mill: "B"

Process	Name of the unit of equipment	Hourly production in kg. per unit of equipment: Actual	Hourly production in kg. per unit of equipment: Standard	Units of equipment per tender (work-load): Actual	Units of equipment per tender (work-load): Standard	Labour consumption in man-hours per 100 kg.: Actual	Labour consumption in man-hours per 100 kg.: Standard	Operational influence — Production influence: Draft schedule influence	Production influence: Rate of delivery of material	Production influence: Process efficiency	Production influence: Total	Labour influence: Direct labour	Labour influence: Indirect labour	Labour influence: Miscellaneous	Labour influence: Total	TOTAL	Man-hours per 100 kg. added by the influences	Percentage of total excess
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
Opening and picking	A picker plus necessary opening units	150.0	125.0	1	2	0.89	1.44	1.168	0.803	0.889	(0.833)	2.000	0.371	1.000	(0.742)	0.618	−0.550	—
Carding	Cards	5.18	3.63	28	28	1.76	2.16	0.910	0.790	0.975	(0.700)	1.000	1.163	1.000	(1.163)	0.815	−0.831	—
Drawing	Delivery	7.45	5.86	16	32	0.69	2.16	0.925	0.850	1.000	(0.788)	2.000	0.810	0.250 [a]	(0.405)	0.319	−1.470	—
Slubber	Spindle	0.134	0.080	145	440	6.77	2.16	0.977	0.700	0.874	(0.597)	3.035	0.629	2.750 [b]	(5.250)	3.135	4.620	13.8
Spinning	Spindle	0.00919	0.00928	475	3,333	47.82	19.10	1.000	1.000	1.010	(1.010)	7.000	0.625	0.566 [c]	(2.475)	2.500	28.650	86.2
Totals and averages						57.94	27.05	1.000	0.925	1.000	(0.925)	5.860	0.629	0.627	(2.310)	2.135	30.419	100.0
Extension to the general sample						46.60	29.10	1.00	0.95	1.00	(0.95)	3.00	0.75	0.75	(1.68)	1.60	—	—

[a] The standard mill has a sliver-lap machine and a second drawing process.
[b] The actual mill has an extra roving process.
[c] Represents general labour existing only in the standard mill

Table No. 78

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Peru
Industry: Weaving
Type of mill: Old

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences*: *Superfluous personnel, after allowing for present conditions*	*Humidification*	*Higher-than-normal speeds*	*Quality of the yarn*	*Wear of the machinery*	*Type of equipment*	*Size*
Total influence 5.11	*Influence of operation 1.94*	*Production*	Draft Sch.	—							
			Speed	0.97			0.97				
			Efficiency	1.24		1.05		1.12	1.05		
			Total	1.20							
		Excess labour	Direct	1.56							
			Indirect	1.31							
			Miscel.	0.79							
			Total	1.62	1.62						
	Size 1.01										1.01
	Type of equipment 2.61									2.61	
TOTALS					1.62	1.05	0.97	1.12	1.05	2.61	1.01
Action to reduce labour					1.62						
Action to improve conditions						1.14					
Causes not requiring modernization for correction					1.85						
Causes requiring modernization									2.77		

Table No. 79

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Peru
Industry: Weaving
Type of mill: Old (with non-automatic looms)

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size* Old (m-h/100 kg.)	*Standard labour consumption for a mill of optimum size* Modern (m-h/100 kg.)	*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences* Type of equipment (E)	*Influences* Size (S)	*Influences* Operation (O)	*Influences* Total (T)
	a	b	c	d	b/c	d/b	a/d	a/c
125	87.00	39.68	13.46	39.68	2.95	1.00	2.19	6.46
150	90.01	44.44	15.92	44.44	2.79	1.00	2.02	5.65
175	93.46	48.31	18.52	48.31	2.61	1.00	1.93	5.05
200	96.62	51.55	20.83	52.06	2.47	1.01	1.86	4.64
225	100.00	54.64	22.73	55.73	2.40	1.02	1.79	4.40
Averages	—	—	—	—	2.61	1.01	1.94	5.11

Table No. 80

PERU: SIZE DISTRIBUTION OF THE WEAVING MILLS

Size (looms)	*Number of mills*	*Percentage of total number of mills*	*Number of looms*	*Percentage of total looms*
10–20	1	6.6	20	0.3
20–50	1	6.7	44	0.7
50–100	3	20.0	251	4.0
100–200	1	6.6	176	2.8
200–300	4	26.7	978	15.5
300–500	1	6.7	429	6.8
500–700	1	6.6	681	10.8
700–1,000	1	6.7	988	15.7
1,000–1,500	2	13.4	2,737	43.4
TOTALS	15	100.0	6,304	100.0
Up to 100	5	33.3	315	5.0
100–300	5	33.3	1,154	18.3
300 and over	5	33.4	4,835	76.7

Source: Basic data for July 1950, given by Banco Industrial del Perú.

Table No. 81

Actual fabric: No. 134; 38/15 x 32/16; 1156 w.e.; 121.28 g/sq.m.
Standard fabric: No. 134; 38/15 x 32/16; 1156 w.e.; 121.28 g/sq.m.
Actual productivity: 1.267 kg/m-h
Standard productivity: 2.580 kg/m-h
Influence of operation: 2.035

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Error: 10.8%

Country: Peru
Type of mill: Old (non-automatic looms)
Mill: "C"

Process	Name of the unit of equipment	Speed in yards/min. or r.p.m.		Efficiency percentage		Units of equipment per tender		Ratio of direct to total labour		Standard productivity in kg/m-h	Standard labour consumption in m-h/100 kg.	Operational influence: Production influence			Operational influence: Labour influence				Total	Man-hours/100 kg. added by the influence	Percentage of total excess
		Actual	Standard	Actual	Standard	Actual	Standard	Actual	Standard			Speed	Process efficiency	Total	Direct	Indirect	Miscellaneous	Total			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Winding	Spindle	50	600	80	70	24	30	21/21	10/10	51.00	1.96	1.710	0.875	(1.495)	1.250	1.000	1.000	(1.250)	1.870	1.71	5.4
Warping	Warper	300	500	70	60	0.37	1	8/8	1/4.3	666.00	0.15	1.667	0.857	(1.430)	2.700	0.232	1.000	(0.626)	0.895	−0.01	—
Slashing	Slasher	20	30	55	65	0.50	1	8/8	1.66/3.33	154.00	0.65	1.500	1.180	(1.770)	2.000	0.500	1.000	(1.000)	1.770	0.50	1.6
Weaving	Loom	194	180	68	85	4	6	123/172	249/264 (264/332)	2.78	36.00	0.928	1.250	(1.160)	1.500	1.315	0.795[a]	(1.570)	1.820	29.50	93.0
Totals and averages										2.58	38.76	0.980	1.210	(1.190)	1.500	1.260	0.810	(1.530)	1.820	31.70	100.0
Extension to the general sample										3.57	48.04	0.97	1.24	(1.20)	1.56	1.31	0.79	(1.62)	1.94	—	—

[a] Represents general labour existing only in the standard mill.

Table No. 82

SUMMARY OF THE ANALYSIS OF THE CAUSES OF LOW PRODUCTIVITY

Country: Peru
Industry: Weaving
Type of mill: Semi-modern[a]

Analysis of the total influence (data of the general sample)		*Analysis of the influence of operation (data of the small sample, extended to the general sample)*			*Redistribution of the influences:* *Superfluous personnel, after allowing for present conditions*	*Humidification*	*Quality of the yarn*	*Low speeds at the preparatory processes*	*Excessive wear of the machinery*	*Type of equipment (influence of the low speed of the looms)*	*Size*
Total influence 2.24	*Influence of operation 1.82*	*Production*	Draft Sch.	—							
			Speed	1.05				1.05			
			Efficiency	1.15			1.10		1.05		
			Total	1.21							
		Excess labour	Direct	2.52							
			Indirect	0.93							
			Miscel.	0.64							
			Total	1.50	1.40	1.05	1.02				
	Size 1.07										1.07
	Type of equipment 1.15									1.15	
TOTALS					1.40	1.05	1.12	1.05	1.05	1.15	1.07
Action to reduce labour					1.40						
Action to improve conditions							1.24				
Causes that can be corrected without buying machinery						1.74					
Causes that can be corrected only by buying machinery										1.29	

[a] With old automatic looms

Table No. 83

BREAKDOWN OF THE TOTAL INFLUENCE INTO ITS COMPONENTS, THE INFLUENCES OF THE TYPE OF EQUIPMENT, SIZE, AND OPERATION

Country: Peru
Industry: Weaving
Type of mill: Semi-modern (with old automatic looms)

Yarn or fabric count	*Actual average labour consumption (m-h/100 kg.)*	*Standard labour consumption for a mill of optimum size:* *Old (m-h/100 kg.)*	*Modern (m-h/100 kg.)*	*Standard labour consumption (old mill) adjusted for size (m-h/100 kg.)*	*Influences:* *Type of equipment (E)*	*Size (S)*	*Operation (O)*	*Total (T)*
	a	*b*	*c*	*d*	*b/c*	*d/b*	*a/d*	*a/c*
125	36.90	15.48	13.46	15.48	1.15	1.00	2.38	2.74
150	39.22	18.31	15.92	18.49	1.15	1.01	2.13	2.46
175	41.67	21.30	18.52	22.15	1.15	1.04	1.88	2.25
200	44.64	23.95	20.83	25.39	1.15	1.06	1.75	2.14
225	47.85	26.14	22.73	28.49	1.15	1.09	1.68	2.10
250	51.81	28.12	24.45	31.21	1.15	1.11	1.66	2.12
275	56.18	30.02	26.11	33.92	1.15	1.13	1.65	2.15
Averages	—	—	—	—	1.15	1.07	1.82	2.24

Table No. 84

Actual fabric: No. 134.5; 80/15 x 44/16; 2430 w.e.; 214.1 gr/sq.m.
Standard fabric: No. 134.5; 80/15 x 44/16; 2430 w.e.; 214.1 gr/sq.m.
Actual productivity: 2.63 kg/m-h
Standard productivity: 6.95 kg/m-h
Influence of operation: 2.64

ANALYSIS OF THE OPERATIONAL INFLUENCE IN SELECTED WEAVING MILLS

Country: Peru
Type of mill: Semi-modern (old automatic looms)
Mill: "D"

Process	*Name of the unit of equipment*	*Speed in yards/min. or r.p.m.*		*Efficiency percentage*		*Units of equipment per tender*		*Ratio of direct to total labour*		*Standard productivity in kg/m-h*	*Standard labour consumption in m-h/100 kg.*	*Operational influence* — *Production influence*			*Labour influence*				TOTAL	*Man-hours/100 kg. added by the influence*	*Percentage of total excess*
		Actual	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*	*Actual*	*Standard*			*Speed*	*Process efficiency*	*Total*	*Direct*	*Indirect*	*Miscellaneous*	*Total*			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Winding	Spindle	350	600	80	70	24	30	21/21	10/10	39.30	2.54	1.716	0.875	(1.495)	1.250	1.000	1.000	(1.250)	1.870	2.22	7.5
Warping	Warper	300	500	58	60	0.37	1	8/8	1/4.3	454.00	0.22	1.660	1.030	(1.710)	2.700	0.232	1.000	(0.626)	1.070	0.02	—
Slashing	Slasher	20	36	46	65	0.50	1	8/8	1.66/3.33	175.50	0.57	1.800	1.410	(2.520)	2.000	0.500	1.000	(1.000)	2.520	0.87	2.9
Weaving	Loom	160	192	68	90	12	58	51.6/144 (144/144)	8.7/26.7 (26.7/54)	9.04	11.06	1.200	1.323	(1.587)	4.840	0.917	0.484[a]	(2.150)	3.420	26.00	87.6
Totals and averages										6.95	14.39	1.320	1.220	(1.610)	4.000	0.900	0.520	(1.870)	3.020	29.91	100.0
Extension to the general sample										4.59	21.75	1.21	1.15	(1.39)	2.52	0.93	0.64	(1.50)	2.09	—	—
Extension to the g.s. considering the influence of speed of the looms as influence of the type of equipment.										4.00	25.00	1.15	1.15	(1.21)	2.52	0.93	0.64	(1.50)	1.82	—	—

[a] Represents general labour existing only in the standard mill.

Chapter VII

METHODOLOGY

I. Selection of the unit of measurement and the type of labour to be included in the investigation

423. Since the purpose of the investigation is to determine the importance of the factors which affect the productivity of the worker only while he is at work, a unit of productivity was chosen based on the man-hour, in preference to others, such as the man-year, which would have obscured the results by including the degree of utilization of the available worker time, which varies from one country to another and which could be easily known, if necessary, by ascertaining the duration of work shifts and the number of shifts per year. Kilogrammes of yarn or fabric were used to assess production. This unit, in addition to being easy to measure, enables comparable results to be obtained for different periods, mills and countries, since it is not affected by divergences in prices, wages, standards of living or rates of exchange.

424. The only labour taken into account was that of the workers who are constantly near the textile equipment, that is, the machine tenders, their helpers, auxiliary labourers engaged in internal transportation, cleaning and maintenance, and the textile supervisors. The inclusion of workers employed in other auxiliary services such as shops, steam, electricity, supply rooms and outside transportation, would have made comparisons very difficult, because their number varies greatly according to the location of the mills, their procurement policy and the type of energy at their disposal.

II. Selection of the general sample

425. In each of the countries visited, an attempt was made to obtain the most representative sample possible of the industrial sectors to be studied, that is, to include, in the same proportion as they actually occur, mills of various sizes, product characteristics and geographical locations.

426. To facilitate the grouping of results, the spinning and weaving mills were considered separately, even when located in the same building, and were further classified as old or modern. Old mills were defined as those equipped with machinery typical of that bought by Latin America during the first quarter of this century, in other words, multiple-process pickers, standard-draft systems, low capacity cans and bobbins, bands instead of tapes in the spinning frames, spoolers, low-speed warpers, slashers without automatic controls, beams with flanges of small diameter, and non-automatic looms. Modern mills were defined as those equipped with one-process pickers, high-draft systems, high capacity cans and bobbins, tapes to drive the spindles of the spinning frames, modern cone and cheese winders, medium or high-speed warpers, slashers with automatic controls, loom beams with flanges of large diameter, and automatic looms. In the few cases where mills were found to have both old and modern machinery, classification was made according to the predominant type, or, where possible, productivities were determined separately for old and modern processes. In the case of Peru, however, a new classification—semi-modern mills—had to be made, because numerous old automatic looms were found with lower speeds than those of modern looms.

III. Determination of productivity

427. In each of the mills, the largest possible number of yarn counts and types of cloths was selected, preference among the latter being given to fabrics of a popular type and simple construction, which are generally produced in large quantities. The following information was secured by direct observation and was checked against the mills' records, when available: (1) the process sequence, or flow of materials, for each product selected; (2) the number of machine units allocated to each one of the in-process or final products, at each process; (3) the number of machine units assigned to direct workers (machine tenders) for a given in-process or final product; (4) the indirect labour assigned to each process (assistants and helpers who work in only one section); (5) the general auxiliary labour (cleaners, sweepers, general supervisors, etc., not directly assignable to a specific section or product); (6) the actual production per machine unit or per product (in-process or final) for a suitable period such as one normal working week (this information was secured only through the mill records). These data were used to compute labour consumption (in man-hours per 100 kilogrammes) for each product selected. Whenever indirect labour was not clearly assignable to the in-process or final products, it was allocated according to the distribution of the machine units for these. Direct-plus-indirect labour consumption for a specific final product was determined by adding up the various sectional labour consumptions, after adjusting them by means of a waste factor.[108] The general auxiliary labour was distributed only among the final products, in proportion to the number of spinning-frame spindles, or to the looms, assigned. Finally, the values of labour consumption were converted into productivities (in kilogrammes per man-hour) in order to have them appear in the graphical results for each country. All the notations and calculations were recorded in a set of mimeographed forms, samples of which (for the spinning-frame section and the final computations) are reproduced in the following pages.

[108] When the mills could not give data on the percentage of waste, practical factors were applied, based on general experience.

Mill.................................. Inst. Cap. 20,000 sp. 475 l. Page 10

Location.............................. Type of product: medium

Country............................... Type of mill: old

Informant............................. Recorded by......................... Date.................................

VII. SPINNING FRAMES

(c) *Machinery data*

Reference	W 24 K	W 38 K	F 34 C	F 40 C	
No. of frames	14	15	10	5	
Total spindles	6356	6810	4540	2270	
Type					
Manufacturer	Platt	Platt	Platt	Platt	
Warp or filling	warp	warp	fill	fill	
Model					
Year	1890	1900	1890	1890	
Draft system	std.	std.	std.	std.	
Lubrication system	n-a	n-a	n-a	n-a	
Traverse	7″ & 8″	6″	7″	7″	
Ring diameter	2″	1½″	1¾″	1½″	
Tape or band	band	band	band	band	
Aut. cleaning system	no	no	no	no	
Type of drive	over. shaf.	over. shaf.	over. shaf.	over. shaf.	
Condition of the equip.	avg.	avg.	avg.	avg.	

(d) *Operation data*

Yarn count	W 24 K	W 38 K	F 34 C	F 40 C	
Twist factor	3.75	3.75	3.00	3.00	
Spindles assigned	6356	6810	4540	2270	
Per cent waste					
Quality of the process	Bad, due to imperfect roving		—avg.—		
Efficiency					
Diam. and r.p.m. del. r.	1″–120	1″–110	1″–140	1″–135	
Ends down/1,000 sp./hr.					

Form 10

Mill.................................. Process: spinning frames Page 20

(e) *Labour and production data*

Product	W 24 K		W 38 K		F 34 C		F 40 C			
No. of shifts and average sh.	1–8		1–8		1–8		1–8			
Prod./tender in .... hs.										
Prod./unit in 8 hs.	32.0		16.4		23.2		20.3			
Period	8 hrs.		8 hrs.		8 hrs.		8 hrs.			
Assigned units	14(454)		15(454)		10(454)		5(454)			
Tot. Prod./Period	447		246		232		102			
W-L and man-shifts:	WL	MS	WL	MS	WL	MS	WL	MS	WL	MS
Tenders	454	14	454	15	454	10	454	5		
Aux. and Sect. Supv.										
1. Doffers		3		3		2		1		
To be distributed 2. Foreman		1	9.							
3. Mechanics		2	10.							
4. Mech. helpers		1	11.							
5. Yarn hauler		1	12.							
6. Cleaners		2	13.							
7.			14.							
8.			15.							
Totals for distrib.	7		Sum of totals 7							
Distribution	2.2		2.4		1.6		0.8			
Total M-S Aux. and S.S.	5.2		5.4		3.6		1.8			

(f) *Determination of labour consumption in the processes*

Kilogrammes Period	447	246	232	102	
Factor					
M-H.—Tenders	112.0	120.0	80.0	40.0	
M-H/100 kg.—Tenders	25.1	48.8	34.5	39.2	
M-H.—Aux. and Sect. Supv.	41.6	43.2	28.8	14.4	
M-H/100 kg.—Aux. and S.S.	9.3	17.5	12.4	14.3	
Total M-H/100 kg.	34.4	66.3	46.9	53.5	

Form 21

Mill.................................. Inst. Cap. 20,000 sp. 475 l. Page 21

Location.............................. Type of product: medium

Country............................... Type of mill: old

(g) *Summary of labour consumption in the spinning mills*

Yarn count	W 24			W 38			F 34			F 40		
Combed (C) or card. (K)	K			K			C			C		
Twist factor	3.75			3.75			3.00			3.00		
	A = Consumpt. in the proc. B = Waste factor. C = M-H per 100 kg. of final product											
	A	B	C	A	B	C	A	B	C	A	B	C
Opening and Picking	6.24	.896	5.59	6.24	.896	5.59	6.24	.753	4.70	6.24	.753	4.70
Cards	8.27	.953	7.88	8.27	.801	6.62	8.27	.801	6.62	8.27	.801	6.62
1st. Drawing frame	1.27	.958	1.22	1.27	.958	1.22	1.27	.805	1.02	1.27	.805	1.02
2nd. Drawing frame	1.27	.963	1.22	1.27	.963	1.22	1.27	.810	1.03	1.27	.810	1.03
3rd. Drawing frame	1.27	.968	1.23	1.27	.968	1.23	1.27	.814	1.03	1.27	.814	1.03
Drawing frames (t)			(3.67)			(3.67)			(1.08)			(1.08)
1st. Lap Machine							0.66	.811	0.53	0.66	.816	0.53
2nd. Lap Machine							0.66	.818	0.54	0.66	.818	0.54
Lap machines (t)									(1.07)			(1.07)
Combers							4.60	.963	4.42	4.60	.963	4.42
1st. Roving frame	2.71	.978	2.65	2.71	.978	2.65	2.71	.973	2.63	2.71	.973	2.63
2nd. Roving frame	4.06	.988	4.01	4.06	.988	4.01	4.06	.982	3.98	4.06	.982	3.98
3rd. Roving frame	8.70	.992	8.63	12.6	.992	12.5	12.6	.992	12.5	12.6	.992	12.5
4th. Roving frame												
Roving frames (t)			(15.3)			(19.2)			(19.1)			(19.1)
Spinning frames	34.4	1.00	34.4	66.3	1.00	66.3	46.9	1.00	46.9	53.5	1.00	53.5
Gen. Aux. Labour			2.85			5.50			3.90			4.55
Opening to Sp. frames			(69.7)			(106.9)			(87.8)			(95.0)
Twisters												
Winders												
Tot. M-H/100 kg.	69.7			106.9			87.8			95.0		
Tot. kg/M-H.	1.53			0.94			1.14			1.05		

Form G-1-Rev.

IV. Expression of productivity

428. With the object of facilitating the comparison of results, the values of productivity were expressed by means of curves, the ordinates of which are these values, in kilogrammes per man-hour, and the abscissae of which are the specifications of the product.

429. As specifications for yarn, only the English system[109] of yarn count was used, with a notation to indicate if the yarn was carded (K) or combed (C).[110] The problem arose as how best to represent the type of fabric with only one figure (as is done with yarns), for the purpose of expressing mill productivity by means of comparable curves. After experimenting with a great variety of formulae, comprising fabric specifications, the relationship between the density of the weave, in warp ends and picks per unit of area, and the weight of the cloth per unit of area, was chosen as being the most representative of fabric construction, in so far as it refers only to its influence on productivity. In fact, in correlation tests between productivities (actual and theoretical) and numbers derived from the formulae tentatively selected, the chosen formula always gave indices that were closer to unity. In practice the following expression of this relationship was used, which is the one employed by Mexican customs offices to appraise fabrics. Its result was termed "yarn count by the English system".

$$\frac{\dfrac{\text{warp ends}}{\text{square inch}} + \dfrac{\text{picks}}{\text{square inch}} \times \text{width of the cloth in inches} \times \dfrac{\text{yards}}{\text{pound}}}{84}$$

430. The level of productivity of a given industrial sector of a country was also expressed by means of a curve, the formula of which was determined by the method of least squares, taking into account all the individual productivity observations of the sector under consideration. No attempt was made to weight the averages according to the number of spindles or looms in each observation, because there were no important differences in this respect, since, generally, a good many observations were made in the large mills and a limited number in the small mills.

V. Standards of comparison

431. For the purpose of (1) enabling a comparison to be made of the productivities obtained in different types of products and different mills, (2) determining the magnitude of productivity deficiencies, and (3) establishing tools for the analysis of these deficiencies, 144 hypothetical standard mills[111] were designed, with sizes varying between 2,000 spindles or forty looms, and 50,000 spindles or 1,000 looms. They were assumed to produce six counts of yarn and six types of cloth, which would cover practically all the range of products found during the investigation. According to their size and type of machinery, these standard mills were attributed the best possible process and labour organization, and it was supposed that they would operate with the best efficiencies attainable, without impairing the quality of the product. The productivities of these standard mills, obtained through calculation, were also expressed by means of curves, in order to make them generally comparable with any results obtained in the actual mills.

432. For the analysis of the mills of the sub-sample, which is explained later, it was necessary to set up other standard mills which were exactly similar in size, machinery and type of product as the actual units studied. This was done because it was necessary to compare not only productivities, but also the elements that cause high or low productivity, such as the speed of the machines, efficiencies, unit weights of in-process products and the number of direct, indirect and miscellaneous labour.

VI. Determination of the optimum size for textile mills

433. During the course of the analysis, it became absolutely necessary to compare results with the productivity of standard mills which would be free from the influence of small size (in spindles or looms); in other words, optimum size only in so far as productivity is concerned. The lower limit of optimum size was determined by plotting productivity against size (graphs 13, 14, 15 and 16) and observing the points at which substantial increases in capacity yield almost unnoticeable increments to productivity. The position of these points varies slightly with the kind of product and the type of equipment, but for the purposes of the investigation, it was deemed enough to adopt general values of 25,000 spindles for the spinning mills and 500 looms for the weaving mills.

434. Theoretically, there is no upper limit to optimum size, as far as productivity is concerned, but in actual practice, when a mill goes beyond certain limits of size, the control of operations is more than proportionately complicated and productivity decreases, because the management does not have complete control of the functioning of the larger mill. The underlying reason for this condition is that the textile industry, in contrast to some other industries, requires that the superintendent remain in close contact with all the operations, no matter how far removed from top-management they might be. In the function of control, there cannot be a complete delegation of authority, because the co-ordination of all the minute operations and functions is a critical point in the success or failure of the mill. Overseers, foremen and section heads, as assistants to the superintendent, share the burden of responsibility, but the latter has to cover the whole range of administrative action. The limit of the supervisory capacity of one man, therefore, limits the size of the mill, unless there happens to be an extraordinarily capable team of men working as a single unit. The observations made in the mills visited, and the opinions gathered from several managers, led to the conclusion that the optimum size of a Latin-American mill, as far as administrative control is concerned, should be around 50,000 spindles or 1,000 looms, though, naturally, this

[109] The English system of yarn count is the number of groups of 840 yards of yarn contained in a pound.

[110] At first, an attempt was made to work independently with warp and filling results and to include additional discriminations, according to the twist factor. However, it was concluded that the differences in productivity due to these classifications were too small compared with the effect of the factors lowering productivity, and that, on the other hand, they would make the study exceedingly complex.

[111] The standard mills include thirty-six modern spinning mills (six sizes: 2,000, 5,000, 10,000, 15,000, 25,000 and 50,000 spindles; and six products: counts 18's, 30's and 35's carded, and 35's, 50's and 70's combed); thirty-six old spinning mills (the same sizes and products); thirty-six modern weaving mills (six sizes: 40, 100, 200, 300, 500 and 1,000 looms; and six products: counts 79.6's, 127.9's, 185.7's, 230.7's, 322.7's, 429.0's); and six old weaving mills (similar sizes and products). All data referring to these factories will be found in the annex appended to the study.

limit depends very much on the personal capacity of the superintendent and on the degree of specialization of production.

435. The lower limit of the optimum size (25,000 spindles and 500 looms) was taken as a basis for all comparisons. The relationship between labour consumption in a standard mill, which is smaller than optimum size, and labour consumption in a standard mill of 25,000 spindles or 500 looms was called the "influence of size", since it is an index of the effect of small mill size on productivity if it acted independently of other factors. This relationship was calculated for all standard mills, old and modern, and for six counts of yarn and of fabric, and was expressed by means of curves (graphs 17, 18, 19 and 20) for the purpose of facilitating the interpolation in the case of actual mills with sizes different from those of the standard mills.

VII. Analysis of the factors of low productivity

A. *Breakdown of the total influence into the influences of type of equipment, size and operation*

436. Graph 21 indicates, diagrammatically, the procedure used to analyse the results of the investigation.[112] The effect of all the factors which cause low productivity in a given industrial sector was expressed as the relationship between its average labour consumption and the labour consumption of a modern standard mill of optimum size. This relationship was called "total influence" and was represented graphically as the distance between the corresponding curves of labour consumption (or of productivity) plotted on a semi-logarithmic scale (curves I' and IV'). Within the same industrial sector, this distance varies, though these variations are not very important, and are not caused by the influence of the specifications of the product (since this is assumed to have been eliminated on establishing the relationship), but simply to the fact that the position of the average curve of actual consumption is affected by some mills in the high counts and by others in the low counts, and that there are productivity differences among them.

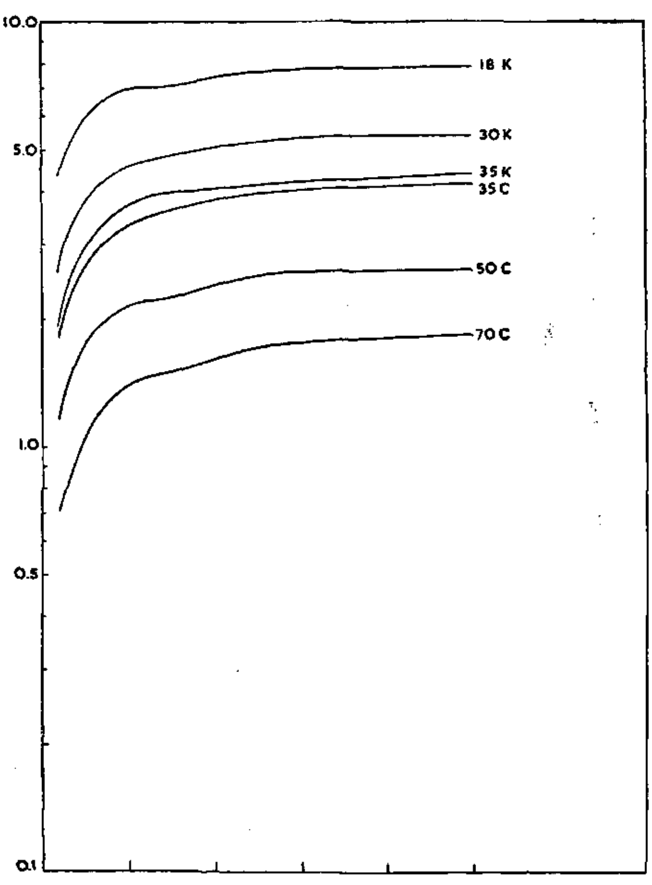
437. As a first step in the analysis, the total influence was broken down into its principal components, the influences of the type of equipment, the mill size, and the operation of the mills.

438. The influence of the type of equipment is the relationship between labour consumption in the old

[112] The data for this graph are conjectural. The curves are similar to those appearing in the graphs for each country, but units of productivity have been used instead of labour consumption, a change which inverts the position of the lines.

Graph No. 13

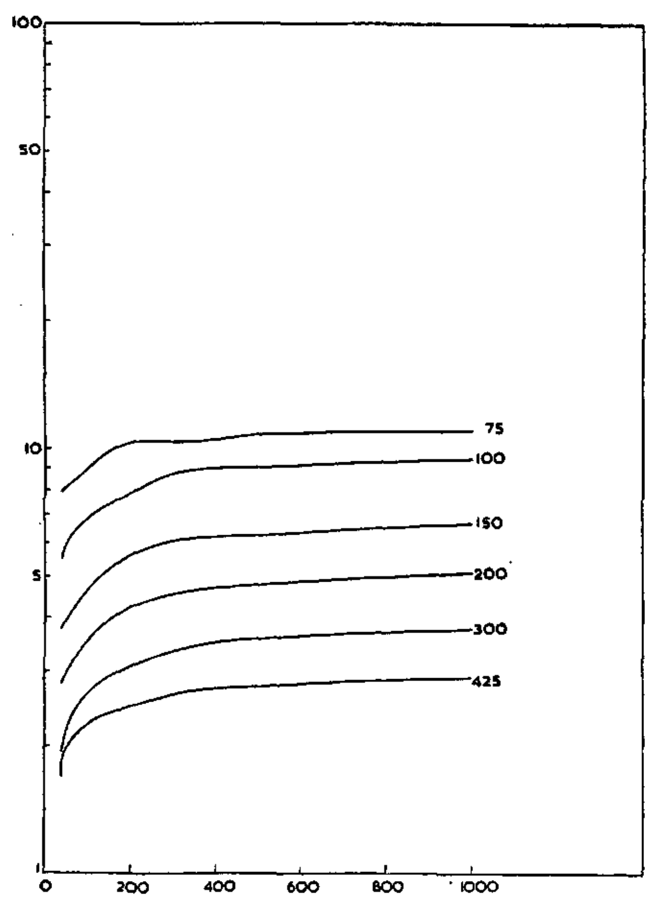
Productivity of the modern standard spinning mills, as a function of their size



X—size of the mill in spindles
Y—productivity in kilogrammes per man-hour

Graph No. 14

Productivity of the modern standard weaving mills, as a function of their size



X—size of the mill in looms
Y—productivity in kilogrammes per man-hour

standard mills and labour consumption in modern standard mills (distance between curves III' and IV'). As this relationship is not significantly affected by the size of the mills considered, it was computed only from data on standard mills of optimum size (25,000 spindles and 500 looms). The fact that some old mills have a certain amount of modern equipment, and vice versa, was not considered in calculating the influence of the type of equipment of a determined sector, because it would have been very laborious to establish special norms or standards of comparison for each mill visited.[113] This simplification, however, does not significantly affect the results, due to the fact that few mills have both old and new machinery, and that most of them are spinning mills, in which the influence of the different types of equipment is not very important. In Peru's textile industry the most prevalent type of mills were the semi-modern or semi-old mills, and their productivities were determined by separating—as far as possible—the old and modern processes of the same mill.

439. The influence of size, that is, of the smallness of the mills, is the relationship between labour consumption in standard mills (either old or modern as the case may be), of a size equal to that of the actual mills, and the labour consumption in standard mills of optimum size. The numerator of this relationship is represented by the average curve of the standard consumptions corresponding to the mill sizes of each one of the observations (V').[114]

440. The influence of operation is the relationship between the average consumption of labour in the industrial sector concerned (I') and the average consumption of labour in the standard mills (old or modern as may be the case) of a size equal to that of the actual mills (V').

441. The product of these three influences (or the sum of the distances which represent them in graph 21) is the total influence which, as was said before, could also have been obtained by dividing actual labour consumption (I') by the consumption of labour in modern standard mills of optimum size (IV').

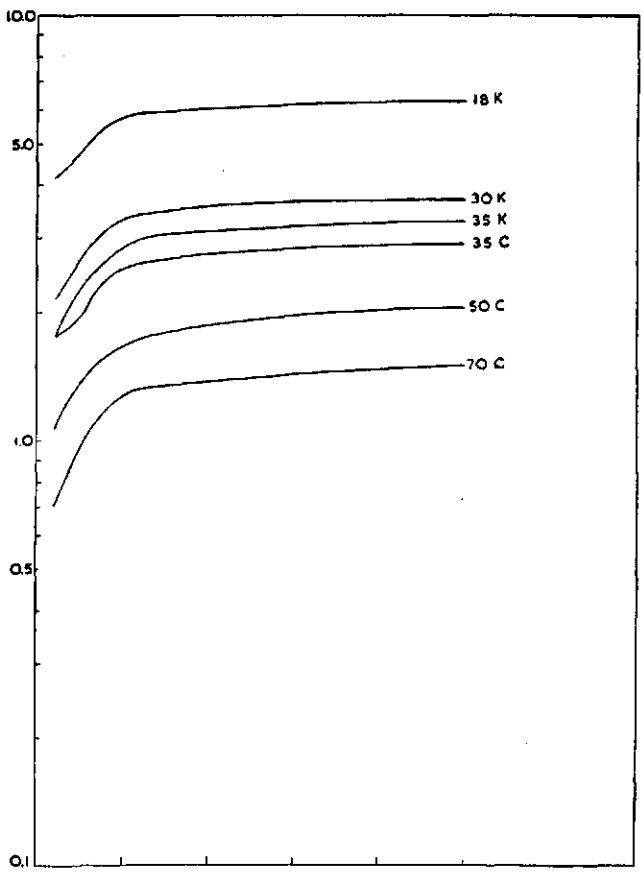
442. If unity is subtracted from one of these influences and the result multiplied by 100, the result is the

[113] However, to compare the mills of the sub-samples, special standard mills were set up, adapted exactly to the product and to the composition of machinery types in the actual units.

[114] In order not to confuse the productivity graphs of the various countries, this curve does not appear in them. The numerical data for this curve can be seen in the tables entitled "Analyses of the total influence in its components, the influences of type of equipment, of size of the factories and of operation".

Graph No. 15

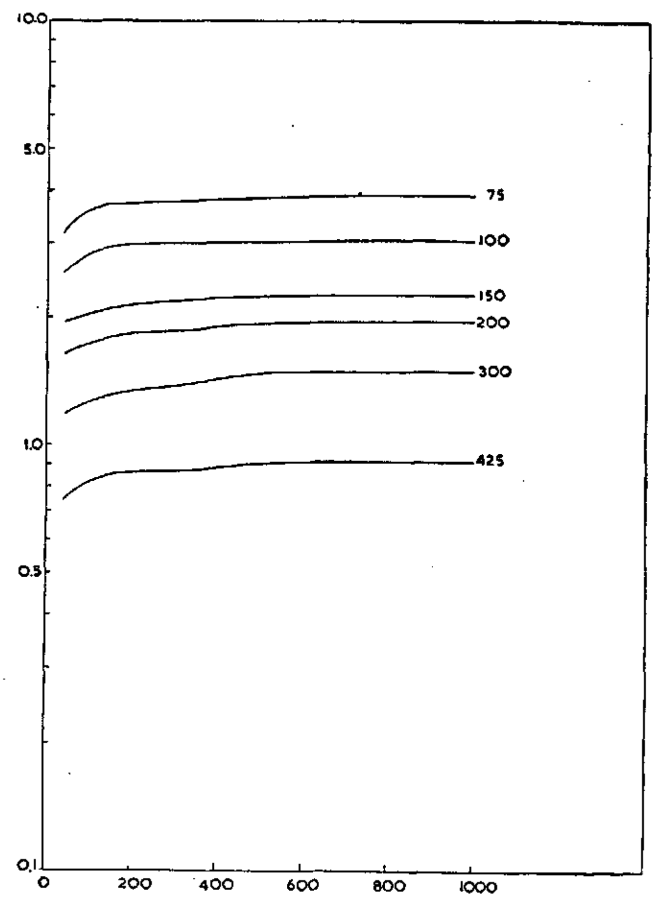
PRODUCTIVITY OF THE OLD STANDARD SPINNING MILLS, AS A FUNCTION OF THEIR SIZE



X—size of the mill in spindles
Y—productivity in kilogrammes per man-hour

Graph No. 16

PRODUCTIVITY OF THE OLD STANDARD WEAVING MILLS, AS A FUNCTION OF THEIR SIZE



X—size of the mill in looms
Y—productivity in kilogrammes per man-hour

percentage of excess labour consumption which would exist if this influence operated independently: or the percentage of increase in productivity which could be obtained if the factors which cause this influence were eliminated. If the reciprocal of an influence is subtracted from unity and multiplied by 100, the result is the percentage of productivity loss corresponding to that influence.

443. For the purpose of representing the influences of a given sector by only one figure instead of by a curve, and to facilitate subsequent analysis, averages were determined as the relationships between the sums of the labour consumptions corresponding to the round-figure counts included within the range of production of the sector considered.[115]

B. *Subdivision of the influence of type of equipment*

444. The influence of type of equipment was subdivided into two parts, one of them corresponding to the difference in the production per machine unit (spindle or loom) between the old and modern equipment, and the other part arising from the differences in the minimum amount of labour required by both types of machinery. This subdivision was based exclusively on the comparison of productions and labour requirements in the standard mills, which appear in the first pages of the annex.[116]

C. *Analysis of the influence of operation*

445. To analyze the influence of operation of a given industrial sector, a limited number of mills from the general sample was selected and examined in great detail. In each one of the processes a comparison was made between the speed of the machines, the unit weights of the products, the efficiencies and the number of workmen, on the one hand, with the data on the standard mills of the same type of machinery and the same size, on the other. The work-loads of tenders, or direct labourers, and the proportions of direct and indirect labour were also examined and compared.

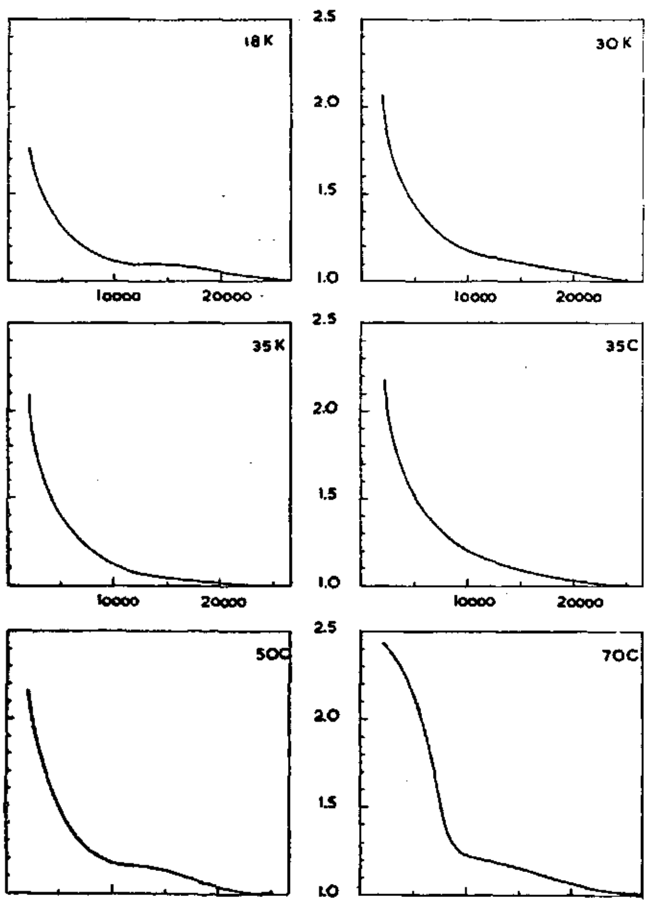
446. By investigating this sub-sample of the industry, it was possible to ascertain that the following influences

[115] The values obtained are equivalent to the weighted averages of the influences, using as weights the consumption of labour corresponding to the counts of yarn or fabric being considered. The fact that the averages were not weighted in relation to the number of observations used in the determination of each of the points in the curves has little importance, because generally there is no significant difference in the values of the influences along the axis of the abscissa.

[116] The summary of results can be seen in table 1, in the first chapter. The small differences in the figures from one country to another are due to differences in the ranges of counts of the products manufactured.

Graph No. 17

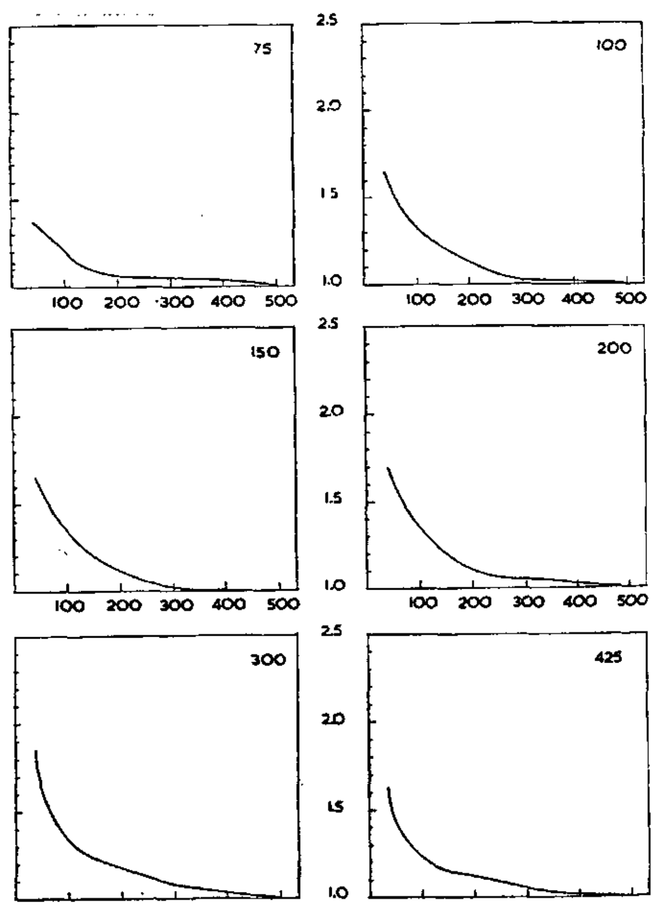
Influence of size on modern spinning mills



X—size of the mill in spindles
Y—value of the influence

Graph No. 18

Influence of size on modern weaving mills



X—size of the mill in looms
Y—value of the influence

comprise the influence of operation in each one of the processes of the mills chosen.

447. The influence of the draft schedule or process organization, is the relationship between the weight per unit of length of the in-process product of a given section of a standard spinning mills, and the weight per unit of length of the in-process product corresponding to the same section in the actual mill.

448. The influence of the speed of the machinery is the relationship between standard and actual rates of delivery corresponding to the final or in-process product of a given section of the actual mill.

449. The influence of efficiency in a certain process is the relation between the standard and actual efficiencies of that process. In this report the term efficiency expresses only the relationship between the hourly real production of the machinery and the theoretical continuous production, that is, the production the machinery would have if it operated without stopping at the speed (either correct or incorrect) assigned to it.

450. The influence of the anormalities in output of the machinery of a given section is the product of the influences of the draft schedule, of speed and process efficiency, for that section. It can also be calculated as the relationship between standard and actual rates of output per machine unit per hour in a given section. In the determination of this influence, as in that of its components, the standard values which serve as a norm for comparison must correspond to the same type of machinery with which the actual mill is equipped.

451. The influence of direct labour (or of the excess of direct workers) is the relationship between the standard and real work-loads[117] of the machine tenders (card tenders, spinners, weavers, etc.).

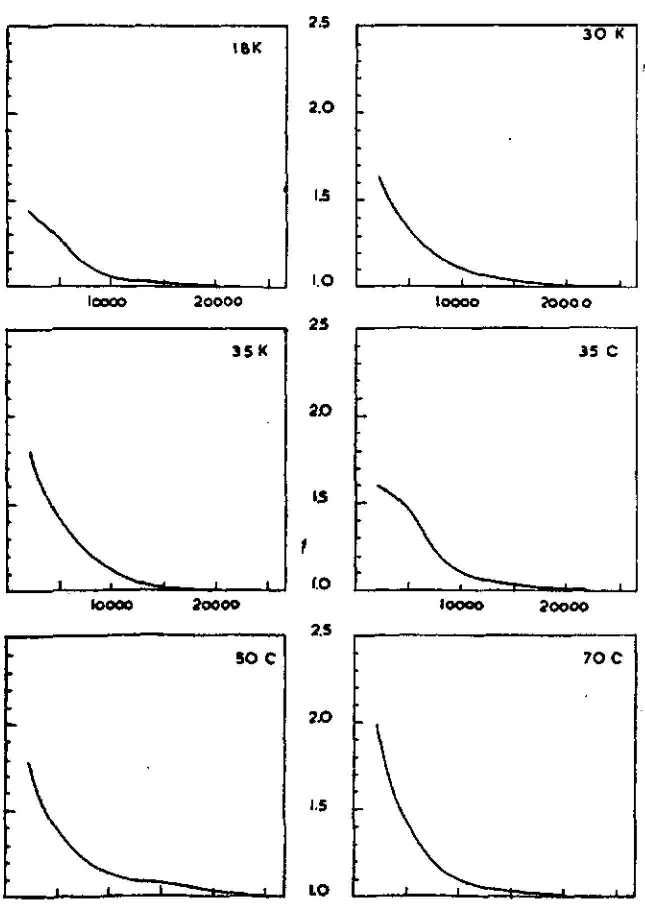
452. The influence of indirect labour is the relationship between the standard and actual ratios of direct labour to direct plus indirect labour in a given section. The helpers (assistants, cleaners, etc.) who work in only one section are called indirect workers.

453. The influence of miscellaneous labour is the relationship between standard and actual ratios of total labour, excluding miscellaneous labour, to total labour, including miscellaneous labour. The workers employed

[117] In this report, the term work-load implies the number of machines or machine units assigned to one worker. Sometimes it is defined in terms of production per worker per unit of time; or indirectly, as the sum of the elementary periods of time the worker spends in the completion of all his duties during the working day.

Graph No. 19

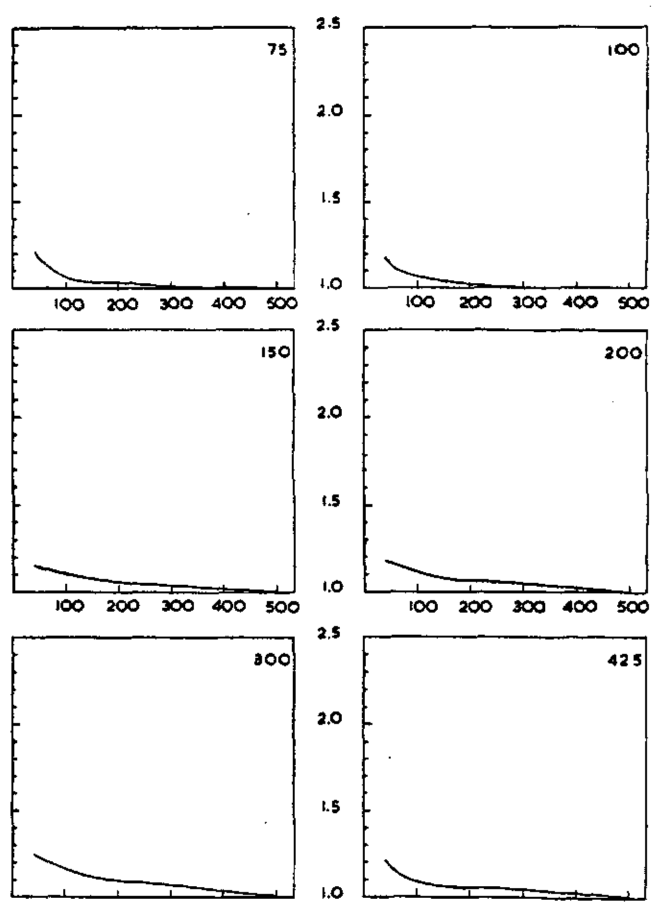
INFLUENCE OF SIZE ON OLD SPINNING MILLS



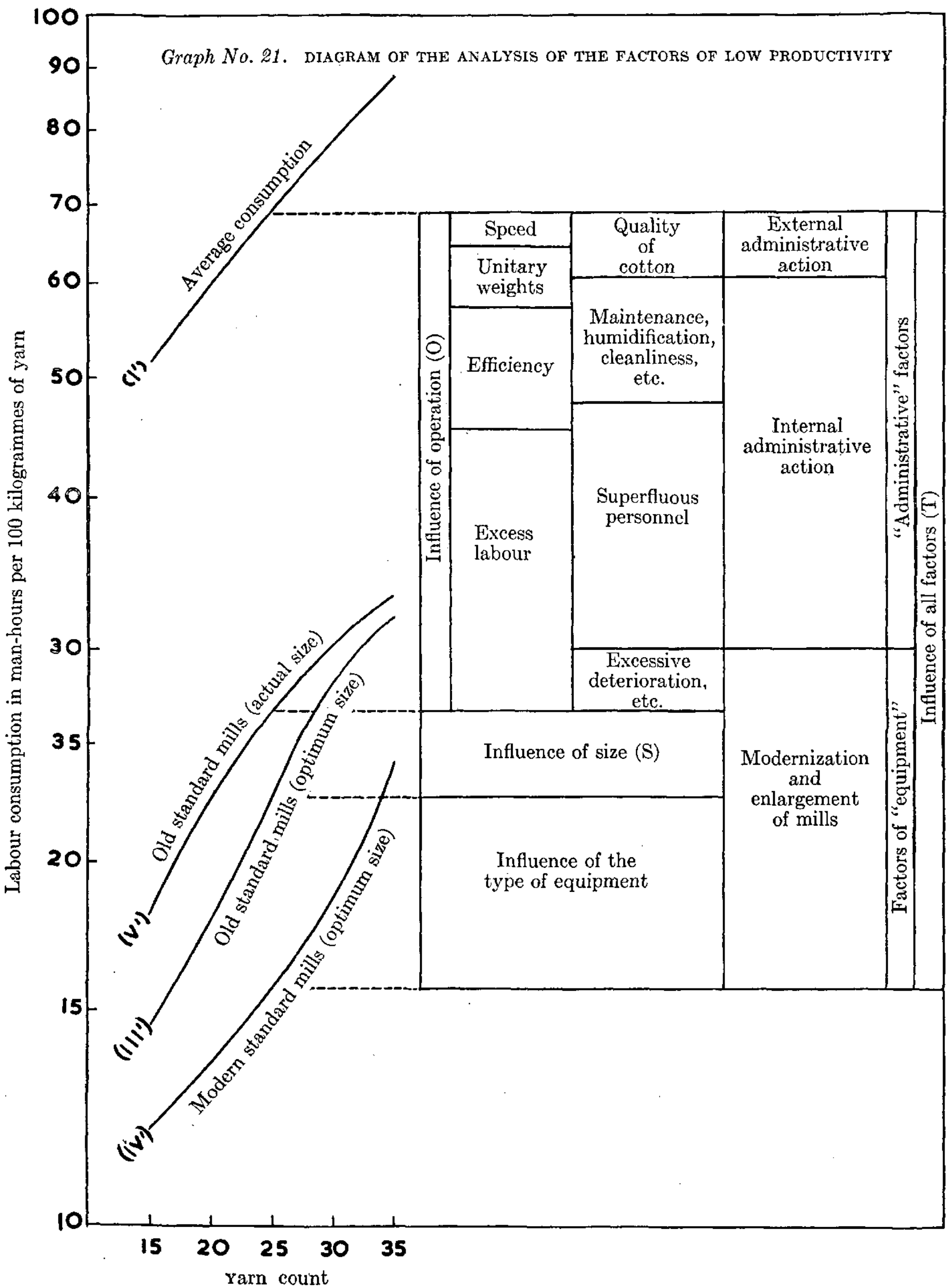
X—size of the mill in spindles
Y—value of the influence

Graph No. 20

INFLUENCE OF SIZE ON OLD WEAVING MILLS



X—size of the mill in looms
Y—value of the influence


Graph No. 21. DIAGRAM OF THE ANALYSIS OF THE FACTORS OF LOW PRODUCTIVITY
Labour consumption in man-hours per 100 kilogrammes of yarn
100
90
80
70
60
50
40
30
35
20
15
10
15
20
25
30
35
Yarn count
(I) Average consumption
(V) Old standard mills (actual size)
(III) Old standard mills (optimum size)
(IV) Modern standard mills (optimum size)
Influence of operation (O)
Speed
Unitary weights
Efficiency
Excess labour
Quality of cotton
Maintenance, humidification, cleanliness, etc.
Superfluous personnel
Excessive deterioration, etc.
External administrative action
Internal administrative action
Modernization and enlargement of mills
Influence of size (S)
Influence of the type of equipment
"Administrative" factors
Factors of "equipment"
Influence of all factors (T)

in extraordinary or superfluous processes, the helpers who work in more than one section and the general supervisors, have also been included among the miscellaneous workers.

454. The influence of total labour (or of the total labour excess) in a given section is the product of the influences of the direct, indirect and miscellaneous labour in that section. It can also be calculated directly as the relationship between the total number of workers per machine unit in a section of the actual mill and the total number of workmen per machine unit in the corresponding section of the standard mill.

455. The determination of these influences made it possible to examine each one of the processes (sections) of the mills of the sub-sample, and to ascertain the existence and importance of abnormalities. The general influences for all the processes together were calculated as the weighted averages of the sectional influences, using as weights, labour consumption for each process if the influence did not exist.[118]

456. The average results of the analysis of the mills in the sub-samples for a given industrial sector were averaged and extended to the general sample by logarithmic methods,[119] except in cases where there were enough elements to make a more appropriate extension.

457. In the final stage of the analysis, the importance of the factors which cause abnormalities in the speed, the unit weight of the products and in labour consumption were estimated. This was effected by means of general observations in the mills, and by spot checks of machine-stop frequency and yarn breakage. The results thus obtained were also expressed as numerical values, both to facilitate their general comparison and their comparison with the importance of other factors, and in order to confine their scope within the limits previously established by measurement.

VIII. Synthesis of the results

458. The results obtained in the analysis of the factors of low productivity were summarized (by multiplication) in groups, for the purpose of showing the relative importance of (1) the factors "of equipment", the elimination of which requires substantial investments for modernization and expansion of the mills; (2) the factors which could be eliminated principally by means of internal administrative action in the mills; and (3) the factors which mainly require the joint action of the industry, the government and the raw material producers. The last two groups were brought together under the title of "administrative causes" (or factors), using the term administrative in a wider sense than is usually ascribed to it.

[118] This average is equivalent to the relationship between total labour consumption, affected by the influence in question, and total labour consumption which is not thus affected. In order that the product of the averages of the partial influences should equal the rate of the total influence of operation in the mill investigated, and thus provide an element of control for the calculations, the following procedure was adopted: the influences of the draft schedule were weighted with standard labour consumption in each process; the influences of speed, with the product of standard labour consumption and the draft schedule influences; the influences of efficiency, with the product of standard labour consumption times the draft schedule influences times the speed influences; the influences of direct labour with the product of standard labour consumption times the draft schedule influences times the speed influences, times the efficiency influence, and so forth successively. Any alteration in the ordering of the weighting would have introduced slight variations in the results. However, this inconsistency of the procedure is of little importance, since the differences involved are much smaller than those caused by fortuitous errors in measurement.

[119] The logarithm of a partial influence of the general sample was made equal to the logarithm of the same influence in the subsample, multiplied by the relationship between the logarithms of the total influences of operation of the general sample and the subsample. In actual practice, these calculations were made graphically on semi-logarithmic paper.

ANNEX

Basic data and productivities of the standard mills

Table No. 1

SUMMARY OF THE PRODUCTIVITY OF THE STANDARD SPINNING MILLS

Yarn count	*Modern spinning mills*						*Old spinning mills*					
	Size in spindles						*Size in spindles*					
	2,000	*5,000*	*10,000*	*15,000*	*25,000*	*50,000*	*2,000*	*5,000*	*10,000*	*15,000*	*25,000*	*50,000*
15's carded	4.91	6.31	7.58	7.62	8.32	8.47	4.81	5.12	6.50	6.77	6.82	7.15
Count: 18's carded												
Productivity	4.39	5.77	6.93	7.02	7.73	7.86	4.17	4.69	5.71	5.91	6.02	6.24
Tot. men/M spindles	(4.66)	(3.60)	(2.90)	(2.95)	(2.68)	(2.63)	(4.65)	(4.12)	(3.40)	(3.29)	(3.22)	(3.11)
Kg/M spind./hour	20.70						19.40					
20's carded	4.04	5.44	6.53	6.65	7.34	7.47	3.78	4.31	5.22	5.39	5.51	5.69
25's carded	3.28	4.60	5.55	5.73	6.35	6.45	2.89	3.41	4.13	4.27	4.41	4.50
Count: 30's carded												
Productivity	2.57	3.75	4.57	4.80	5.35	5.44	2.18	2.70	3.31	3.49	3.60	3.68
Tot. men/M spindles	(4.66)	(3.20)	(2.60)	(2.49)	(2.23)	(2.19)	(4.85)	(3.92)	(3.20)	(3.04)	(2.94)	(2.89)
Kg/M spind./hour	11.90						10.60					
Count: 35's carded												
Productivity	1.98	2.95	3.69	3.96	4.15	4.36	1.76	2.24	2.83	3.09	3.16	3.29
Tot. men/M spindles	(4.66)	(3.13)	(2.50)	(2.33)	(2.23)	(2.13)	(4.83)	(3.80)	(3.00)	(2.75)	(2.69)	(2.59)
Kg/M spind./hour	9.28						8.50					
Count: 35's combed												
Productivity	1.80	2.62	3.31	3.56	3.93	4.19	1.76	1.90	2.55	2.69	2.80	2.90
Tot. men/M spindles	(5.15)	(3.53)	(2.80)	(2.60)	(2.36)	(2.21)	(4.83)	(4.46)	(3.33)	(3.15)	(3.04)	(2.93)
Kg/M spind./hour	9.27						8.50					
40's combed	1.56	2.26	2.88	3.04	3.39	3.57	1.48	1.69	2.22	2.32	2.46	2.57
45's combed	1.34	1.95	2.49	2.58	2.91	3.03	1.27	1.56	1.92	2.00	2.16	2.28
Count: 55's combed												
Productivity	1.17	1.70	2.17	2.22	2.53	2.60	1.08	1.36	1.69	1.76	1.90	2.05
Tot. men/M spindles	(4.83)	(3.33)	(2.60)	(2.56)	(2.24)	(2.17)	(4.83)	(3.80)	(3.07)	(2.95)	(2.73)	(2.54)
Kg/M spind./hour	5.66						5.20					
55's combed	1.02	1.50	1.92	1.96	2.25	2.32	0.96	1.24	1.53	1.60	1.72	1.88
60's combed	0.90	1.34	1.73	1.77	2.04	2.12	0.86	1.14	1.42	1.49	1.59	1.74
65's combed	0.79	1.19	1.56	1.61	1.87	1.96	0.78	1.04	1.34	1.40	1.48	1.61
Count: 70's combed												
Productivity	0.70	1.05	1.40	1.47	1.71	1.82	0.70	0.97	1.28	1.34	1.39	1.50
Tot. men/M spindles	(4.66)	(3.13)	(2.33)	(2.22)	(1.92)	(1.81)	(4.83)	(3.52)	(2.66)	(2.53)	(2.44)	(2.27)
Kg/M spind./hour	3.28						3.40					

Table No. 2

SUMMARY OF THE PRODUCTIVITY OF THE STANDARD WEAVING MILLS

Fabric count	*Modern weaving mills*						*Old weaving mills*					
	Size of looms						*Size of looms*					
	40	*100*	*200*	*300*	*500*	*1000*	*40*	*100*	*200*	*300*	*500*	*1000*
75's	7.90	8.89	10.30	10.33	10.86	11.00	3.20	3.65	3.72	3.80	3.86	3.90
Count: 79.6's												
Productivity:	7.25	8.48	9.89	10.02	10.49	10.69	3.06	3.43	3.54	3.59	3.66	3.70
Tot. men/loom	(0.30)	(0.26)	(0.22)	(0.22)	(0.21)	(0.20)	(0.53)	(0.48)	(0.46)	(0.45)	(0.44)	(0.44)
Kg/loom/hour	2.176						1.630					
100's	5.50	6.86	7.81	8.78	9.08	9.45	2.57	2.82	2.96	3.00	3.02	3.03
125's	4.39	5.46	6.48	7.28	7.43	7.84	2.16	2.31	2.43	2.47	2.52	2.53
Count: 127.9's												
Productivity:	4.31	5.36	6.35	7.13	7.28	7.66	2.12	2.28	2.39	2.41	2.48	2.48
Tot. men/loom	(0.24)	(0.19)	(0.16)	(0.14)	(0.14)	(0.14)	(0.38)	(0.35)	(0.33)	(0.33)	(0.32)	(0.32)
Kg/loom/hour	1.035						0.796					
150's	3.78	4.62	5.60	6.14	6.28	6.69	1.95	2.04	2.13	2.17	2.25	2.26
175's	3.26	3.97	4.85	5.23	5.40	5.80	1.78	1.86	1.95	1.99	2.07	2.08
Count: 185.7's												
Productivity:	3.06	3.76	4.78	5.38	5.61	5.98	1.72	1.80	1.88	1.92	2.01	2.02
Tot. men/loom	(0.24)	(0.20)	(0.16)	(0.14)	(0.31)	(0.12)	(0.36)	(0.34)	(0.33)	(0.32)	(0.31)	(0.31)
Kg/loom/hour	0.741						0.616					
200's	2.80	3.53	4.28	4.55	4.80	5.10	1.63	1.73	1.82	1.85	1.94	1.96
225's	2.43	3.20	3.84	4.06	4.40	4.60	1.49	1.62	1.69	1.74	1.83	1.85
Count: 230.7's												
Productivity:	2.37	3.14	3.77	3.98	4.32	4.52	1.45	1.59	1.66	1.72	1.81	1.82
Tot. men/loom	(0.24)	(0.18)	(0.15)	(0.14)	(0.13)	(0.12)	(0.33)	(0.30)	(0.29)	(0.28)	(0.27)	(0.26)
Kg/loom/hour	0.565						0.482					
250's	2.19	2.98	3.54	3.75	4.09	4.25	1.37	1.50	1.56	1.62	1.71	1.73
275's	2.04	2.83	3.27	3.52	3.83	3.98	1.27	1.38	1.45	1.50	1.60	1.61
300's	1.93	2.70	3.04	3.32	3.59	3.75	1.18	1.27	1.34	1.38	1.48	1.50
325's	1.84	2.59	2.83	3.14	3.37	3.54	1.10	1.18	1.24	1.28	1.37	1.38
Count: 322.7's												
Productivity:	1.82	2.57	2.78	3.10	3.31	3.49	1.07	1.15	1.21	1.25	1.33	1.34
Tot. men/loom	(0.22)	(0.15)	(0.14)	(0.13)	(0.12)	(0.11)	(0.32)	(0.30)	(0.29)	(0.28)	(0.26)	(0.26)
Kg/loom/hour	0.393						0.348					
350's	1.78	2.50	2.67	2.98	3.16	3.34	1.01	1.09	1.14	1.18	1.25	1.27
375's	1.74	2.41	2.57	2.84	2.99	3.16	0.92	1.00	1.04	1.07	1.14	1.16
400's	1.71	2.33	2.50	2.72	2.85	3.01	0.83	0.91	0.95	0.97	1.02	1.04
425's	1.69	2.26	2.46	2.65	2.77	2.89	0.75	0.83	0.86	0.87	0.91	0.92
Count: 429.0's												
Productivity:	1.69	2.25	2.45	2.64	2.76	2.88	0.74	0.82	0.84	0.87	0.89	0.90
Tot. men/loom	(0.24)	(0.18)	(0.16)	(0.15)	(0.15)	(0.14)	(0.45)	(0.41)	(0.40)	(0.40)	(0.38)	(0.38)
Kg/loom/hour	0.405						0.337					

Table No. 3

MODERN STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's carded* Warp Filling	*30's carded* Warp Filling	*35's carded* Warp Filling	*35's combed* Warp Filling	*50's combed* Warp Filling	*70's combed* Warp Filling
STAPLE	1" Mid.	1 1/16" Mid.	1 1/16" S.M.	1⅛" S.M.	1⅛" S.M.	1⅛" S.M.
OPENER						
100% production kg/hr.	409.0	409.0	409.0	409.0	409.0	409.0
Percentage efficiency	80	80	80	80	80	80
Actual production kg/hr.	327.0	327.0	327.0	327.0	327.0	327.0
Required hourly production/1000 sp.	23.0	13.24	10.32	11.96	7.31	4.36
Required continuous units/1000 sp.	0.070	0.041	0.032	0.037	0.022	0.013
PICKER (one process)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)
Diam. of feed pulley	7½"	7½"	7½"	8½"	8½"	8½"
R.p.m. of beater	1200	1200	1200	1000	1000	1000
Diam. of calendar roll	9"	9"	9"	9"	9"	9"
100% production kg/hr.	156.0	156.0	156.0	141.5	141.5	141.5
Percentage efficiency	80	80	80	80	80	80
Actual production kg/hr.	125.0	125.0	125.0	113.2	113.2	113.2
Number of blades	2 and carding	2 and carding	2 and carding	2 and carding	2 and carding	2 and carding
Diam. of feed roll	3"	3"	3"	3"	3"	3"
Required hourly production/1000 sp.	22.4	12.84	10.00	11.61	7.10	4.22
Required continuous units/1000 sp.	0.18	0.103	0.08	0.102	0.063	0.037
CARDS	0.151 (55 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.167 (50 grns.)
R.p.m. of doffer	9	7.5	7.5	7.5	5.5	5.5
Draft	111.0	123.0	123.0	123.0	123.0	123.0
Percentage waste	6	5	5	5	5	5
100% production kg/hr.	5.04	4.00	4.00	4.00	3.00	3.00
Percentage efficiency	90	90	90	90	90	90
Actual production kg/hr.	4.54	3.63	3.63	3.63	2.70	2.70
Diam. of cans	12"	12"	12"	12"	12"	12"
Required hourly production/1000 sp.	21.2	12.20	9.50	11.06	6.76	4.02
Required continuous units/1000 sp.	4.67	3.36	2.61	3.07	2.50	1.48
DRAWING (standard)	—	—	—	0.189 (44 grns.)	0.189 (44 grns.)	0.189 (44 grns.)
Number of rolls	—	—	—	4	4	4
Doublings	—	—	—	6	6	6
Draft	—	—	—	5.3	5.3	5.3
R.p.m. of front roll	—	—	—	320	320	320
Diam. of front roll	—	—	—	1⅛"	1⅛"	1⅛"
100% production kg/hr.	—	—	—	6.5	6.5	6.5
Percentage efficiency	—	—	—	80	80	80
Actual production kg/hr.	—	—	—	5.2	5.2	5.2
Diam. of cans	—	—	—	12"	12"	12"
Required hourly production/1000 sp.	—	—	—	11.01	6.73	4.00
Required continuous units/1000 sp.	—	—	—	2.12	1.29	0.77
LAP WINDER 10½"	—	—	—	0.0099 (846 grns.)	0.0099 (846 grns.)	0.0099 (846 grns.)
Doublings	—	—	—	20	20	20
Draft	—	—	—	1.04	1.04	1.04
Yards/minute	—	—	—	57.8	57.8	57.8
100% production kg/hr.	—	—	—	175.0	175.0	175.0
Percentage efficiency	—	—	—	75	75	75
Actual production kg/hr.	—	—	—	131.4	131.4	131.4
Required hourly production/1,000 sp.	—	—	—	10.96	6.70	3.98
Required continuous units/1,000 sp.	—	—	—	0.083	0.051	0.030

Table No. 3 (continued)

MODERN STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's carded* Warp	Filling	*30's carded* Warp	Filling	*35's carded* Warp	Filling	*35's combed* Warp	Filling	*50's combed* Warp	Filling	*70's combed* Warp	Filling
COMBER	—		—		—		0.154 (54 grns.)		0.154 (54 grns.)		0.154 (54 grns.)	
Nips/minute	—		—		—		100		100		100	
Draft	—		—		—		15.6		15.6		15.6	
Percentage waste	—		—		—		16		16		18	
Number of heads	—		—		—		12		12		12	
100% production kg/hr.	—		—		—		20.0		22.0		22.0	
Percentage efficiency	—		—		—		81.8		77		77	
Actual production kg/hr.	—		—		—		18.0		17.0		17.0	
Diam. of cans	—		—		—		12"		12"		12"	
Required hourly production/1,000 sp.	—		—		—		9.45		5.78		3.35	
Required continuous units/1000 sp.	—		—		—		0.0525		0.340		0.215	
LAP WINDER 9"	0.0099 (846 grns.)		0.0108 (769 grns.)		0.0108 (769 grns.)		0.0100 (831 grns.)		0.0100 (831 grns.)		0.0100 (831 grns.)	
Doublings	16		16		16		16		16		16	
Draft	1.04		1.04		1.04		1.04		1.04		1.04	
Yards/minute	58.2		58.2		58.2		43.7		43.7		43.7	
100% production kg/hr.	192.0		164.5		164.5		141.0		141.0		141.0	
Percentage efficiency	75		75		75		75		75		75	
Actual production kg/hr.	144.0		132.8		131.8		105.5		105.5		105.5	
Required hourly production/1,000 sp.	21.1		12.14		0.945		9.40		5.75		3.34	
Required continuous units/1,000 sp.	0.15		0.092		0.072		0.089		0.054		0.033	
DRAWING (long draft)	0.151 (55 grns.)		0.167 (50 grns.)		0.167 (50 grns.)		0.167 (50 grns.)		0.167 (50 grns.)		0.167 (50 grns.)	
Number of rolls	5		5		5		5		5		5	
Doublings	1		1		1		1		1		1	
Draft	15.4		15.2		15.2		16.6		16.6		16.6	
R.p.m. of front roll	340		340		340		350		350		350	
Diam. of front roll	1 1/8"		1 1/8"		1 1/8"		1 1/8"		1 1/8"		1 1/8"	
100% production kg/hr.	7.00		6.50		6.50		6.68		6.68		6.68	
Percentage efficiency	90		90		90		90		90		90	
Actual production kg/hr.	6.36		5.86		5.86		6.00		6.00		6.00	
Required hourly production/1,000 sp.	21		12.08		9.41		9.36		5.72		3.32	
Required continuous units/1,000 sp.	3.31		2.06		1.59		1.56		0.95		0.55	
DRAWING (standard)	—		0.167 (50 grns.)		0.167 (50 grns.)		—		—		—	
Number of rolls	—		4		4		—		—		—	
Doublings	—		6		6		—		—		—	
Draft	—		1.0		1.0		—		—		—	
R.p.m. of front roll	—		340		340		—		—		—	
Diam. of front roll	—		1 1/8"		1 1/8"		—		—		—	
100% production kg/hr.	—		6.53		6.53		—		—		—	
Percentage efficiency	—		80		80		—		—		—	
Actual production kg/hr.	—		5.22		5.22		—		—		—	
Required hourly production/1,000 sp.	—		12.02		9.36		—		—		—	
Required continuous units/1,000 sp.	—		2.31		1.78		—		—		—	
LONG DRAFT ROVING (J-3)	1.45		3.00	2.25	4.00	2.00	4.00		2.50		2.50	
Size frame	10" x 5"		8" x 4"	9" x 4 1/2"	8" x 4"	9" x 4 1/2"	8" x 4"		9" x 4 1/2"		9" x 4 1/2"	
Doublings	1		1	1	1	1	1		1		1	
Draft	9.61		17.9	13.4	23.9	11.9	23.9		14.9		14.9	
Twist multiplier	1.10		1.30	1.20	1.30	1.20	1.30		1.20		1.20	
R.p.m. of front roll	183		144	142	125	150	125		134		134	
Diam. of front roll	1 3/16"		1 1/8"	1 3/16"	1 1/8"	1 3/16"	1 1/8"		1 3/16"		1 3/16"	
100% production kg/hr.	0.424		0.153	0.212	0.097	0.251	0.098		0.180		0.180	
Percentage efficiency	80		83.0	82.5	83	82	81		79.5		79.5	
Actual production kg/hr.	0.340		0.127	0.175	0.080	0.206	0.080		0.144		0.144	
Grams/bobbin	0.736		0.426	0.570	0.426	0.570	0.426		0.570		0.570	
Hours/doff	1.736		2.780	2.690	4.340	2.270	4.340		3.165		3.165	
Doffs in 8 hours	3.840		2.470	2.530	1.55	3.05	1.55		2.105		2.105	
Allowance for stoppage in hours	0.346		0.460	0.470	0.830	0.410	0.830		0.635		0.635	
Required hourly production/1,000 sp.	20.8		7.41	4.54	5.31	4.01	9.31		5.69		3.32	
Required continuous units/1,000 sp.	61.2		58.34	25.94	66.67	19.46	116.37		39.51		23.7	

Table No. 3 (continued)

MODERN STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's carded* Warp	*18's carded* Filling	*30's carded* Warp	*30's carded* Filling	*35's carded* Warp	*35's carded* Filling	*35's combed* Warp	*35's combed* Filling	*50's combed* Warp	*50's combed* Filling	*70's combed* Warp	*70's combed* Filling
STANDARD ROVING	—		—		—		—		5.50		7.50	
Size frame	—		—		—		—		8" x 4"		7" x 3½"	
Doublings	—		—		—		—		2		2	
Draft	—		—		—		—		4.40		6.00	
Twist multiplier	—		—		—		—		1.30		1.35	
R.p.m. of front roll	—		—		—		—		106		106	
Diam. of front roll	—		—		—		—		1⅛"		1⅛"	
100% production kg/hr.	—		—		—		—		0.061		0.045	
Percentage efficiency	—		—		—		—		81		86	
Actual production kg/hr.	—		—		—		—		0.050		0.386	
Grams/bobbin	—		—		—		—		0.476		0.284	
Hours/doff	—		—		—		—		7.810		6.310	
Doffs in 8 hours	—		—		—		—		0.926		1.111	
Allowance for stoppage in hours	—		—		—		—		0.840		0.890	
Required hourly production/1,000 sp.	—		—		—		—		5.69		3.31	
Required continuous units/1000 sp.	—		—		—		—		113.8		8.58	
SPINNING (long draft)	18's	18's	26's	34's	35's	35's	35's	35's	50's	50's	70's	70's
Doublings	1	1	2	1	2	1	2	2	2	2	2	2
Draft	12.8	12.8	18.0	15.7	18.2	18.2	18.2	18.2	18.9	18.9	19.5	19.5
Twist multiplier	4.75	3.50	4.50	3.75	4.50	3.75	4.50	3.75	4.50	3.75	4.50	3.75
R.p.m. of front roll	134	165	129	140	113	140	113	140	95	120	80	93
Diam. of front roll	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
100% production kg/hr.	0.0211	0.0260	0.0140	0.0116	0.0090	0.0111	0.0090	0.0111	0.0053	0.0064	0.0032	0.0038
Percentage efficiency	91	88	92	90	93	91	93	91	94	93	94	94
Actual production kg/hr.	0.0192	0.0228	0.0129	0.0104	0.0085	0.0103	0.0085	0.0103	0.0050	0.0063	0.0030	0.0035
Percentage contraction	4	3	4	3	4	3	4	3	4	3	4	3
Ring diameter	2⅜"	1⅝"	2"	1⅜"	1⅞"	1⅜"	1⅞"	1⅜"	1¾"	1¼"	1⅝"	1¼"
Gauge	4"	3"	3½"	3"	3½"	3"	3½"	3"	3¼"	3"	3¼"	3"
Traverse	8½"	7½"	8"	7"	8"	7"	8"	7"	8"	7"	7½"	7"
R.p.m. of spindles	8500	7700	9300	9600	9300	9600	9300	9600	9500	9600	9500	9200
Percentage warp and filling	55	45	62	38	57	43	57	43	50	50	50	50
Average production kg/hr.	0.0207		0.0119		0.00928		0.00928		0.00568		0.00328	
Grams/bobbin	0.175	0.066	0.109	0.040	0.094	0.040	0.094	0.040	0.081	0.036	0.078	0.036
Hours/doff	9.65	3.15	4.68	4.17	4.65	3.96	4.68	3.96	16.33	5.34	15.39	9.42
Doffs in 8 hours	0.83	2.54	1.71	1.92	1.72	2.02	1.71	2.02	0.49	1.50	0.52	0.85
Required hourly production/1,000 sp.	20.7		11.9		9.28		9.27		5.66		3.28	
Required continuous units/1,000 sp.	1000		1000		1000		1000		1000		1000	

Table No. 4

Man-shifts/day: 28
Man-hours/hour: 9.33
Production/hour: 41.0 kg.
Labour consumption: 22.8 m-h/100 kg.
Productivity: 4.39 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	5 bales in 24 hrs.			1	8–10 bales/hr.	0.12	—	—	
	Opener tenders		0.14	1	1	6–8 bales/hr.	0.25	—	—	
	Waste man	114 kg. in 24 hrs.			1	680 kg/hr.	0.12	—	—	
Picking	Picker tenders		0.36	1	1	4	0.25	—	—	
	Waste machine operator	57 kg. in 24 hrs.			1	45 kg/hr.	0.25	—	—	1
Cards	Card tenders		9.34	10	3	40	0.25	0.25	0.25	
	Card grinders				3	50–68	0.20	0.20	0.20	
	Card strippers				3	136	0.08	0.08	0.08	
Lap winders	Winder operators		0.89	1	3	3	0.33	0.33	0.33	
Drawing	Drawing tenders		6.61	8	3	48–60	0.14	0.14	0.14	3
Slubbers—LD (120 sp.)	Slubber tenders	10″ x 5″—1.45 hr.–0.736 kg/bob	122	1	3	3	1	1	1	3
Spinning	Spinners	No. frames 4W-3F	2,000	1,100–900	3	1800	1	1	1	3
	Top cleaners				3	5,000 sp.	0.5	0.5	0.5	
	Doffers	3,220 bob/8 hrs. Doffs 8 hrs. 0.83–2.54			3	800–1,000 bob/hr.	0.5	0.5	0.5	3
	Roving hoister	464 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	3
	Yarn man	3,220 bob/8 hrs.			3	20 M/8 hrs.	0.5	0.5	0.5	
General										
	Oiler and miscellaneous				3	all mill	1	1	1	3
	Bobbin cleaners and misc.	464 rov. bob.+2,300 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	—	—	1
	Overhaulers				1	12.5 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	
	Cleaners, sweepers, misc.				3	12.5–15M.sp.	0.5	0.5	0.5	3
	Overseer				1	50 M.sp.	1	—	—	1
										28

Table No. 5

Man-shifts/day: 28
Man-hours/hour: 9.33
Production/hour: 24 kg.
Labour consumption: 38.8 m-h/100 kg.
Productivity: 2.57 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 26's W and 34's F carded (avg. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	3 bales in 24 hrs.			1	8–10 bales/hr.	0.10	—	—	
	Opener tenders		0.08	1	1	6–8 bales/hr.	0.25	—	—	
	Waste man	22 kg. in 24 hrs.			1	680 kg/hr.	0.15	—	—	
Picking	Picker tenders		0.21	1	1	4	0.25	—	—	
	Waste machining operator	11 kg. in 24 hrs.			1	45 kg/hr.	0.20	—	—	1
Cards	Card tender		6.72	8	3	40	0.25	0.25	0.25	
	Card grinders						0.25	0.25	0.25	
	Card strippers				3	136	0.25	0.25	0.25	
Lap winders	Winder operators		0.18	1	3	3	0.33	0.33	0.33	
Drawing (5 roll)	Drawing tenders		4.12	4	3	48.60	0.16	0.16	0.16	
Drawing (4 roll)	Drawing tenders		4.6	4	3	48–56	0.17	0.17	0.17	
Slubbers—LD (120 sp.)	Slubber tenders	8″ x 4″–3.00 hr.–0.426 kg/bob.	116	1	3	4	0.25	0.33	0.33	
Slubbers–LD (154 sp.)	Slubber tenders	9″ x 4½″–2.22 hr.–0.570 kg/bob.	51	1	3	3	0.33	0.33	0.33	6
Spinning	Spinners	No. frames 4Ws–F	2,000	1,160–840	3	2,900 sp.	1	1	1	
	Top cleaners				3	5,000 sp.	0.5	0.5	0.5	
	Doffers	2,490 bob/8 hrs. Doffs 8 hrs. 0.715–1.92			3	1,000 bob/hr.	0.5	0.5	0.5	6
	Spindle setter and tape man									
	Roving hoister	410 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	2,490 bob/8 hrs.			3	20 M. bob/8 hrs.	0.5	0.5	0.5	3
	Fixer									
General										
	Oiler				3	all mill	1	1	1	3
	Bobbin cleaners	410 rov. bob+1,500 fill bob/8 hrs.				750–1,000 bob/hr.	1	—	—	1
	Overhaulers and misc.					50 M.sp.	1	—	—	1
	Overhauler's helper									
	Fixer				3	25 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	
	Cleaners and sweepers				3	12.5 M–15M.sp.	0.5	0.5	0.5	3
	General work and misc.				1	50 M.sp.	1	—	—	1
										28

Table No. 6

Man-shifts/day: 28
Man hours/hour: 9.33
Production/hour: 18.5 kg.
Labour consumption: 50.5 m-h/100 kg.
Productivity: 1.98 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	2 bales in 24 hrs.			1	8–10 bales/hr.	0.10	—	—	
	Opener tenders		0.6	1	1	6 bales/hr.	0.25	—	—	
	Waste man	50 kg. in 24 hrs.			1	680 kg/hr.	0.15	—	—	
Picking]	Picker tenders		0.16	1	1	4	0.25	—	—	
	Waste machine operator	25 kg. in 24 hrs.			1	45 kg/hr.	0.25	—	—	1
Cards	Card tenders		5.23	6	3	40	0.25	0.25	0.25	
	Card grinders				3	50–68	0.25	0.25	0.25	
	Card strippers				3	136	0.17	0.17	0.17	
Lap winders	Winder operators		0.14	1	3	3	0.33	0.33	0.33	
Drawing (5 roll)	Drawing tenders		3.19	4	3	48–60	0.16	0.16	0.16	3
Drawing (4 roll)	Drawing tenders		3.55	4	3	48–56	0.17	0.17	0.17	
Slubbers—LD (140 sp.)	Slubber tenders	8″ x 4″–4.00 hr.–0.426 kg/bob.	132	1	3	4	0.33	0.33	0.33	
Slubbers—LD (40 sp.)	Slubber tenders	9″ x 4½″–2.00 hr.–0.570 kg/bob.	38	1	3	3	0.33	0.33	0.33	3
Spinning	Spinners	No. frames 4W–3F	2,000	1,140–960	3	2,900 sp.	1	1	1	
	Top cleaners				3	5,000 sp	0.5	0.5	0.5	
	Doffers	2,740 bob/8 hrs. Doffs 8 hrs. 0.72–2.02			3	800–1,000 bob/hr.	0.5	0.5	0.5	6
	Roving hoister	315 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	2,740 bob/8 hrs.			3	20,000 bob/8 hrs.	0.5	0.5	0.5	3
General										
	Oiler				3	all mill	1	1	1	3
	Bobbin cleaners	315 rov. bob.+1920 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	—	—	1
	Overhaulers				1	50 M.sp	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				1	50 M.	1	—	—	1
	Overseer									
										28

Table No. 7

Man-shifts/day: 31
Man-hours/hour: 10.3
Production/hour: 18.5 kg.
Labour consumption: 55.67 m-h/100 kg.
Productivity: 1.80 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 35's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	2.5 bales in 24 hrs.			1	8–10 bales/hr.	0.10	—	—	
	Opener tender		0.07	1	1	6–10 bales/hr.	0.25	—	—	
	Waste man	114 kg. in 24 hrs.			1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.20	1	1	4	0.25	—	—	
	Waste machine operator	28 kg. in 24 hrs.			1	45 kg/hr.	0.20	—	—	1
Cards	Card tenders		6.12	7	3	40	0.25	0.25	0.25	
	Card grinders				3	50–68	0.25	0.25	0.25	
	Card strippers				3	136	0.17	0.17	0.17	
Drawing (4 roll)	Drawing tenders		4.23	4	3	48–56	0.16	0.16	0.16	
Lap machine (20 ends)	Lap winder tender		0.17	1	1	3	0.17	0.17	0.17	
Combers	Comber tender		1.05	1	3	6	0.50	0.50	0.50	3
Lap machine (16 ends)	Lap winder tender		0.18	1	1	3	0.25	0.25	0.25	
Drawing (5 roll)	Drawing tenders		3.12	4	3	48–60	0.25	0.25	0.25	3
Roving (120 sp.)	Roving tenders	8″ x 4″–4.00 hr.–0.426 kg/bob.	232	2	3	5	1	1	1	3
Spinning	Spinners	No. frames 4W–3F	2,000	1,140–860	3	2,900 sp.	1	1	1	
	Top cleaners				3	5,000 sp.	0.5	0.5	0.5	
	Doffers	3,142 bob/8 hrs. Doffs in 8 hrs. 0.72–2.02			3	1,000 bob/hr.	0.5	0.5	0.5	6
	Roving hoister	344 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	3,142 bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	348 rov. bob+ 1,720 fill bob.			1	750–1,000 bob/hr.	1	—	—	1
	Overhaulers				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	3
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.	1	—	—	1
										31

Table No. 8

Man-shifts/day: 29
Man-hours/hour: 9.66
Production/hour: 11.3 kg.
Labour consumption: 85.48 m-h/100 kg.
Productivity: 1.17 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 50's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	1.5 bales in 24 hrs.			1	8–10 bales/hr.	0.10	—	—	
	Opener tender		0.4	1	1	6–8 bales/hr.	0.25	—	—	
	Waste man				1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.12	1	1	4	0.25	—	—	
	Waste machine operator				1	45 kg/hr.	0.25	—	—	1
Cards	Card tenders		5.00	6	3	40	0.50	0.25	0.50	
	Card grinders				3	50–68	0.50	0.25	0.25	
	Card strippers				3	136	0.17	0.17	0.25	
Drawing (4 roll)	Drawing tenders		2.59	4	2	48–56	0.16	0.16	—	
Lap machine (20 ends)	Lap winder tender		0.10	1	1	3	0.17	—	—	
Combers	Comber tender		0.68	1	2	6	0.16	0.16	—	
Lap machine (16 ends)	Lap winder tender		0.11	1	1	3	0.17	—	—	
Drawing (5 roll)	Drawing tenders		1.91	4	2	48–60	0.16	—	—	4
Roving (80 sp.)	Roving tenders	9″ x 4½″–2.50 hr.–0.57 kg/bob.	19	1	3	3	0.50	0.50	0.50	
Roving (116 sp.)	Roving tenders	8″ x 4″–5.50 hr.–0.426 kg/bob.	227	2	3	5–6	0.50	0.50	0.50	
	Roving hauler									3
Spinning	Spinners	No. frames 4W–3F	2,000	1,100–900	3	2,900 sp.	1	1	1	
	Top cleaners				3	5,000 sp.	0.5	0.5	0.5	
	Doffers	1,890 bob/8 hrs.–Doffs 8 hrs. 0.49–1.5			3	1,000 bob/hr.	0.5	0.5	0.5	6
	Roving hoister	380 bob/8 hrs.			3	600–700 bob/hr.	0.50	0.50	0.50	
	Yarn man	2 M bob/8 hrs.			3	20 M bob/8 hrs.	0.50	0.50	0.50	3
General										
	Oilers				3	all mill	1	1.	1	3
	Bobbin cleaners	380 rov. bob.+1,350 bob/8 hrs.			1	750–1,000 bob/hr.	1	—	—	1
	Overhaulers				1	50 M. sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer on third hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
										29

Table No. 9

Man-shifts/day: 28
Man-hours/hour: 9.33
Production/hour: 6.56 kg.
Labour consumption: 142.2 m-h/100 kg.
Productivity: 0.70 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 sp.
Mill type: Modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	1 bale in 24 hrs.			1	8–10 bales/hr.	0.10	—	—	
	Opener tender		0.023	1	1	6–8 bales/hr.	0.25	—	—	
	Waste man	44 kg. in 24 hrs.			1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.08	1	1	4	0.25	—	—	
	Waste machine operator	11 kg. in 24 hrs.			1	45 kg/hr.	0.25	—	—	
Cards	Card tenders		3.05	4	3	40	0.20	0.25	0.25	1
	Card grinders				3	50–68	0.20	0.20	0.20	
	Card strippers				3	136	0.20	0.25	0.25	
Drawing (4 rolls)	Drawing tenders		1.6	4	2	48–56	0.20	0.25	—	
Lap machine (20 ends)	Lap winder tender		0.06	1	1	3	—	0.25	—	
Combers	Comber tender		0.42	1	2	6	0.20	—	0.25	
Lap machine (16 ends)	Lap winder tender		0.06	1	1	3	—	—	0.35	
Drawing (5 roll)	Drawing tenders		1.12	4	1	50–60	0.20	—	—	3
Roving (48 sp.)	Roving tenders	9″ x 4½″–2.50 hr.–0.57 kg/bob.	46	1	3	4	0.50	0.50	0.50	
Roving (172 sp.)	Roving hauler	7″ x 3½″–1.50 hr.–0.284 kg/bob	170	1	3	5–6	0.50	0.50	0.50	3
Spinning	Spinners	No. frames 4W–3F	2,000	1,086–914	3	2,900 sp.	1	1	1	
	Top cleaners				3	5,000 sp.	0.5	0.5	0.5	
	Doffers	1,350 bob/8 hrs.–Doffs in 8 hrs.	0.525–0.852		3	1,000 bob/hr.	0.5	0.5	0.5	6
	Roving hoister	840 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	1,350 bales/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	900 rov. bob.+800 fill bob.			1	750–1,000 bob/hr.	1	—	—	1
	Overhaulers				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier man				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Overseer				1	25 M.sp.	1	—	—	1
										28

Table No. 10

Man shifts/day: 54
Man hours/hour: 18
Production/hour: 104 kg.
Labour consumption: 17.31 m-h/100 kg.
Productivity: 5.77 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000
Mill type: Modern
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	12 bales in 24 hrs.	0.35	1	1	8–10 bales/hr.	0.25	—	—	
	Opener tenders			1	3	6–8 bales/hr.	0.25	0.25	0.25	
	Waste man				1	680 kg/hr.	—	0.50	—	
Picking	Picker tenders		0.90	1	3	4 pickers	0.25	0.25	0.25	
	Waste machine operator			1	1	45 kg/hr.	—	—	0.50	3
Cards	Card tenders		23.35	25	3	40	0.7	0.7	0.7	
	Card grinders				3	50–68	1	1	1	
	Card strippers				3	136	0.3	0.3	0.3	6
Lap winders	Winder operators		0.74	1	3	3	0.33	0.33	0.33	
Drawing (5 roll)	Drawing tenders		16.54	16	3	48–60	0.33	0.33	0.33	
	Can boy				3	116	0.33	0.33	0.33	
Drawing (4 roll)	Drawing tenders									3
Slubbers—LD (140 sp.)	Slubber tenders	10" x 5"–1.45 hr.–(0.736 kg/bob.)	306	3	3	3	1	1	1	3
Slubbers—LD (120 sp.)										
Spinning	Spinners	No. frames 12W–7F	5,000	2,750–2,250	3	1,800	3	3	3	9
	Top cleaners				3	5,000	1	1	1	3
	Doffers	5,200 bob/8 hrs. Doffs in 8 hrs. 1.83+2.54			3	800–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M.sp.	1	—	—	1
	Roving hoister	128 bob/hr.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	5,700 bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	1,024 rov. bob.–4,000 fill bob. 8 hrs.			3	750–1,000 bob/hr.	1	1	—	2
	Overhaulers				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										54

Table No. 11

Man shifts/day: 48
Man hours/hour: 16
Production/hour: 60 kg.
Labour consumption: 26.6 m-h/100 kg.
Productivity: 3.75 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000
Mill type: Modern
Product: 16's W and 34's F carded (avg. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	19 bales in 21 hrs.			1	8–10 bales/hr.	0.33	—	—	
	Opener tenders		0.20	1	2	6–8 bales/hr.	0.33	0.12	—	
	Waste man			1	1	680 kg/hr.	—	0.33	—	
Picking	Picker tenders		0.51	1	2	4	0.33	0.33	—	
	Waste machine operator			1	1	45 kg/hr.	—	0.21	—	2
Cards	Card tenders		16.80	18	3	40	0.5	0.5	0.5	
	Card grinders				1	50–68	1	—	—	
	Card strippers				3	136	0.5	0.5	0.5	4
Lap winders	Winder operators		0.46	1	2	3	0.33	0.33	—	
Drawing (5 roll)	Drawing tenders		10.30	12	3	48.60	0.33	0.33	0.5	
	Can boy									
Drawing (4 roll)	Drawing tenders		11.54	12	3	48.56	0.33	0.33	0.5	
Slubbers—LD (148)	Slubber tenders	8″ x 4″–3.00 hr.–0.426 kg/bob.	291	2	3	4	0.5	0.5	0.5	3
Slubbers—LD (132)	Slubber tenders	9″ x 4½″–2.25 kg./bob.	129	1	3	3	0.5	0.5	0.5	3
Spinning	Spinners	No. frames 10W–7F	5,000.00	2,860–2,140	3	2,900	2	2	2	6
	Top cleaners				3	5,000	1	1	1	3
	Doffers	6,000 bob/8 hrs. Doffs/8 hrs. 0.715–1.92			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M	1	—	—	1
	Roving hoister	127 bob/hr.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	6,000 bob/8 hr.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	1,040 rov. bob. and 4,000 fill bob/8 hrs.			2	750–1,000 bob/8 hrs.	1	1	—	2
	Overhaulers				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										48

Table No. 12

Man shifts/day: 47
Man hours/hour: 15.66
Production/hour: 46.2 kg.
Labour consumption: 33.89 m-h/100 kg.
Productivity: 2.95 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 5,000
Mill type: Modern
Product: 35's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	15 bales in 24 hrs.			1	8–10 bales/hr.	0.25	—	—	
	Opener tenders		0.16	1	2	6 bales/hr.	0.25	0.13	—	
	Waste man			1	1	680 kg/hr.	—	0.25	—	
Picking	Picker tenders		0.40	1	2	4 pickers	0.50	0.50	—	
	Waste machine operator			1	1	45 kg/hr.	—	0.12	—	
Cards	Card tenders		13.08	15	3	40	0.5	0.5	0.5	2
	Card grinders				1	50–68	1	—	—	
	Card strippers				3	136	0.5	0.5	0.5	
Lap winders	Winder operators		0.36	1	2	3	0.33	0.33	—	
Drawing (5 roll)	Drawing tenders		7.98	8	3	48–60	0.33	0.33	0.5	
Drawing (4 roll)	Drawing tenders		8.88	8	3	48.56	0.33	0.33	0.5	
Slubbers—LD (112 sp.)	Slubber tenders	8″ x 4″-4.00 hr. (0.426 kg/bob.)	331	3	3	4	0.5	0.5	0.5	6
Slubbers—LD (100 sp.)	Slubber tenders	9″ x 4½″-2.00 hr. (0.570 kg/bob.)	97	1	3	3	0.5	0.5	0.5	3
Spinning	Spinners	No. frames 10W–7F	5,000	2,850–2,150	3	2,900 (W & F)	2	2	2	6
	Top cleaners				3	5,000	1	1	1	3
	Doffers	6.300 bob/8 hrs. Doffs 8 hrs. 0.72–2.02			3	800–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M	1	—	—	1
	Roving hoister	98 bob/hr.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	6,300 bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	98 rov. bob. and 4,200 fill bob/8 hrs.			2	750–1,000 (bob/hr.)	1	1	—	2
	Overhaulers				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										47

Table No. 13

Man-shifts/day: 53
Man-hours/hour: 17.66
Production hour: 46.3 kg.
Labour consumption: 38.14 m-h/100 kg.
Productivity: 2.62 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 5,000 sp.
Mill type: Modern
Product: 35's combed yarn

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	5 bales in 24 hrs.			1	8–10 bales/hr.	0.20	—	—	
	Opener tender		0.18	1	1	6 bales/hr.	0.20	—	—	
	Waste man			1	1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.51	1	1	4	0.25	—	—	
	Waste machine operator			1	1	45 kg/hr.	0.20	—	—	1
Cards	Card tenders		15.31	16	3	40	0.5	0.5	0.5	
	Card grinders				1	50–68	1	—	—	
	Card strippers				3	136	0.5	0.5	0.5	4
Drawing (4 roll)	Drawing tenders		10.58	12	3	48–56	0.5	0.5	0.5	
Lap machine (20 ends)	Lap winder tender		0.42	1	2	3	0.5	0.5	—	
Combers	Comber tender		2.62	3	3	6	1	1	1	
	Comber fixer				1	20–26	1	—	—	
Lap machine (16 ends)	Lap winder tender		0.45	1	2	3	0.5	0.5	—	
Drawing (5 roll)	Drawing tenders		7.80	8	3	48–60	0.5	0.5	0.5	9
Roving (148 sp.)	Roving tenders	8″ x 4″–4.00 hr. (0.426 kg/bob.)	581	4	3	5	1	1	1	3
Roving (160 sp.)	Roving tenders									
Spinning	Spinners	Sp. frames 10W–7F	5,000.00	2,850–2,150	3	2,900	2	2	2	6
	Top cleaners				3	5,000	1	1	1	3
	Doffers	(6,400 bob/8 hrs.) (Doffs 8 hrs. 0.72 and 2.02)			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M.sp.	1	—	—	1
	Roving hoister	(880 bob/8 hrs.)				600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	6,350 bob. in 8 hrs.			3	20,000 bob/8 hrs.	0.5	0.5	0.5	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	880 rov. bob.–4,300 fill bob/8 hrs.			2	750–1,000 bob/hr.	1	1	—	2
	Overhaulers				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer				3	25 M.sp.	1	1	1	3
	Second hand				2	50 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										53

Table No. 14

Man-shifts/day: 50
Man-hours/hour: 16.66
Production/hour: 28.3 kg.
Labour consumption: 58.87 m-h/100 kg.
Productivity: 1.70 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 5,000 sp.
Mill type: Modern
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	3.5 bales in 24 hrs.			1	8–10 bales hr.	0.20	—	—	
	Opener tender		0.11	1	1	6–8 bales hr.	0.20	—	—	
	Waste man			1	1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.32	1	1	4	0.25	—	—	
	Waste machine operator			1	1	45 kg/hr.	0.20	—	—	1
Cards	Card tenders		12.52	13	3	40	0.30	0.30	0.30	
	Card grinders				1	50–68	0.40	—	—	
	Card strippers				3	136	0.30	0.30	0.30	
Drawing (4 roll)	Drawing tenders		6.47	8	3	48–56	0.30	0.30	0.30	
Lap machine (20 ends)	Lap winder tender		0.26	1	1	3	0.30	—	—	
Combers	Comber tender		1.70	2	3	6	0.50	0.50	0.50	
Lap machine (16 ends)	Lap winder tender		0.27	1	1	3	0.30	—	—	
Drawing (5 roll)	Drawing tenders		4.76	8	2	48–60	0.50	0.50	0.50	7
Roving (100 sp.)	Roving tenders	9" x 4½"–2.50 hr.–0.570 kg/bob.	197	2	3	3	1	1	1	3
Roving (144 sp.)	Roving tenders	8" x 4"–5.50 hr.–0.426 kg/bob	569	4	3	5–6	1	1	1	3
Spinning	Spinners	No. frames 10W–7F	5,000	2,800–2,250	3	2,900 sp.	2	2	2	6
	Top cleaners				3	5,000 sp.	1	1	1	3
	Doffers	4,700 bob/8 hrs. (Doffs 8 hrs. 0.49–1.5)			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M.sp	1	—	—	1
	Roving hoister	928 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	4,700 bob/8 hrs.			3	20 M bob/hr.	0.5	0.5	0.5	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oilers				3	all cd. room except cds.	1	1	1	3
	Bobbin cleaners	1,000 rov. bob. and 3,000 fill bob/8 hrs.			2	750–1,000 bob/hr.	1	1	—	2
	Overhaulers				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer				3	25 M.sp.	1	1	1	3
	Second hand				2	50 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										50

Table No. 15

Man-shifts/day: 47
Man-hours/hour: 15.66
Production/hour: 16.4 kg.
Labour consumption: 95.48 m-h/100 kg.
Productivity: 1.05 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 sp.
Mill type: modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Opening	Bale opener	2.5 bales in 24 hrs.			1	8–10 bales hr.	0.20	—	—	
	Opener tender		0.06	1	1	6 bales hr.	0.20	—	—	
	Waste man			1	1	680 kg/hr.	0.15	—	—	
Picking	Picker tender		0.18	1	1	4	0.25	—	—	
	Waste machine operator			1	1	45 kg/hr.	0.20	—	—	1
	Fixer opening and picking									
Cards	Card tenders		7.40	9	3	40	0.30	0.30	0.30	
	Card grinders				1	50–68	0.40	—	—	
	Card strippers				3	136	0.30	0.30	0.30	
Drawing (4 roll)	Drawing tenders		3.84	4	3	48–56	0.30	0.30	0.30	
Lap machine (20 ends)	Lap winder tender		0.15	1	1	3	0.30	—	—	
Combers	Comber tender		1.07	1	3	6	0.50	0.50	0.50	
Lap machine (16 ends)	Lap winder tender		0.16	1	1	3	0.30	—	—	
Drawing (4 roll)	Drawing tenders		2.76	4	3	50–60	0.50	0.50	0.50	7
Roving (148 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (0.570 kg/bob.)	126	1	3	4	0.50	0.50	0.50	
Roving (160 sp.)	Roving tenders	7″ x 3½″–7.50 hr. (0.284 kg/bob.)	478	3	3	5–6	0.50	0.50	0.50	3
Spinning	Spinners	No. frames 10W–7F	5.000	2,715–2,285	3	2,900	2	2	2	6
	Top cleaners				3	5,000	1	1	1	3
	Doffers	3,400 bob/8 hrs. (Doffs 8 hrs. 0.525–0.852)			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M	1	—	—	1
	Roving hoister	692 bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	3,400 bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer				3	12.5 M	1	1	1	3
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	700 rov. bob. and 2,000 fill bob/8 hrs.			2	750–1,000/hr.	1	1	—	2
	Overhaulers				1	pick. draw. comb.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp. rov.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer				3	25 M.sp.	1	1	1	3
	Second hand				2	50 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										47

Table No. 16

Man-shifts/day: 87
Man hours/hour: 29
Production/hour: 201 kg.
Labour consumption: 14.4 m-h/100 kg.
Productivity: 6.93 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 10,000 sp.
Mill type: Modern
Product: 18's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	24 bales in 24 hrs.			1	8–10 bales/hr.	0.30	0.30	0.30	
	Opener tenders		0.10	1	3	6–10 bales/hr.	0.50	0.50	0.50	
	Waste man	552 kg. in 24 hrs.		1	1	680 kg/hr.	0.70	—	—	
Picking	Picker tenders		1.79	2	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator	276 kg. in 24 hrs.		1	1	45 kg/hr.	1	—	—	5
Cards	Card tenders		46.70	49	3	40	1	1	1	3
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		1.47	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		33.07	32	3	48–60	1	1	1	3
Drawing (4 roll)	Drawing tenders									
Slubbers—LD (120 sp.)	Slubber tenders	10" x 5" (1.45 hrs.) 0.736 kg/bob.	612	5	3	3	1	1	1	3
Slubbers—LD (132 sp.)	Slubber tenders									
Spinning	Spinners	No. frames 20W–14F	10,000	5,500–4,500	3	1,800	6	6	6	18
	Top cleaners				3	5,000	2	2	2	6
	Doffers	16,000 bob/8 hrs. (Doffs in 8 hrs–0.83–2.54)			3	800–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M.sp.	1	—	—	1
	Overhauler helpers				1	25 M.sp.	1	—	—	1
	Spindle setter and tape man				1	50 M.sp.	1	—	—	1
	Roving hoister	280 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	16,000 bob/8 hrs.			3	20 M. bob/8 hrs.	1	1	1	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	2,200 bob. 12,000 fill bob/8 hrs.			3	750–1,000 hr.	2	2	1	5
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helpers				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										87

Table No. 17

Man-shifts/day: 78
Man-hours/hour: 26
Production/hour: 119 kg.
Labour consumption: 21.85 m-h/ 100 kg.
Productivity: 457 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000 sp.
Mill type: Modern
Product: 26's W and 34's F carded (avg. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	14 bales in 24 hrs.			2	8–10 bales/hr.	0.12	0.12	—	
	Opener tenders		0.41	1	3	6–8 bales/hr.	0.38	0.38	0.50	
	Waste man			1	1	680 kg/hr.	0.50	—	—	
Picking	Picker tenders		1.03	1	3	4	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr	0.50	—	—	4
Cards	Card tender		33.60	35	3	40	1	1	1	3
	Card grinders				3	50–68	0.75	0.75	0.75	
	Card strippers				3	136	0.25	0.25	0.25	3
Lap winders	Winder operators		0.92	1	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		20.61	20	3	48–60	0.50	0.50	0.50	
Drawing (4 roll)	Drawing tenders		23.09	24	3	48–60	0.50	0.50	0.50	3
Slubbers—LD (120 sp.)	Slubber tenders	8″ x 4″–300 hr. (0.426 kg/bob.)	583	5	3	4	1	1	1	3
Slubbers—LD (132 sp.)	Slubber tenders	9″ x 4½″–2.25 hr. (0.570 kg/bob.)	260	2	3	3	1	1	1	3
Spinning	Spinners	No. frames 20W–13F	10,000	5,720–4,280	3	2,900	4	4	4	12
	Top cleaners				3	5,000	2	2	2	6
	Doffers	12,300 bob/8 hrs. (Doffs 8 hrs. 0.715–1.92)			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M	1	—	—	1
	Overhaulers helpers				1	25 M	1	—	—	1
	Spindle setter and tape man				1	50 M.sp.	1	—	—	1
	Roving hoister	254 bob/hr.			3	600–700 bob/hr.	0.50	0.50	0.50	3
	Yarn man	12,300 bob/8 hrs.			3	20 M bob/8 hrs.	0.50	0.50	0.50	
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	2,000 rov. bob. x 8,000 F.A. bob/8 hrs.			3	750–1,000 hrs.	2	2	2	6
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helper				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				3	10 M.sp.	1	1	—	2
										78

Table No. 18

Man-shifts/day: 75
Man-hours/hour: 25
Production/hour: 92.4 kg.
Labour consumption: 27.1 m-h/100 kg.
Productivity: 3.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000 sp.
Mill type: Modern
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Opening	Bale opener	11 bales in 24 hrs.				8–10 bales/hr.	0.12	—	—	
	Opener tenders		0.33	1	3	6 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.38	—	—	
Picking	Picker tenders		0.80	1	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr.	0.50	—	—	4
Cards	Card tender		26.17	28	3	40	1	1	1	3
	Card grinders				3	50–68	0.50	0.50	0.50	
	Card strippers				3	136	0.50	0.50	0.50	3
Lap winders	Winder operators		0.72	1	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		15.95	16	3	48–60	0.50	0.50	0.50	
Drawing (4 roll)	Drawing tenders		17.76	16	3	48–56	0.50	0.50	0.50	3
Slubbers—LD (136 sp.)	Slubber tenders	8" x 4"-4.00 hr. (0.426 kg/bob.)	663	5	3	4	1	1	1	3
Slubbers—LD (100 sp.)	Slubber tenders	9" x 4½"-2.00 hr. (0.510 kg/bob.)	194	2	3	3	1	1	1	3
Spinning	Spinners	No. frames 20W–13F	10,000	5,100–4,300	3	2,900	3	3	3	9
	Top cleaners				3	5,000 sp.	2	2	2	6
	Doffers	13,000 bob/8 hrs. (Doffs/8 hrs. 0.72–2.02)			3	800–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M.sp.	1	—	—	1
	Overhaulers helpers				1	25 M.sp.	1	—	—	1
	Spindle setter and tape man				1	50 M.sp.	1	—	—	1
	Roving hoister	194 rov. bob/hr.			3	600–700 bob/hr.	0.50	0.50	0.50	
	Yarn man	13,000 bob/hr.			3	20 M. bob/8 hrs.	0.50	0.50	0.50	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oiler				3	all except pickers and cards	1	1	1	3
	Bobbin cleaners	1,552 rov. bob. and 8,600 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helper				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	15 M.sp.	0.5	0.5	0.5	3
	Second hand				3	15 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										75

Table No. 19

Man-shifts/day: 84
Man hours/hour: 28
Production/hour: 92.7 kg.
Labour consumption: 30.2 m-h/100 kg.
Productivity: 3.31 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000
Mill type: Modern
Product: 35's combed yarn

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Opening	Bale opener	13 bales in 24 hrs.			1	8–10 bales/hr.	0.12	—	—	
	Opener tender		0.37	1	1	6 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.38	—	—	
Picking	Picker tender		1.02	1	3	4	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr.	0.50	—	—	4
Cards	Card tenders		30.72	32	3	40	1	1	1	3
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Drawing (4 rolls)	Drawing tenders		21.17	20	3	48–56	0.50	0.50	0.50	
Lap machine (20 ends)	Lap winder tender		0.83	1	3	3	0.50	0.50	0.50	3
Combers	Comber tender		5.25	6	3	6	1	1	1	3
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		0.89	1	3	3	0.33	0.33	0.33	
Drawing (5 roll)	Drawing tenders		15.60	16	3	48–60	0.33	0.33	0.33	
	Can boy			36	3	116	0.33	0.33	0.33	3
Roving	Roving tenders	8″ x 4″–4.00 hr. (0.426 kg/bob.)	1.163	8	3	5	2	2	2	6
Spinning	Spinners	No. frames 20 W–13 F	10.000	5,700–4,300	3	2,900	3	3	3	9
	Top cleaners				3	5,000	2	2	2	6
	Doffers	12,700 bob/8 hrs. (Doffs/8 hrs. 0.72–2.02)			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M	1	—	—	1
	Overhaulers helpers				1	25 M	1	—	—	1
	Spindle setter and tape man				1	50 M	1	—	—	1
	Roving hoister	1,750 bob/8 hrs.			3	600–700 bob/hr.	0.40	0.40	0.40	
	Yarn man	12,700 bob/8 hrs.			3	20,000 bob/8 hrs.	0.60	0.60	0.60	3
	Fixer				3	12.5 M.sp.	1	1	1	3
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	1,700 rov. bob. and 8,600 F 11 bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
	General work and misc.				2	12.5–15 M	1	1	—	2
										84

Table No. 20

Man-shifts/day: 78
Man hours/hour: 26
Production/hour: 56.5 kg.
Labour consumption: 45.9 m-h/100 kg.
Productivity: 2.17 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000
Mill type: Modern
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	8 bales in 24 hrs.			1	8–10 bales/hr.	0.12	—	—	
	Opener tender		0.22	1	2	6–8 bales/hr.	0.13	0.25	0.25	
	Waste man			1	1	680 kg/hr.	0.50	—	—	
Picking	Picker tender		0.63	1	2	4	0.25	0.25	—	
	Waste machine operator			1	1	45 kg/hr.	—	0.25	—	2
Cards	Card tenders		25.09	26	3	40	1	1	1	3
	Card grinders				3	50–68	0.50	0.50	0.50	
	Card strippers				3	136	0.50	0.50	0.50	3
Drawing (4 rolls)	Drawing tenders		12.94	12	3	48–56	0.50	0.50	1	
Lap machine (20 ends)	Lap winder tender		0.51	1	2	3	0.50	0.50	—	3
Combers	Comber tender		3.4	4	3	6	1	1	1	3
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		0.65	1	2	3	0.33	0.33	—	
Drawing (5 roll)	Drawing tenders		9.53	12	3	48–60	0.33	0.33	—	
	Can boy				3	116	0.33	0.33	—	3
Roving (132 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (570 kg. bob.)	3.95	3	3	3	2	2	2	6
Roving (160 sp.)	Roving tenders	8″ x 4″–5.50 hr. (0.426 kg/bob)	1,138	7	3	5–6	1	1	1	3
Spinning	Spinners	No. frames 20–W–14 F	10,000	5,600–4,500	3	2,900	3	3	3	9
	Top cleaners	7,600 bob/8 hrs. (Doffs 8 hrs. 0.49–1.5)			3	5,000	2	2	2	6
	Doffers				3	1,000	1	1	1	3
	Overhaulers				1	25 M	1	—	—	1
	Overhaulers helpers				1	25 M	1	—	—	1
	Spindle setter and tape man				1	50 M	1	—	—	1
	Roving hoister	233 bob/hr.			3	600–700 bob/hr.	0.50	0.50	0.50	3
	Yarn man	7,600 bob/8 hrs.			3	20–M bob/hr.	0.50	0.50	0.50	3
	Fixer				3	12.5 M.sp.	1	1	1	
General										
	Oilers				3	all cd. room except cards	1	1	1	3
	Bobbin cleaners	1,900 rov. bob and 6,750 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	1	5
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer on third hand				3	25 M.sp.	1	1	1	3
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M	1	—	—	1
	General work and *misc.*				2	10 M.sp.	1	1	—	2
										78

Table No. 21

Man-shifts/day: 70
Man hours/hour: 23.3
Production/hour: 32.8 kg.
Labour consumption: 71 m-h/100 kg.
Productivity: 1.40 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000
Mill type: Modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	5,000 bales in 24 hrs.			1	810 bales/hr.	0.12	—	—	
	Opener tender		0.11	1	1	6 bales/hr.	0.25	—	—	
	Waste man			1	1	680 kg. hr.	0.13	—	—	
Picking	Picker tender		0.31	1	1	4	0.25	—	—	
	Waste machine operator			1	1	1	0.25	—	—	1
Cards	Card tenders		14.79	16	3	40	0.70	0.70	0.70	
	Card grinders				1	50–68	1	—	—	
	Card strippers					136	0.30	0.30	0.30	4
Drawing (4 rolls)	Drawing tenders		7.68	8	3	48–56	0.33	0.50	0.50	
Lap machine (20 ends)	Lap winder tender		0.30	1	1	3	0.33	—	—	4
Combers	Comber tender		2.15	2	3	6	0.33	0.50	0.50	
	Comber fixer				1	20–26	1	—	—	
Lap machine (16 ends)	Lap winder tender		0.33	1	1	3	0.50	—	—	2
Drawing (5 roll)	Drawing tenders		5.50	8	2	50–60	0.50	1	—	
	Can boy									
Roving (148 sp.)	Roving tenders	9" x 4½"–2.50 hr. (0.570 kg/bob.)	2.37	2	3	4	1	1	1	3
Roving (160 sp.)	Roving tenders	7" x 3½"–7.50 hr. (0.284 kg/bob.)	858	5	3	5–6	2	2	2	6
Spinning	Spinners	No. frames 19W–14F	10,000	5,430–4,570	3	2,900	4	4	4	12
	Top cleaners				3	5,000	2	2	2	6
	Doffers	6.562 bob/8 hrs. (Doffs 8 hrs. 0.525–0.852)			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M.sp.	1	—	—	1
	Overhaulers helpers				1	25 M.sp.	1	—	—	1
	Spindle setter and tape man				1	50 M.sp.	1	—	—	1
	Roving hoister	1,400 bob/8 hrs.			3	600–700 bob/8 hrs.	0.50	0.50	0.50	
	Yarn man	6,562 bob/8 hrs.			3	20 M bob/hr.	0.50	0.50	0.50	3
	Fixer				3	12.5 M	1	1	1	3
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	1,400 rov. bob/4,000 fill bob/8 hrs.			2	750–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M.sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	General work and misc.				2	10 M.sp.	1	1	—	2
										70

Table No. 22

Man-shifts/day: 133
Man-hours/hour: 44.3
Production/hour: 311 kg.
Labour consumption: 14.25 m-h/100 kg.
Productivity: 7.02 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	38 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	
	Opener tenders		1.06	1	3	6–8 bales/hr.	0.25	0.25	0.25	
	Waste man			1	1	680 kg/hr.	0.25	—	—	
Picking	Picker tenders		2.69	3	3	4 pickers	0.75	0.75	0.75	
	Waste machine operator			1	1	145 kg/hr.	0.75	—	—	5
Cards	Card tenders		70.05	73	3	40	2	2	2	6
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		2.21	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		49.61	48	3	48–60	1	1	1	3
Drawing (4 roll)	Drawing tenders						1	1	1	3
Slubbers—LD (116 sp.)	Slubber tenders	10" x 5"–1.45 hr. (0.736 kg/bob.)	918	8	3	3	3	3	3	9
Spinning	Spinners	No. frames 34 W–21 F	15,000	8,250–6,750	3	1,800	9	9	9	27
	Top cleaners				3	5,000	3	3	3	9
	Doffers	2,400 bob/8 hrs. (Doffs 8 hrs. 0.83–2.54)			3	800–1,000 bob/hr.	3	3	3	9
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				2	25 M.sp.	1	1	—	2
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle setter				2	25 M.sp.	1	1	—	2
	Spindle and tape man									
	Roving hoister	425 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	24,000 bob/hr.			3	20 M bob/hr.	2	2	2	6
	Fixer or third hand				3	12.5 M.sp.	1	1	1	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
General										
	Oiler				2	all except cards	1	1	1	3
	Bobbin cleaners	3,400 rov. bob. and 1,700 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Fixer				3	25 M	1	1	1	3
	Humidifier men				3	25 M	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										133

Table No. 23

Man-shifts/day: 112
Man-hours/hour: 37.33
Production/hour: 179 kg.
Labour consumption: 20.85 m-h/100 kg.
Productivity: 4.80 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 26's W and 34's F carded (avg. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	20 bales in 24 hrs.			1	8–10 bales/1 hr.	0.25	—	—	
	Opener tenders		0.61	1	3	6–8 bales/1 hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.15	—	—	
Picking	Picker tenders		1.54	2	3	4	0.50	0.50	0.50	4
	Waste machine operator			1	1	45 kg/hr.	0.60	—	—	
Cards	Card tenders		50.90	52	3	40	1.25	1.25	1.25	
	Card grinders				3	50–68	1	1	1	
	Card strippers				3	136	0.75	0.75	0.75	9
Lap winders	Winder operators		1.38	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		30.91	32	3	48–60	1	1	1	3
Drawing (4 roll)	Drawing tenders		34.63	32	3	48.56	1	1	1	3
Slubbers—LD (40 sp.)	Slubber tenders	8″ x 4″–3.00 hr. (0.426 kg/bob.)	875	6	3	4	2	2	2	6
Slubbers—LD (120 sp.)	Slubber tenders	9″ x 4½″–2.25 hr. (0.570 kg/bob.)	389	3	3	3	1	1	1	3
Spinning	Spinners	No. frames 30W–20F	15,000	8,600–6,400	3	2,900	5	5	5	15
	Top cleaners				3	5,000	3	3	3	9
	Doffers	1,800 bob/8 hrs. (Doffs 8 hrs. 0.715–1.92)			3	800–1,000	3	3	3	9
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				3	25 M.sp.	1	1	1	3
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle and tape man				2	25 M.sp.	1	1	—	2
	Roving hoister	380 bob/hr.			3	600/700 bob/hr.	1	1	1	3
	Yarn man	18,000 bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	12.5 M	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	3,000 rov. bob. x 12,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Fixer				3	25 M	1	1	1	3
	Humidifier men				3	25 M	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										112

Table No. 24

Man-shifts/day: 105
Man hours/hour: 35
Production/hour: 138.6 kg.
Labour consumption: 25.25 m-h/100 kg.
Productivity: 3.96

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	16 bales in 24 hrs.			1	8–10 bales/hr.	0.50	—	—	
	Opener tenders		0.48	1	2	6 bales/hr.	0.50	0.50	—	
	Waste man			1	1	680 kg/hr.	0.50	—	—	
Picking	Picker tenders		1.20	2	2	4 pickers	0.50	0.50	—	
	Waste machine operator			1	1	45 kg/hr.	1	—	—	4
Cards	Card tenders		39.25	41	3	40	1	1	1	3
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	0.5	0.5	0.5	
Lap winders	Winder operators		1.08	1	3	3	0.50	0.50	0.50	3
Drawing (5 roll)	Drawing tenders		23.93	24	3	48.60	0.50	0.50	0.50	
Drawing (4 roll)	Drawing tenders		26.64	24	3	48.60	0.50	0.50	0.50	3
Slubbers—LD (144 sp.)	Slubber tenders	8" x 4"–4.00 hr. (0.426 kg/bob.)	995	7	3	4	2	2	2	6
Slubbers—LD (120 sp.)	Slubber tenders	9" x 4½"–2.00 hr. (0.576 kg/bob.)	292	2	3	3	1	1	1	3
Spinning	Spinners	No. frames 30W–33F		8,550–7,450	3	2,900	5	5	5	15
	Top cleaners			15,000	3	5,000	3	3	3	9
	Doffers	20,000 bob/8 hrs. (Doffs/8 hrs. 0.72–2.02)			3	800–1,000 bob/hr.	3	3	3	9
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				2	25 M.sp.	1	1	—	2
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle setter and tape man				2	25 M.sp.	1	1	—	2
	Roving hoister	285 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	20,000 bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	12.5 M.sp.	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
General					3	all except pickers and cards	1	1	1	3
	Oiler									
	Bobbin cleaners	2,300 rov. bob. and 15,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helper				1	50 M.sp.	1	—	—	1
	Fixer				3	25 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp.	1	1	1	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										105

Table No. 25

Man-shifts/day: 117
Man-hours/hour: 39
Production/hour: 139 kg.
Labour consumption: 28.06 m-h/100 kg.
Productivity: 3.56 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 35's combed yarn

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	19 bales in 24 hrs.			1	8–10 bales/hr.	0.33	—	—	
	Opener tender		0.55	1	3	6 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.33	—	—	
Picking	Picker tender		1.53	2	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr.	0.33	—	—	4
Cards	Card tenders		46.08	48	3	40	1.25	1.25	1.25	
	Card grinders				3	50–68	1	1	1	
	Card strippers				3	136	0.75	0.75	0.75	9
Drawing (4 roll)	Drawing tenders		31.75	32	3	48–56	1	1	1	3
Lap machine (20 ends)	Lap winder tender		1.25	2	2	3	1	1	—	2
Combers	Comber tender		7.87	8	3	6	1	1	1	3
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tenders		1.33	2	2	3	1	1	—	2
Drawing (5 roll)	Drawing tenders		23.40	24	3	48–60	1	1	1	3
Roving (148 sp.)	Roving tenders	8″ x 4″–4.00 hr. (0.426 kg/bob)	1,745	12	3	5	3	3	3	9
Roving (160 sp.)	Roving tenders									
Spinning	Spinners	No. frames 30 W–20 F	15,000	8,550–6,450	3	2,900	5	5	5	15
	Top cleaners				3	5,000	3	3	3	9
	Doffers	20,000 bob/8 hrs. (Doffs/8 hrs. 0.72–2.02)			3	1,000 bob/hr.	3	3	3	9
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				2	25 M.sp.	1	1	—	2
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle setter and tape man				2	25 M.sp.	1	1	—	2
	Roving hoister	330 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	20,000/8 hrs.			3	20,000 bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	12.5 M.sp.	1	1	1	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	2,700 rov. bob. and 13,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	1	5
	Overhaulers				1	50 M	1	—	—	1
	Overhaulers helper				1	50 M	1	—	—	1
	Humidifier men				3	25 M	1	1	1	3
	Fixer or third hand				3	25 M	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										117

Table No. 26

Man-shifts/day: 115
Man-hours/hour: 38.33
Production/hour: 84.9 kg.
Labour consumption: 4.51 m-h/100 kg.
Productivity: 2.22 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	12 bales in 24 hrs.			1	8–10 bales	0.33	—	—	
	Opener tender		0.33	1	3	6–8 bales	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.33	—	—	
Picking	Picker tender		0.95	1	3	4	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/1 hr.	0.33	—	—	4
Cards	Card tenders		37.56	40	3	40	1	1	1	3
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Drawing (4 roll)	Drawing tenders		19.41	20	3	48–56	0.50	0.50	0.50	
Lap machine (20 ends)	Lap winder tender		0.77	1	3	3	0.50	0.50	0.50	3
Combers	Comber tender		5.10	5	3	6	1	1	1	3
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tenders		0.81	1	3	3	0.5	0.5	0.5	
Drawing (5 roll)	Drawing tenders		14.29	16	3	48–60	0.5	0.5	0.5	3
Roving (148 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (4.570 kg./bob.)	592	5	3	3.	2	2	2	6
Roving (160 sp.)	Roving tenders	8″ x 4″–5.50 hr. (0.476 kg/bob)	1,707	11	3	5–6	2	2	2	6
Spinning	Spinners	No. frames 29 W-21 F	15,000	8,400–6,750	3	2,900 sp.	5	5	5	15
	Top cleaners				3	5,000 sp.	3	3	3	9
	Doffers	14,000 bob/8 hrs. (Doffs in 8 hrs. 0.49–1.50)			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				2	25 M.sp.	1	1	—	2
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle setter and tape man				2	50 M.sp.	1	1	—	2
	Roving hoister	350 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	14,000 bob. in 8 hrs.			3	20 M-bob/hr.	1	1	1	3
	Fixer or third hand				3	12.5 M.sp.	1	1	1	3
	Second hand				1	50 M.sp.	1	—	—	1
	Overseer									
General										
	Oilers				3	all cd. rooms except cards	1	1	1	3
	Bobbin cleaners	3,000 rov. bob. and 10,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helper				1	50 M.sp.	1	—	—	1
	Humidifier men				3	25 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										115

Table No. 27

Man-shifts/day: 100
Man-hours/hour: 33.33
Production/hour: 49.2 kg.
Labour consumption: 67.74 m-h/100 kg.
Productivity: 1.47 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000
Mill type: Modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	Second shift	Third shift	*Total man-shifts*
Opening	Bale opener	7 bales in 24 hrs.			1	8–10 bales/hr.	0.25	—	—	
	Opener tender		0.17	1	2	6–8 bales/hr.	0.25	0.25	—	
	Waste man			1	1	680 kg/hr.	0.25	—	—	
Picking	Picker tender		0.55	1	2	4 pickers	0.25	0.50	—	
	Waste machine operator			1	1	45 kg/hr.	—	0.25	—	2
Cards	Card tenders		22.19	23	3	40	0.60	0.60	0.60	
	Card grinders				1	50–68	1	—	—	
	Card strippers				3	136	0.40	0.40	0.40	4
Drawing (4 roll)	Drawing tenders		11.52	12	3	48.56	0.50	0.50	1	
Lap machine (20 ends)	Lap winder tender		0.45	1	2	3	0.50	0.50	—	3
Combers	Comber tender		3.21	4	3	6	1	1	1	3
	Comber fixer				2	20–26	1	1	1	2
Lap machine (16 ends)	Lap winder tenders		1.47	1	2	3	0.5	0.5	0.5	
Drawing (5 roll)	Drawing tenders		8.28	8	3	50–60	0.5	0.5	0.5	3
Roving (132 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (0.570 kg/bob.)	378	3	3	4	1	1	1	3
Roving (160 sp.)	Roving tenders	7″ x 3½″–7.50 hr. (0.284 kg/bob.)	1,434	9	3	5–6	2	2	2	6
Spinning	Spinners	No. frames 30 W–24 F	15,000	8,145–7,855	3	2,900	5	5	5	15
	Top cleaners				3	5,000	3	3	3	9
	Doffers	11,000 bob/8 hrs. (Doffs 8 hrs. 0.525–0.852)			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				2	25 M.sp.	1	1	—	2
	Overhaulers helpers				2	25 M.sp.	1	1	—	2
	Oiler				2	25 M.sp.	1	1	—	2
	Spindle setter and tape man				2	25 M.sp.	1	1	—	2
	Roving hoister	270 bob/hr.			3	600–700 bob/hr.	0.50	0.50	0.50	
	Yarn man	11,000 bob/8 hrs.			3	20 M bob/hr.	0.50	0.50	0.50	3
	Fixer or third hand				3	12.5 M	1	1	1	3
	Second hand				2	25 M	—	1	1	2
	Overseer				1	50 M	1	—	—	1
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	2,200 rov. bob. x 7,000 fill bob/8 hrs.			3	750–1,000 bob./1 hr.	2	2	2	6
	Overhaulers				1	50 M.sp.	1	—	—	1
	Overhaulers helper				1	50 M.sp.	1	—	—	1
	Humidifier men				3	25 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				2	25 M.sp.	—	1	1	2
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–5 M.sp.	1	1	1	3
	General work and misc.				2	10 M.sp.	2	2	—	4
										100

Table No. 28

Man-shifts/day: 201
Man-hours/hour: 67
Production/hour: 518 kg.
Labour consumption: 12.93 m-h/100 kg.
Productivity: 7.73 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000 sp.
Mill type: Modern
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	60 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	
	Opener tenders		1.76	2	3	6–8 bales/hr.	1	1	1	
	Waste man			1	1	680 kg/hr.	1	—	—	5
Picking	Picker tenders		4.48	5	3	4 pickers	1	1	1	3
	Waste machine operator			1	2	45 kg/hr.	1	1	—	2
Cards	Card tenders		116.75	122	3	40	3	3	3	9
	Card grinders				3	50–68	2	2	2	6
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		3.68	4	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		82.68	84	3	48–60	2	2	2	6
	Can boy				3	116	1	1	1	3
Slubbers—LD (120 sp.)	Slubber tenders	10" x 5"–1.45 hr. (0.73 kg/bob.)	1,530	13	3	3	4	4	4	12
Spinning	Spinners	No. frames 57 W–35 F	25,000	13,750–11,250	3	1,800	14	14	14	42
	Top cleaners				3	5,000	5	5	5	15
	Doffers	40,400 bob/8 hrs. (Doffs 8 hrs. 0.832–2.54)			3	800–1,000 bob/hr.	6	6	6	18
	Spindle setter				3	50 M	0.50	0.50	0.50	
	Overhaulers				3	25 M	1	1	1	
	Overhaulers helpers				3	25 M	1	1	1	
	Oiler				3	25 M	1	1	1	
	Oiler and tape man				3	50 M	0.50	0.50	0.50	12
	Roving hoister	700 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	40,400 bob/8 hrs.			3	20 M/8 hrs.	2	2	2	6
	Fixer or third hand				3	15–17 M.sp.	2	2	2	6
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
General										
	Oiler				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	5,600 rov. bob.–29,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	4	4	4	12
	Overhaulers				3	50 M	1	1	1	3
	Overhaulers helpers				3	50 M	1	1	1	3
	Fixer or third hand				3	25 M	1	1	1	3
	Humidifier men				3	25 M	1	1	1	3
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	2	2	2	6
	General work and misc.				3	10 M. sp.	2	2	2	6
										201

Table No. 29

Man-shifts/day: 167
Man-hours/hour: 55,66
Production/hour: 298 kg.
Labour consumption: 18,68 m-h/100 kg.
Productivity: 5.35 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000
Mill type: Modern
Product: 26's W and 34's F carded (av. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* — *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	35 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	
	Opener tenders		1.02	1	3	6–8 bales/hr.	0.25	0.25	0.25	
	Waste man			1	1	680 kg/hr.	1	—	—	
Picking	Picker tenders		2.57	3	3	4 pickers	0.25	0.25	0.25	
	Waste machine operator			1	1	45 kg/hr.	1	—	—	5
Cards	Card tenders		34	88	3	40	2	2	2	6
	Card grinders				3	50–68	2	1	1	4
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		2.30	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		51.52	52	3	48–60	1	1	1	3
Drawing (4 roll)	Drawing tenders		57.72	56	3	48.56	1	1	1	3
	Can boy				3	116	1	1	1	3
Slubbers—LD (148 sp.)	Slubber tenders	8″ x 4″–3.00 hr. (0.426 kg/bob.)	1,458	10	3	4	2	2	2	6
Slubbers—LD (132 sp.)	Slubber tenders	9″ x 4½″–2.25 hr. (0.570 kg/bob.)	648	5	3	3	2	2	2	6
Spinning	Spinners	No. frames 50 W–35 F	25,000	14,300–10,700	3	2,900	9	9	9	27
	Top cleaners				3	5,000	5	5	5	15
	Doffers	31,000 bob/8 hrs. (Doffs 8 hrs. 1.715–1.92)			3	1,000 bob/hr.	4	4	4	12
	Spindle setter				3	50 M.sp.	0.50	0.50	0.50	
	Overhaulers				3	25 M.sp.	1	1	1	
	Overhaulers helpers				3	25 M.sp.	1	1	1	
	Oiler				3	25 M.sp.	1	1	1	
	Oiler and tape man				3	50 M	0.50	0.50	0.50	12
	Roving hoister	637 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	31,000 bob/8 hrs.			3	20 M. bob/8 hrs.	2	2	1	5
	Fixer or third hand				3	12.5 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.	1	—	—	1
General										
	Oiler				3	all except cards	1	1	1	3
	Bobbin cleaners	5,000 rov. bob–21,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				3	50 M	1	1	1	3
	Overhaulers helpers				3	50 M	1	1	1	3
	Fixer or third hand				3	25 M	1	1	1	3
	Humidifier men				3	25 M	1	1	1	3
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50,000 sp.	1	—	—	1
	Cleaners and sweepers				3	12,500–15,000 sp.	2	2	2	6
	General work and misc.				3	10 M.sp.	2	2	2	6
										167

Table No. 30

Man-shifts/day: 167
Man-hours/hour: 55.66
Production/hour: 231
Labour consumption: 24.1 m-h/100 kg.
Productivity: 4.15 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000 sp.
Mill type: Modern
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	28 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	
	Opener tenders		0.80	1	3	6 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	1	—	—	
Picking	Picker tenders		2.00	2	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator		-	1	1	45 kg/hr.	1	—	—	6
Cards	Card tenders		65.42	68	3	40	2	2	2	6
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		1.80	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		39.88	40	3	48–60	1	1	1	3
Drawing (4 roll)	Drawing tenders		44.40	44	3	48–56	1	1	1	3
	Can boy				3	116	1	1	1	3
Slubbers—LD (140 sp.)	Slubber tenders	8″ x 4″–4.00 hr. (0.426 kg/bob.)	1,662	12	3	4	3	3	3	9
Slubbers—LD (120 sp.)	Slubber tenders	9″ x 4½″–2.00 (0.570 kg/bob.)	486	4	3	3	1	1	1	3
Spinning	Spinners	No. frames 50 W–33 F	25,000	14,250–10,750	3	2,900	9	9	9	27
	Top cleaners				3	5,000	5	5	5	15
	Doffers	32,000 bob/8 hrs. (Doffs 8 hr. 0.72–2.02)			3	1,000 bob/hr.	4	4	4	12
	Spindle setter				3	50 M.sp.	0.50	0.50	0.50	
	Overhaulers				3	25 M.	1	1	1	
	Overhaulers helpers				3	25 M.	1	1	1	
	Oiler				3	25 M	1	1	1	
	Oiler and tape man				3	50 M	0.50	0.50	0.50	12
	Roving hoister	500 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	32,000 bob/8 hrs.			3	20,000 bob/hr.	2	2	2	6
	Fixer or third man				3	15–17 M.sp.	2	2	2	6
	Second hand				3	50 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
General										
	Oiler				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	4,000 rev. bob. and 22,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M	1	1	1	3
	Humidifier men				3	25 M	1	1	1	3
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	2	2	2	6
	General work and misc.				3	10 M.sp.	2	2	2	6
										167

Table No. 31

Man-shifts/day: 177
Man-hours/hour: 59
Production/hour: 231.7 kg.
Labour consumption: 25.46 m-h/100 kg.
Productivity: 3.93 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000
Mill type: Modern
Product: 35's combed yarn

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	32 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	
	Opener tender		0.92	1	3	6 bales/hr.	0.25	0.25	0.25	
	Waste man			1	1	680 kg/hr.	1	—	—	
Picking	Picker tender		2.55	3	3	4 pickers	0.75	0.75	0.75	
	Waste machine operator			1	1	45 kg/hr.	1	—	—	6
Cards	Card tenders		76.80	82	3	40	2	2	2	6
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Drawing (4 roll)	Drawing tenders		52.92	52	3	48–56	1	1	1	3
Lap machine (20 ends)	Lap winder tender		2.08	2	3	3	1	1	1	3
Combers	Comber tender		13.12	13	3	6	2	2	2	6
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		2.22	2	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		39.00	40	3	48–60	1	1	1	3
	Can boy				3	116	1	1	1	3
Roving (148 sp.)	Roving tenders	8" x 4"–4.00 hr. (0.426 kg./bob.)	2,909	20	3	5	4	4	4	12
Spinning	Spinners	No. frames 50 W–33 F	25,000	14,250–10,750	3	2,900	9	9	9	27
	Top cleaners				3	5,000	5	5	5	15
	Doffers	31,975 bob/8 hrs. (Doffs 8 hrs. 0.72–2.02)			3	1,000 bob/hr.	4	4	4	12
	Spindle setter				3	50 M	0.50	0.50	0.50	
	Overhaulers				3	25 M	1	1	1	
	Overhaulers helpers				3	25 M	1	1	1	
	Oiler				3	25 M	1	1	1	
	Oiler and tape man				3	50 M	0.50	0.50	0.50	12
	Roving hoister	540 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	32,000 bob/8 hr.			3	20,000 bob/hr.	2	2	1	5
	Fixer or third hand				3	15–17 M.sp.	2	2	2	6
	Second hand				3	25 M.	1	1	1	3
	Overseer				3	50 M.	1	—	—	1
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	4,000 rov. bob. and 22,000 fill bob/8 hrs.			3	750–1,000 hr.	3	3	2	8
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helper				3	50 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				3	25 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M	2	2	2	6
	General work and misc.				3	10 M.sp.	2	2	2	6
										177

Table No. 32

Man-shifts/day: 168
Man-hours/hour: 56
Production/hour: 141.5 kg.
Labour consumption: 39.58 m-h/100 kg.
Productivity: 2.53 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000
Mill type: Modern
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	19 bales in 24 hrs.			1	8–10 bales/hr.	0.50	—	—	
	Opener tender		0.55	1	3	6–8 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.50	—	—	
Picking	Picker tender		1.58	2	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr.	1	—	—	5
Cards	Card tenders		62.60	65	3	40	2	2	2	6
	Card grinders				3	50–68	1	1	1	3
	Card strippers				3	136	1	1	1	3
Drawing (4 roll)	Drawing tenders		32.35	32	3	48–56	1	1	1	3
Lap machine (20 ends)	Lap winder tender		128	2	2	3	1	1	—	2
Combers	Comber tender		8.50	9	3	6	1.50	1.50	1.50	
	Comber fixer				3	20–26	0.50	0.50	0.50	6
Lap machine (16 ends)	Lap winder tender		1.35	2	2	3	1	1	—	2
Drawing (4 roll)	Drawing tenders		23.82	24	3	48–60	0.50	0.50	0.50	
	Can boy				3	116	0.50	0.50	0.50	3
Roving (144 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (0.570 kg/bob.)	988	7	3	3–4	2	2	2	6
Roving (160 sp.)	Roving tenders	8″ x 4″-50 hr. (0.476 kg/bob.)	2,845	18	3	5–6	3	3	3	9
Spinning	Spinners	No. frames 49 W-34 F	25,000	14,000–11,250	3	2,900	9	9	9	27
	Top cleaners				3	5,000	5	5	5	15
	Doffers	23,850 bob/8 hrs. (Doffs in 8 hrs. 0.49–1.50)			3	1,000 bob/hr.	3	3	3	9
	Spindle setter				3	50 M.sp.	0.50	0.50	0.50	
	Overhaulers				3	25 M.sp.	1	1	1	
	Overhaulers helpers				3	25 M.sp.	1	1	1	
	Oiler				3	25 M.sp.	1	1	1	
	Oiler and tape man				3	50 M.sp.	0.50	0.50	0.50	12
	Roving hoister	580 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	29,000 bob/8 hrs.			3	20 M bob/8 hrs.	2	1	1	4
	Fixer or third hand				3	12.5 M	2	2	2	6
	Second hand				3	25 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
General										
	Oilers				3	all cd. room except cd. and cp.	1	1	1	3
	Bobbin cleaners	4,600 rov. bob. and 17,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helper				3	50 M.sp.	1	1	1	3
	Humidifier men				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	1	1	1	3
	Second hand				3	50 M.sp.	1	1	1	3
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	2	2	2	6
	General work and misc.				3	10 M.sp.	2	2	2	6
										168

Table No. 33

Man-shifts/day: 144
Man-hours/hour: 48
Production/hour: 82 kg.
Labour consumption: 58.54 m-h/100 kg.
Productivity: 1.71 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000
Mill type: Modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	12 bales in 24 hrs.			1	6–8 bales/hr.	0.33	—	—	
	Opener tender		0.28	1	3	6 bales/hr.	0.50	0.50	0.50	
	Waste man			1	1	680 kg/hr.	0.33	—	—	
Picking	Picker tender		0.92	1	3	4 pickers	0.50	0.50	0.50	
	Waste machine operator			1	1	45 kg/hr.	0.33	—	—	4
Cards	Card tenders		36.98	39	3	40	1	1	1	3
	Card grinders				1	50–68	0.70	—	—	
	Card strippers				3	136	0.30	1	1	3
Drawing (4 roll)	Drawing tenders		19.20	20	3	48–56	0.50	0.50	0.50	
Lap machine (20 ends)	Lap winder tender		0.75	1	3	3	0.50	0.50	0.50	3
Combers	Comber tender		5.35	6	3	6	1	1	1	3
Lap Machine (16 ends)	Lap winder tender		0.78	1		3	0.33	0.33	0.33	
Drawing (5 roll)	Drawing tenders		13.80	16	3	48–60	0.33	0.33	0.33	
	Can boy				3	116	0.33	0.33	0.33	3
Roving (144 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (0.570 kg/bob.)	575	4	3	4	1	1	1	3
Roving (156 sp.)	Roving tenders	7″ x 3½″–7.50 hr. (0.284 kg/bob.)	2,140	14	3	5–6	3	3	3	9
Spinning	Spinners	No. frames 47 W-36 F	25,000	13,575–11,425	3	2,900	9	9	9	27
	Top cleaners				3	5,000	5	5	5	15
	Doffers	17,000 bob/8 hrs. (Doffs in 8 hrs. 0.525–0.852)			3	1,000 bob/hr.	2	2	2	6
	Spindle setter				3	50 M	0.50	0.50	0.50	
	Overhaulers				3	25 M	1	1	1	
	Overhaulers helpers				3	25 M	1	1	1	
	Oiler				3	25 M	1	1	1	
	Oiler and tape man				3	50 M	0.50	0.50	0.50	12
	Roving hoister	438 bob/hr.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	17,000 bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	15–17 M.sp.	2	2	2	6
	Second hand				3	25 M.	1	1	1	3
	Overseer				1	50 M	1	—	—	1
General										
	Oilers				3	all except cards	1	1	1	3
	Bobbin cleaners	3,500 rov. bob. and 10,000 fill bob/8 hrs.			3	750 bob/hr.	2	2	2	6
	Overhaulers				3	50 M	1	1	1	3
	Overhaulers helper				3	50 M	1	1	1	3
	Humidifier men				3	50 M	1	1	1	3
	Fixer or third hand				3	25 M	1	1	1	3
	Second hand				3	50 M	1	1	1	3
	Overseer				1	50 M	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	2	2	2	6
	General work and misc.				3	10 M.sp.	2	2	2	6
										144

Table No. 34

Man-shifts/day: 395
Man-hours/day: 131.66
Production/hour: 1,035 kg.
Labour consumption: 12.72 m-h/100 kg.
Productivity: 7.86 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	121 bales in 24 hrs.			2	8–10 bales/hr.	1	1	—	2
	Opener tenders		3.5	4	3	6–8 bales/hr.	1	1	1	3
	Waste man				1	680 kg/hr.	1	—	—	1
Picking	Picker tenders		9.00	9	3	4 pickers	3	3	3	9
	Waste machine operator				3	1 picker and waste man	1	1	1	3
	Fixer opening and picking				3	op. and pick.	1	1	1	3
Cards	Card tenders		233,50	243	3	40	6	6	6	18
	Card grinders				3	50–68	5	5	5	15
	Card strippers				3	136	2	2	2	6
Lap winders	Winder operators		7.90	8	3	3	3	3	3	9
Drawing (5 roll)	Drawing tenders		165.40	164	3	48–60	4	4	4	12
Drawing (4 roll)	Drawing tenders				3	116	2	2	2	6
	Can boy									
Slubbers-LD (120 sp.)	Slubber tenders	10 x 5–1.45 hr. (0.736 kg/bob.)	3.060	26	3	3	9	9	9	27
Spinning	Spinners	No. Frames 114 W–70 F	50,000	27,500–22,500	3	1,800	28	28	28	84
	Top cleaners				3	5,000	10	10	10	30
	Doffers	80,800 bob/8 hrs. (Doffs 8 hrs.–0.83–2.54)			3	800–1,000 bob/hr.	10	10	10	30
	Spindle setter				3	50 M.sp.	1	1	1	3
	Overhaulers				3	25 M.sp.	2	2	2	6
	Overhaulers helpers				3	25 M.sp.	2	2	2	6
	Oiler				3	25 M.sp.	2	2	2	6
	Oiler and tape man				3	50 M.sp.	1	1	1	3
	Roving hoister	1,420 bob/hr.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	80,800 bob/8 hr.			3	20 M bob/8 hrs.	4	4	4	12
	Fixer or third hand				3	12.5 M.sp.	4	4	4	12
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
General										
	Oiler				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	11,000 rov. bob. and 57,000 fill bob/8 hrs.			3	750–1,000/hr.	8	8	8	24
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Humidifier men				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	General work and misc.				3	10 M.sp.	4	4	4	12
										395

Table No. 35

Man-shifts/day: 328
Man-hours/hour: 109.33
Production/hour: 595 kg.
Labour consumption: 18.37 m-h/100 kg.
Productivity 5.44 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 26's W and 34's F carded (av. 30's)

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	70 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tenders		2.02	2	3	6–8 bales/hr.	0.75	0.75	0.75	
	Waste man				1	680 kg/hr.	1	—	—	
Picking	Picker tenders		5.14	5	3	4 pickers	1.25	1.25	1.25	7
	Waste machine operator		1	1	2	45 kg/hr.	1	1	—	2
	Fixer opening and picking				1	op. and pick.	1	—	—	1
Cards	Card tenders		168.00	175	3	40	5	5	5	15
	Card grinders				3	50–68	3	3	3	9
	Card strippers				3	136	2	2	2	6
Lap winders	Winder operators		4.60	5	3	3	2	2	2	6
Drawing (5 roll)	Drawing tenders		103.07	104	3	48–60	2	2	2	6
Drawing (4 roll)	Drawing tenders		115.00	116	3	48–60	3	3	3	9
Slubbers—LD (140 sp.)	Slubber tenders	8″ x 4″–3.00 hr. (0.426 kg/bob.)	2,913	21	3	4	5	5	5	15
Slubbers—LD (40 sp.)	Slubber tenders	9″ x 4½″–2.25 hr.	1,297	9	3	3	3	3	3	9
Spinning	Spinners	No. frames 100 W–69 F	50,000	28,600–21,400	3	2,900	17	17	17	51
	Top cleaners				3	5,000	10	10	10	30
	Doffers	62,000 bob/8 hrs. (Doffs in 8 hrs. 0.715–1.92)			3	1000 bob/hr.	8	8	8	24
	Spindle setter				3	50 M	1	1	1	3
	Overhaulers				3	25 M	2	2	2	6
	Overhaulers helpers				3	25 M	2	2	2	6
	Oiler				3	25 M	2	2	2	6
	Oiler and tape man				3	50 M	1	1	1	3
	Roving hoister	1,270 bob/hr.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	10,000 rov. and 62,000 bob/8 hrs.			3	20 M bob/8 hrs.	4	4	4	12
	Fixer or third hand				3	12.5 M	4	4	4	12
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
General										
	Oiler				3	all except cards and spin	1	1	1	3
	Bobbin cleaners	10,000 rov. bob. and 41,000 fill bob/8 hrs.			3	750–1,000/hr.	6	6	6	18
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Humidifier men				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	General work and misc.				3	10 M.sp.	4	4	4	12
										328

Table No. 36

Man-shifts/day: 319
Man-hours/hour: 106.33
Production/hour: 464 kg.
Labour consumption: 22.92 m-h/100 kg.
Productivity: 4.36 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 35's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men			Total man-shifts
							First shift	Second shift	Third shift	
Opening	Bale opener	55 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tenders		1.60	2	3	6 bales/hr.	1	1	1	3
	Waste man				1	680 kg/hr.	1	—	—	1
Picking	Picker tenders		4.00	4	3	4 pickers	1	1	1	3
	Waste machine operator			1	3	45 kg/hr.	1	1	1	3
	Fixer-opening and picking				3	op. and pick.	1	1	1	3
Cards	Card tenders		130.8	136	3	40	4	4	4	12
	Card grinders				3	50–68	2	2	2	6
	Card strippers				3	136	1	1	1	3
Lap winders	Winder operators		3.60	4	3	3	1	1	1	3
Drawing (5 roll)	Drawing tenders		79.80	80	3	48–60	2	2	2	6
Drawing (4 roll)	Drawing tenders		88.80	88	3	48–56	2	2	2	6
	Can boy				3	116	2	2	2	6
Slubbers—LD (140 sp.)	Slubber tenders	8″ x 4″-4.00 hr. (0.426 kg/bob.)	3,325	24	3	4	6	6	6	18
Slubbers—LD (120 sp.)	Slubber tenders	9″ x 4½″-2 hr. (0.570 kg/bob.)	973.30	8	3	3	3	3	3	9
Spinning	Spinners	No. frames 99 W–66 F	50,000	28,500–21,500	3	2,900 sp.	17	17	17	51
	Top cleaners				3	5,000 sp.	10	10	10	30
	Doffers	64,000 bob/8 hrs. (Doffs/8 hrs. 0.72–2.02)			3	800–1,000 bob/hr.	9	9	9	27
	Spindle setter				3	50 M	1	1	1	3
	Overhaulers				3	25 M	2	2	2	6
	Overhaulers helpers				3	25 M	2	2	2	6
	Oiler				3	25 M	2	2	2	6
	Oiler and tape man				3	50 M	1	1	1	3
	Roving hoister	960 rov. bob/hr.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	64,000 bob/8 hrs.			3	20 M bob/8 hrs.	3	3	3	9
	Fixer or third hand				3	12.5 M.sp.	4	4	4	12
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
General										
	Oiler				3	all except pick and cards	1	1	1	3
	Bobbin cleaners	7,700 rov. bob and 43,000 fill bob/8 hrs			3	750–1,000 bob/hr.	6	6	6	18
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Humidifier men				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	General work and misc.				3	10 M.sp.	4	4	4	12
										319

Table No. 37

Man-shifts/day: 332
Man-hours/hour: 110.66
Production/hour: 463.5 kg.
Labour consumption: 23.87 m-h/100 kg.
Productivity: 4.19 kg/m-h.

STANDARD MILLS
OPTIMUM OPERATION AND LABOUR CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 35's combed yarn

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	63 bales in 24 hrs.			1	8–10 bales/hr	1	—	—	1
	Opener tender		1.83	2	3	6 bales/hr.	0.75	0.75	0.75	
	Waste man				1	680 kg/hr.	1	—	—	
Picking	Picker tender		5.10	5	3	4 pickers	1.25	1.25	1.25	7
	Waste machine operator			1	2	45 kg/hr.	1	1	—	2
	Fixer opening and picking				2	op. and pick	1	1	—	2
Cards	Card tenders		153.60	160	3	40	4	4	4	12
	Card grinders				3	50–68	3	3	3	9
	Card strippers				3	136	1	1	1	3
Drawing (4 roll)	Drawing tenders		105.80	104	3	48–56	2	2	2	6
Lap machine (20 end)	Lap winder tender		4.15	4	3	3	1	1	1	3
Combers	Comber tender		26.25	26	3	6	5	5	5	15
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		4.45	5	3	3	2	2	2	6
	Can boy				3	116	1	1	1	3
Drawing (5 roll)	Drawing tenders		78.00	78	3	48–60	2	2	2	6
	Can boy									
Roving (148 sp.)	Roving tenders	8″ x 4″–4.00 hr. (0.426 kg/bob.)	5.818	40	3	5	8	8	8	24
Roving (160 sp.)	Roving tenders									
Spinning	Spinners	No. frames 99 W–66 F			3	2,900	17	17	17	51
	Top cleaners				3	5,000	10	10	10	30
	Doffers	63,000 bob/8 hrs.			3	1,000 bob/hr	8	8	8	24
	Spindle setter				3	50 M	1	1	1	3
	Overhaulers				3	25 M	2	2	2	6
	Overhaulers helpers				3	25 M	2	2	2	6
	Oiler				3	25 M	2	2	2	6
	Oiler and tape man				3	50 M	1	1	1	3
	Roving hoister	1,000 bob/hr.			3	600/700 bob/hr	2	2	2	6
	Yarn man	63,000 bob/8 hrs.			3	20,000 bob/8 hrs.	3	3	3	9
	Fixer or third hand				3	12.5 M.sp.	3	3	3	9
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	25 M.sp.	1	—	—	1
General										
	Oilers				3	All except pickers and cards	1	1	1	3
	Bobbin cleaners	8,000 rov. bob and 43,000 fill bob			3	750–1,000 bob/hr.	6	6	6	18
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp.	2	2	2	6
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	General work and misc.				3	10 M.sp.	4	4	4	12
										332

Table No. 38

Man-shifts/day: 326
Man-hours/hour: 108.66
Production/hour: 283 kg.
Labour consumption: 38.39 m-h/100 kg.
Productivity: 2.60 kg/m-h.

STANDARD MILLS
OPTIMUM OPERATION AND LABOUR CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	38 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tender		1.10	1	3	6–8 bales/hr.	0.25	0.25	0.25	
	Waste man				1	680 kg/hr.	1	—	—	
Picking	Picker tender		3.15	3	3	4	0.75	0.75	0.75	4
	Waste machine operator				1	45 kg/hr.	1	—	—	1
	Fixer opening and picking				3	op. and pick	1	1	1	3
Cards	Card tenders		125.20	130	3	40	4	4	4	12
	Card grinders				3	50–68	2	2	2	6
	Card strippers				3	136	1	1	1	3
Drawing (4 roll)	Drawing tenders		64.70	64	3	48–56	2	2	2	6
Lap machine (20 end)	Lap winder tender		2.55	3	3	3	1	1	1	3
Combers	Comber tender		17.00	17	3	6	3	3	3	9
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		270	3	3	3	1	1	1	3
	Can boy									
Drawing (5 roll)	Drawing tenders		47.60	48	3	48–60	1	1	1	3
	Can boy			112	3	116	1	1	1	3
Roving (148 sp.)	Roving tenders	9" x 4½"–2.50 hr. (0.570 kg/bob.)	1.975	14	3	3	5	5	5	15
Roving (160 sp.)	Roving tenders	8" x 4"–5.50 hr. (0.426 kg/bob.)	5,690	36	3	5–6	7	7	7	21
Spinning	Spinners	No. frames 97 W–70 F	50,000	28,000–22,500	3	2,900 sp.	17	17	17	51
	Top cleaners				3	5,000 sp.	10	10	10	30
	Doffers	48,000 bob/8 hrs. (Doffs in 8 hrs. 049–1.5)			3	1,000 bob/hr.	6	6	6	18
	Spindle setter				3	50 M.sp.	1	1	1	3
	Overhaulers				3	25 M.sp.	2	2	2	6
	Overhaulers helpers				3	25 M.sp.	2	2	2	6
	Oiler				3	25 M.sp.	2	2	2	6
	Oiler and tape man				3	50 M.sp.	1	1	1	3
	Roving hoister				3	600–700 bob/hr.	4	4	4	12
	Yarn man				3	20 M bob/8 hrs.	3	3	3	9
	Fixer or third hand				3	12.5 M.sp.	4	4	4	12
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	25 M.sp.	1	—	—	1
General										
	Oilers				3	All card room except cards and spin.	1	1	1	3
	Bobbin cleaners	9,200 rov. bob. and 34,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	5	5	5	15
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Humidifier men				3	25 M.sp	2	2	2	6
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	General work and misc.				3	10 M.sp.	4	4	4	12
										326

Table No. 39

Man-shifts/day: 271
Man-hours/hour: 90.33
Production/hour: 164 kg.
Labour consumption: 55.08 m-h/100 kg.
Productivity: 1.82 kg/m-h.

STANDARD MILLS
OPTIMUM OPERATION AND LABOUR
CONSUMPTION

Mill size: 50,000
Mill type: Modern
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	23 bales in 24 hrs.			1	8–10 bales/hr.	0.50	—	—	
	Opener tender		0.55	1	3	6–8 bales/hr.	0.50	0.50	0.50	
	Waste man				1	680 kg/hr.	0.50	—	—	
Picking	Picker tender		1.84	2	3	4 pickers	0.50	0.50	0.50	4
	Waste machine operator				1	45 kg/hr	1	—	—	1
	Fixer opening and picking				1	op. and picker	1	—	—	1
Cards	Card tenders		74.00	77	3	40	2	2	2	6
	Card grinders				3	50–68	1.50	1.50	1.50	
	Card strippers				3	136	0.50	0.50	0.50	6
Drawing (4 rolls)	Drawing tenders		38.40	40	3	48–56	1	1	1	3
Lap machine (20 end)	Lap winder tender		1.50	2	3	3	1	1	1	3
Combers	Comber tender		10.70	11	3	6	2	2	2	6
	Comber fixer				3	20–26	1	1	1	3
Lap machine (16 ends)	Lap winder tender		1.60	2	3	3	1	1	1	3
	Can boy									
Drawing (5 roll)	Drawing tenders		27.60	28	3	50–66	0.50	0.50	0.50	
	Can boy				3	116	0.50	0.50	0.50	3
Roving (148 sp.)	Roving tenders	9″ x 4½″–2.50 hr. (0.570 kg/bob.)	1.153	8	3	4	3	3	3	9
Roving (160 sp)	Roving tenders	7″ x 3½″–7.50 hr. (0.284 kg/bob.)	4.283	27	3	5–6	5	5	5	15
Spinning	Spinners	No. frames 95 W–70 F			3	2,900	17	17	17	51
	Top cleaners				3	5,000	10	10	10	30
	Doffers	34,000 bob/8 hrs. (Doffs 8 hrs. 0.525–0.852)			3	1,000 bob/hr.	4	4	4	12
	Spindle setter				3	50 M	1	1	1	3
	Overhaulers				3	25 M	2	2	2	6
	Overhaulers helpers				3	25 M	2	2	2	6
	Oiler				3	25 M	2	2	2	6
	Oiler and tape man				3	50 M	1	1	1	3
	Roving hoister	876 bob/hr.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	34,000 bob/8 hrs.			3	20 M bob/8 hrs.	2	2	2	6
	Fixer or third hand				3	12.5 M	4	4	4	12
	Second hand				3	25 M	2	2	2	6
	Overseer				1	50 M	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	7,000 rov. bob. and 26,000 fill bob/8 hrs.			3	750–1,000 bob/hr.	4	4	4	12
	Overhaulers				3	50 M.sp.	1	1	1	3
	Overhaulers helpers				3	50 M.sp.	1	1	1	3
	Humidifier men				3	50 M.sp.	1	1	1	3
	Fixer or third hand				3	25 M.sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 M.sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M.sp	4	4	4	12
	General work and misc				3	10 M.sp.	4	4	4	12
										271

Table No. 40

Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	7.5	548 m/min. 600 y/p.m.	2.586 kg.	70%	1.810 kg.	137.62 kg.	76.00
Warpers	405 ends	451 m/min. 500 y/p.m.	873.2 kg.	60%	539.9 kg.	136.94 kg.	0.26
Slashers	1,620 ends	31.0 m/min. 34 y/p.m.	237.0 kg.	65%	142.2 kg.	136.26 kg.	0.96
Tying-in		270 knots/min.	10.0 beams	50%	5.0 beams	0.83 beams	0.17
Looms	Osnaburg	192 r.p.m.	11.25 m. 2.419 kg.	90%	10.12 m. 2.176 kg.	217.60 kg.	100

FABRIC SPECIFICATIONS

Name in English: Osnaburg.
Name in Spanish: Osnaburgo.
Warp density 40. Filling density 26.
Warp count 7.5's. Filling count 8.25's.
Width in the reed 44 m.–111.7 cm. Width in the grey 40 m.–101.6 cm.
Grams/m. 215.1. Grams/sq. m. 192.56. Yds/lb. 2.30.
Percentage warp 62.01. Percentage filling 37.99.
Fabric count: 79.6.

Table No. 41

Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	13	548 m/min. 600 y/min.	1.492 kg.	70%	1.044 kg.	53.64 kg.	51.20
Warpers	485 ends	457 m/min. 500 y/min.	603.4 kg.	60%	362.0 kg.	53.38 kg.	0.15
Slashers	1,940 ends	33 m/min. 36 y/min.	174.3 kg.	65%	113.2 kg.	53.12 kg.	0.47
Tying-in		270 knots/min.	8.35 beams	50%	4.17 beams	0.32 beams	0.076
Looms	Sheeting A	192 r.p.m.	6.096 m. 1.150 kg.	90%	5.486 m. 1.035 kg.	103.5 kg.	100

FABRIC SPECIFICATIONS

Name in English: Sheeting A.
Name in Spanish: Telas para sabanas A.
Warp density 48. Filling density 48.
Warp count 13's. Filling count 13's.
Width in the reed 42.64″–108.3 cm. Width in the grey 40″–101.6 cm.
Grams/m. 188.8. Grams/sq. m. 174.3. Yds/lb. 2.63.
Percentage warp 50.82. Percentage filling 49.18.
Fabric count: 127.9.

Table No. 42

Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	17	548 m/min. 600 y/min.	1.140 kg.	70%	0.798 kg.	43.60 kg.	54.60
Warpers	485 ends	457 m/min. 500 y/min.	461.2 kg.	60%	276.7 kg.	43.40 kg.	0.156
Slashers	1,940 ends	41.1 m/min. 45 y/min.	166.3 kg.	65%	108.0 kg.	43.20 kg.	0.40
Tying-in		270 knots/min.	8.3 beams	50%	4.15	0.264 beams	0.062
Looms	Sheeting B	192 r.p.m.	6.649 m. 0.823 kg.	90%	5.984 m. 0.741 kg.	74.10 kg.	100

FABRIC SPECIFICATIONS

Name in English: Sheeting B.
Name in Spanish: Sabana B.
Warp density 48. Filling density 44.
Warp count 17's. Filling count 21's.
Width in the reed 42.36″–107.59 cm. Width in the grey 40″–101.6 cm.
Grams/m. 123.83. Grams/sq. m. 115.09. Yds/lb. 4.00.
Percentage warp 57.73. Percentage filling 45.
Fabric count 185.7.

Table No. 43

Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	21	548 m/min. 600 y/min.	0.923 kg.	70%	0.646 kg.	32.10 kg.	48.40
Warpers	445 ends	457 m/min. 500 y/min.	342.7 kg.	60%	205.6 kg.	31.96 kg.	0.155
Slashers	1,780 ends	45.7 m/min. 50 y/min.	137.1 kg.	65%	89.11 kg.	31.80 kg.	0.357
Tyings-in		270 knots/min.	9.16 beams	50%	4.55 kg.	0.19 beams	0.043
Looms	Sheeting C	192 r.p.m.	6.649 m. 0.628 kg.	90%	5.894 m. 0.565 kg.	56.50 kg.	100

FABRIC SPECIFICATIONS

Name in English: Sheeting C.
Name in Spanish: Sabana C.
Warp density 44. Filling density 44.
Warp count 21's. Filling count 26's.
Width in the reed 41.96″–106.57 cm. Width in the grey 40″–101.6 cm.
Grams/m. 94.44. Grams/sq. m. 88.61. Yds/lb. 5.26.
Percentage warp 55.65. Percentage filling 44.35.
Fabric count 230.7.

Table No. 44

Mill type: Modern
Product: Print cloth
Fabric count: 332.7

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	30	548 m/min. 600 y/min.	0.646 kg.	70%	0.452 kg.	23.08 kg.	51.00
Warpers	449 ends	457 m/min. 500 y/min.	241.9 kg.	60%	145.1 kg.	22.86 kg.	0.16
Slashers	3,144 ends	28 m/min. 30.6 y/min.	96.45 kg.	65%	62.69 kg.	22.64 kg.	0.36
Tying-in		270 knots/min.	5.15 beams	50%	2.57 beams	0.14 beams	0.054
Looms	Print cloth	192 r.p.m.	3.567 m. 0.437 kg.	90%	3.291 m. 0.393 kg.	39.30 kg.	100

FABRIC SPECIFICATIONS

Name in English: Print cloth.
Name in Spanish: Tela de estampe.
Warp density 80. Filling density: 80.
Warp count: 30's. Filling count: 40's.
Width in the reed: 42.2″–107 cm. Width in the grey: 39″–99 cm.
Grams/m: 119.58. Grams/sq. m. 111.75. Yds/lb. 4.14.
Percentage warp: 57.3. Percentage filling: 42.2.
Fabric count: 332.7.

Table No. 45

Mill type: Modern
Product: Broadcloth
Fabric count: 429

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Cone winders	50	548 m/min. 600 y/p.m.	0.389 kg.	70%	0.272 kg.	26.00 kg.	95.60
Warpers	464 ends	457 m/min. 500 y/p.m.	151.0 kg.	60%	90.6 kg.	25.75 kg.	0.28
Slashers	5,568 ends	16.4 m/min. 18 y/p.m.	65.1 kg.	65%	42.3 kg.	25.50 kg.	0.60
Tying-in		270 knots/min.	2.91 beams	50%	1.45 beams	0.10 beams	0.07
Looms	Broadcloth	192 r.p.m.	3.856 m. 0.450 kg.	90%	3.470 m. 0.405 kg.	40.50 kg.	100

FABRIC SPECIFICATIONS

Name in English: Broadcloth.
Name in Spanish: "Broadcloth."
Warp density: 144. Filling density: 76.
Warp count: 50's. Filling count: 45's.
Width in the reed 43.9″–111.5 cm. Width in the grey 38.5″–97.79 cm.
Grams/m. 116.72. Grams/sq. m. 119.10. Yds/lb. 4.25.
Percentage warp 61.7. Percentage filling 38.3.
Fabric count 429.

Table No. 46

Man-shifts/day: 36
Man-hours/hour: 12
Production/hour: 87.0 kg.
Labour consumption: 13.8 m-h/100 kg.
Productivity: 7.25 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	55.0	30	40	3	20	2	2	2	6
Warping	Warper tenders	60	54.7	0.10	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	54.4	0.38	1	1	2	1	—	—	1
	Helpers						3–4	1	—	—	1
Tying-in	Tying-in machine operator	50	0.33 beams	0.06	1	1	1	1	—	—	1
Weaving	Weavers	90	87.0	40	40	3	38 looms	1	1	1	3
	Battery hands					3	25 looms	2	2	2	6
	Loom fixers					3	50 looms	1	1	1	3
General	Yarn haulers, warper doffers, warp men, filling hauler and quill men (full quills/8 hrs: 5.2 M; empty quills/8 hrs.: 5.2 M)					3	40 looms	1	1	1	3
	Drawing- in hands, spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	0.40	0.40	0.40	
	Cloth doffers and truckers					3	250 looms	0.20	0.20	0.20	
	Blow-off men and sweepers					3	250 looms	0.20	0.20	0.20	
	Oilers					3	250 looms	0.20	0.20	0.20	
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											36

Table No. 47

Man-shifts day: 29
Man-hours/hour: 9.6
Production/hour: 41.4 kg.
Labour consumption: 23.2 m-h/100 kg.
Productivity: 4.31 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Winding or spooling	Winder hands	70	21.4	20	30	3	30	1	1	1	3
Warping	Warper tenders	60	21.3	0.05	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	21.2	0.18	1	1	2	0.5	—	—	
	Helpers					1	3–4	0.5	—	—	1
Tying-in	Tying-in machine operator	50	0.13 beams	0.03	1	1	1	1	—	—	1
Weaving	Weavers	90	41.4	40	40	3	72 looms	1	1	1	3
	Battery hands					3	45 looms	1	1	1	3
	Loom fixers					3	72 looms	1	1	1	3
General											
	Yarn haulers, warper doffers, warp men, filling hauler and quill men (full quills/8 hrs.: 3.2 M; empty quills/8 hrs.: 3.2 M)					3	40 looms	1	1	1	3
	Drawing-in hands, spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	0.40	0.40	0.40	
	Cloth doffers and truckers					3	250 looms	0.20	0.20	0.20	
	Blow-off men and sweepers					3	250 looms	0.20	0.20	0.20	
	Oilers					3	250 looms	0.20	0.20	0.20	3
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											29

Table No. 48

Man-shifts/day: 29
Man-hours/hour 9.6
Production/hour: 29.6 kg.
Labour consumption: 32.65 m-h/100 kg.
Productivity: 3.06 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	17.44	21.84	30	3	40	1	1	1	3
Warping	Warper tenders	60	17.36	.0627	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer and third hand					1	1	1	—	—	1
	Slasher tenders	65	17.28	.08	1	1	2	0.5	—	—	1
	Helpers					1	3–4	0.5	—	—	
Tying-in	Tying-in machine operator and misc.	50	.1056	.025	1	1	1	1	—	—	1
Weaving	Weavers	90	29.64	40	40	3	50 looms	1	1	1	3
	Battery hands					3	68 looms	1	1	1	3
	Loom fixers					3	72 looms	1	1	1	3
General											
	Yarn haulers, warper doffers, warp men, filling haulers and quill men (full quills/8 hrs.: 2.4 M; empty quills/8 hrs.: 2.4 M)					3	40 looms	1	1	1	3
	Drawing-in hands and spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	.49	.49	.49	
	Cloth doffers and truckers					3	250 looms	.17	.17	.17	
	Blow-off men and sweepers					3	250 looms	.17	.17	.17	
	Oilers					3	312 looms	.17	.17	.17	3
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											29

Table No. 49

Man-shifts/day: 29
Man-hours/hour: 9.6
Production/hour: 22.60 kg.
Labour consumption: 42.2 m-h/100 kg.
Productivity: 2.37 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	12.8	20	30	3	40	1	1	1	3
Warping	Warper tenders	60	12.7	0.06	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixers					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	12.7	0.14	1	1	2	0.5	—	—	
	Helpers						3-4	0.5	—	—	1
Tying-in	Tying-in machine operator	50	0.07 beams	0.017	1	1	1	1	—	—	1
Weaving	Weavers	90	22.60	40	40	3	56 looms	1	1	1	3
	Battery hands					3	56 looms	1	1	1	3
	Loom fixers					3	72 looms	1	1	1	3
General											
	Yarn haulers, warper doffers, warp men, filling haulers and quill men (full quills/8 hrs.: 2.4 M; empty quills/8 hrs.: 2.4 M)					3	40 looms	1	1	1	3
	Drawing-in hands, spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	0.40	0.40	0.40	
	Cloth doffers and truckers					3	250 looms	0.20	0.20	0.20	
	Blow-off men and sweepers					3	250 looms	0.20	0.20	0.20	
	Oilers					3	250 looms	0.20	0.20	0.20	3
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											20

Table No. 50

Man-shifts/day: 26
Man-hours/hour: 8.6
Production/hour: 15.7 kg.
Labour consumption: 55.0 m-h/100 kg.
Productivity: 1.82 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	9.25	21	30	3	50	1	1	1	3
Warping	Warper tenders	60	9.15	0.06	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	9.05	0.14	1	1	2	0.5	—	—	
	Helpers						3–4	0.5	—	—	1
Tying-in	Tying-in machine operator	50	0.05 beam	0.02	1	1	1	1	—	—	1
Weaving	Weavers	90	15.72	40	40	3	63 looms	1	1	1	3
	Battery hands					3	82 looms	0.5	0.5	0.5	
	Loom fixers					3	82 looms	0.5	0.5	0.5	3
Genera											
	Yarn haulers, warper doffers, warp men, filling haulers and quill men (full quills/8 hrs.: 1.3M; empty quills/8 hrs.: 1.3 M)					3	40 looms	1	1	1	3
	Drawing-in hands, spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	0.40	0.40	0.40	
	Cloth doffers and truckers					3	250 looms	0.20	0.20	0.20	
	Blow-off men and sweepers					3	250 looms	0.20	0.20	0.20	
	Oilers					3	250 looms	0.20	0.20	0.20	3
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											26

Table No. 51

Man-shifts/day: 29
Man-hours/hour: 9.6
Production/hour: 16.2 kg.
Labour consumption: 59.2 m-h/100 kg.
Productivity: 1.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winders hands	70	10.4	38	40	3	50	1	1	1	3
Warping	Warper tenders	60	10.3	0.11	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	10.2	0.24	1	1	2	0.5	—	—	
	Helpers					1	3–4	0.5	—	—	1
Tying-in	Tying-in machine operator	50	0.04 beams	0.03	1	1	1	1	—	—	1
Weaving	Weavers	90	16.2	40	40	3	3.2 looms	1.5	1.5	1.5	
	Battery hands					3	80 looms	0.5	0.5	0.5	6
	Loom fixers					3	72 looms	1	1	1	3
General											
	Yarn haulers, warper doffers, warp men, filling haulers and quill men (full quills/8 hrs: 1.2 M; empty quills/8 hrs.: 1.2 M)					3	40 looms	1	1	1	3
	Drawing-in hands, spare weavers and smash hands					3	40 looms	1	1	1	3
	Loom cleaners					3	100 looms	0.40	0.40	0.40	
	Cloth doffers and truckers					3	500 looms	0.20	0.20	0.20	
	Blow-off men and sweepers					3	250 looms	0.20	0.20	0.20	
	Oilers					3	250 looms	0.20	0.20	0.20	3
	Section hands					3	250 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											29

Table No. 52

Man-shifts/day: 77
Man-hours/hour: 25.6
Production hour: 217.6 kg.
Labour consumption: 11.80 m-h/100 kg.
Productivity: 8.48 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	137.6	76	80	3	20	4	4	4	12
Warping	Warper tenders	60	136.9	0.26	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	136.2	0.96	1	3	2	1	1	1	3
	Helpers						3–4	1	1	1	3
Tying-in	Tying-in machine operator	50	0.83 beams	0.16	1	1	1	1	—	—	1
Weaving	Weavers	90	217.6	100	100	3	38 looms	3	3	3	9
	Battery hands					3	25 looms	4	4	4	12
	Loom fixers					3	50 looms	2	2	2	6
General											
	Yarn haulers and warper doffers					1	500–700 kg/hr.	1	—	—	1
	Drawing-in hands					2	250 looms	1	1	—	2
	Warp men					2	250 looms	1	1	—	2
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 13 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 13 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	1	1	1	3
	Cloth doffers and truckers					2	250 looms	1	0.5	—	
	Blow-off men and sweepers					2	250 looms	1	0.5	—	3
	Oilers					3	250 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											77

Table No. 53

Man-shifts/day: 58
Man-hours/hour: 19.3
Production hour: 103.5 kg.
Labour consumption: 18.65 m-h/100 kg.
Productivity: 5.36 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Winding or spooling	Winder hands	70	53.6	51	60	3	30	2	2	2	6
Warping	Warper tenders	60	53.3	0.14	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	53.1	0.46	1	2	2	1	1	—	2
	Helpers					2	3–4	1	1	—	2
Tying-in	Tying-in machine operator	50	0.32 beams	0.07	1	1	1	1	—	—	1
Weaving	Weavers	90	103.5	100	100	3	72 looms	2	2	2	6
	Battery hands					3	45 looms	2	2	2	6
	Loom fixers					3	72 looms	2	2	2	6
General											
	Yarn haulers and warper doffers					1	500–700 kg/hr.	1	—	—	1
	Drawing-in hands					2	250 looms	1	1	—	2
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	250 looms	0.5	0.5	0.5	3
	Filling hauler (full quills/8 hrs.: 8 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 8 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	1	1	1	3
	Cloth doffers and truckers					3	250 looms	0.5	0.5	0.5	
	Blow-off men and sweepers					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											58

Table No. 54

Man-shifts/day: 59
Man-hours/hour: 19.6
Production/hour: 74.1 kg.
Labour consumption: 26.6 m-h/100kg.
Productivity: 3.76 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

Process	Job	Efficiency in percentage	Production in kg/hr.	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Winding or spooling	Winder hands	70	43.6	54.6	60	3	40	2	2	2	6
Warping	Warper tenders	60	43.4	.156	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer and third hand					2	all prep.	1	1	—	2
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	43.2	.40	1	2	2	1	1	—	2
	Helpers					2	3-4	1	1	—	2
Tying-in	Tying-in machine operator and misc.	50	.264	.062	1	1	1	1	—	—	1
Weaving	Weavers	90	74.1	100	100	3	50	2	2	2	6
	Battery hands					3	62	2	2	2	6
	Loom fixers					3	72	2	2	2	6
General											
	Yarn haulers and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					2	250 looms	1	1	—	
	Warp men					3	300 looms	0.5	0.5	0.5	5
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 6 M)					3	20–25 M/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 6 M)					3	30–40 M/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	1	1	1	3
	Cloth doffers and truckers					3	250 looms	0.5	0.5	0.5	
	Blow-off men and sweepers					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	312 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseers					1	500 looms	1	—	—	1
											59

Table No. 55

Man-shifts/day: 54
Man-hours/hour: 18
Production/hour: 56.5 kg.
Labour consumption: 31.81 m-h/100 kg.
Productivity: 3.14 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	Job	Efficiency in percentage	Production in kg/hr.	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Winding or spooling	Winder hands	70	32.1	49	60	3	40	2	2	2	6
Warping	Warper tenders	60	31.9	0.15	1	1	1	0.5	—	—	
	Warper creelers					1	1	0.5	—	—	1
	Fixer					3	all prep.	1	1	1	3
Slashing	Slasher tenders	65	31.8	0.35	1	1	2	1	—	—	1
	Helpers					1	3–4	1	—	—	1
Tying-in	Tying-in machine operator	50	0.19 beams	0.04	1	1	1	1	—	—	1
Weaving	Weavers	90	56.5	100	100	3	56 looms	2	2	2	6
	Battery hands					3	56 looms	2	2	2	6
	Loom fixers					3	72 looms	2	2	2	6
General											
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	0.5	—	
	Drawing-in hands					2	250 looms	1	0.5	—	3
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	250 looms	0.5	0.5	0.5	3
	Filling haulers (full quills/8 hrs.: 6 M)					3	20–25 M/bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 6 M)					3	30–40 M/bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	1	1	1	3
	Cloth doffers and truckers					3	250 looms	0.5	0.5	0.5	
	Blow-off men and sweepers					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											54

Table No. 56

Man-shifts/day: 46
Man-hours/hour: 15.3
Production/hour: 39.3 kg.
Labour consumption: 38.9 m-h/100 kg.
Productivity: 2.57 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Winding or spooling	Winder hands	70	23.0	51	50	3	50	1	1	1	3
Warping	Warper tenders	60	22.8	0.15	1	1	1	0.5	—	—	1
	Warper creelers					1	1	0.5	—	—	
	Fixer					2	all prep.	1	1	—	2
Slashing	Slasher tenders	65	22.6	0.36	1	1	2	1	—	—	1
	Helpers						3–4	1	—	—	1
Tying-in	Tying-in machine operator	50	0.14 beams	0.05	1	1	1	1	—	—	1
Weaving	Weavers	90	39.3	100	100	3	63 looms	2	2	2	6
	Battery hands					3	82 looms	2	2	1	5
	Loom fixers					3	82 looms	2	2	1	5
General											
	Yarn hauler and warper doffers					1	500–700 kg/hr.	1	—	—	1
	Drawing-in hands					1	250 looms	1	—	—	1
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	250 looms	0.5	0.5	0.5	3
	Filling haulers (full quills/8 hrs.: 3.2 M)					2	20–25 M bob/8 hrs.	0.5	0.5	—	
	Quill men (empty quills/8 hrs.: 3.2 M)					2	30–40 M bob/8 hrs.	0.5	0.5	—	2
	Loom cleaners					3	100 looms	1	1	1	3
	Cloth doffers and truckers					3	250 looms	0.5	0.5	0.5	
	Blow-off men and sweepers					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											46

Table No. 57

Man shifts/day: 54
Man-hours/hour: 18
Production/hour: 40.5 kg.
Labour consumption: 44.4 m-h/100 kg.
Productivity: 2.25 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	26.0	96	100	3	50	2	2	2	6
Warping	Warper tenders	60	25.7	0.28	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer						all prep.	1	—	—	1
Slashing	Slasher tenders	65	25.5	0.60	1	2	2	1	1	—	2
	Helpers						3–4	1	1	—	2
Tying-in	Tying-in machine operator	50	0.10 beams	0.07	1	1	1	1	—	—	1
Weaving	Weavers	90	40.5	100	100	3	32 looms	3	3	3	9
	Battery hands					3	80 looms	2	1	1	4
	Loom fixers					3	72 looms	2	2	1	5
General											
	Yarn haulers and warper doffers					1	500–700 kg/hr.	1	—	—	1
	Drawing-in hands					1	250 looms	1	—	—	1
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	250 looms	0.5	0.5	0.5	3
	Filling hauler (full quills/8 hrs.: 3 M)					3	20–25 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills/8 hrs.: 3 M)					3	30–40 M bob/8 hrs.	0.3	0.3	0.3	
	Loom cleaners					3	100 looms	1	1	1	
	Cloth doffers and truckers					3	500 looms	0.3	0.3	0.3	6
	Blow-off men and sweepers					2	250 looms	1	1	—	2
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											54

Table No. 58

Man-shift/day: 132
Man-hours/hour: 44
Production/hour: 435.2 kg.
Labour consumption: 10.1 m-h/100 kg.
Productivity: 9.89 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	275.2	152	160	3	20	8	8	8	24
Warping	Warper tender	60	273.8	0.52	1	2	1	1	1	—	2
	Warper creelers					2	1	1	1	—	2
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	272.4	1.92	2	3	2	1	1	1	3
	Helpers					3	3–4	0.5	0.5	0.5	
	Size man					3	5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	1.66 beams	0.32	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	90	435.2	200	200	3	38 looms	5	5	5	15
	Battery hands					3	25 looms	8	8	8	24
	Loom fixers					3	50 looms	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 26 M)					3	20–25 M bob/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 26 M)					3	30–40 M bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					1	500 looms	—	1	—	1
	Overseers					1	500 looms	1	—	—	1
											132

Table No. 59

Man-shifts/day: 98
Man-hours/hour: 32.6
Production/hour: 207.0 kg.
Labour consumption: 15.74 m-h/100 kg.
Productivity: 6.35 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	107.2	102	120	3	30	4	4	4	12
Warping	Warper tenders	60	106.6	0.26	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	106.2	0.92	1	3	2	1	1	1	3
	Helpers					3	3–4	0.5	0.5	0.5	
	Size man					3	5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	0.64 beams	0.14	1	1	1	1	—	—	1
	Tying-in helper					1	1	1	—	—	1
Weaving	Weavers	90	207.0	200	200	3	72 looms	3	3	3	9
	Battery hands					3	45 looms	5	5	5	15
	Loom fixers					3	72 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 16 M)					3	20–25 M bob/8 hrs.	1	1	0.5	
	Quill men (empty quills/8 hrs.: 16 M)					3	30–40 M bob/8 hrs.	1	—	0.5	4
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											98

Table No. 60

Man-shifts/day: 93
Man-hours/hour: 31
Production/hour: 148.2 kg.
Labour consumption: 20.95 m-h/100 kg.
Productivity: 4.78 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

								Men			
Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	87.2	109.2	120	3	40	3	3	3	9
Warping	Warper tenders	60	86.8	.312	1	1	1	1	—	—	1
	Warper creelers				1	1	1	1	—	—	1
	Fixer and third hand					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	86.4	.80	1	3	2	1	1	1	3
	Helpers					3	3–4	0.5	0.5	0.5	
	Size man					3	3–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator and misc.	50	.528	.124	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	90	148.2	200	200	3	50 looms	4	4	4	12
	Battery hands					3	62 looms	4	4	4	12
	Loom fixers					3	72 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg.	1	1	—	2
	Drawing-in hands and spare weavers					3	250 looms	1	1	1	3
	Warp men					3	300 looms	1	1	—	2
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 12M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 12 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	312 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseers					1	500 looms	1	—	—	1
											93

Table No. 61

Man-shifts/day: 90
Man-hours/hour: 30
Production/hour: 113.1 kg.
Labour consumption: 26.55 m-h/100 kg.
Productivity: 3.77 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	64.2	98	100	3	40	3	3	3	9
Warping	Warper tenders	60	63.9	0.31	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	63.6	0.71	1	2	2	1	1	—	2
	Helpers					2	3–4	0.5	0.5	—	
	Size man					2	5–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	50	0.38 beams	0.08	1	1	1	0.5	—	—	
	Tying-in machine helper					1	1	0.5	—	—	1
Weaving	Weavers	90	113.10	200	200	3	56 looms	4	4	4	12
	Battery hand					3	56 looms	4	4	4	12
	Loom fixers					3	72 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					2	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 11.5 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 11.5 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											90

Table No. 62

Man-shifts/day: 85
Man-hours/hour: 28.3
Production/hour: 78.6 kg.
Labour consumption: 35.98 m-h/100 kg.
Productivity: 2.78 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Winding or spooling	Winder hands	70	46.1	102	100	3	50	2	2	2	6
Warping	Warper tenders	60	45.7	0.31	1	1	1	1	—	—	1
	Warper creelers					1	1	1	—	—	1
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	45.2	0.72	1	3	2	1	1	1	3
	Helpers					2	3–4	0.5	0.5	—	
	Size man					2	5–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	50	0.27 beams	0.10	1	1	1	0.5	—	—	
	Tying-in machine helper					1	1	0.5	—	—	1
Weaving	Weavers	90	78.6	200	200	3	63 looms	4	4	4	12
	Battery hands					3	82 looms	3	3	3	9
	Loom fixers					3	82 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 6.4 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 6.4 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											85

Table No. 63

Man-shifts/day: 99
Man-hours/hour: 33
Production/hour: 81.0 kg.
Labour consumption: 40.8 m-h/100 kg.
Productivity: 2.45 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	52.0	191	200	3	50	4	4	4	12
Warping	Warper tenders	60	51.5	0.51	1	2	1	1	1	—	2
	Warper creelers					2	1	1	1	—	2
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
Slashing	Slasher tenders	65	51.0	1.21	2	2	2	1	1	1	3
	Helpers					2	3–4	0.5	0.5	0.5	
	Size man					2	5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	0.20 beams	0.14	1	1	1	0.5	—	—	
	Tying-in machine helper					1	1	0.5	—	—	1
Weaving	Weavers	90	81.0	200	200	3	32 looms	6	6	6	18
	Battery hands					3	80 looms	3	3	3	9
	Loom fixers					3	72 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	1	1	1	3
	Filling haulers (full quills/8 hrs.: 6 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 6 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	2	2	2	6
	Cloth doffers and truckers					3	500 looms	1	1	—	2
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					1	500 looms	—	1	—	1
	Overseer					1	500 looms	1	—	—	1
											99

Table No. 64

Man-shift/day: 195
Man-hours/hour: 65
Production/hour: 652.8 kg.
Labour consumption: 9.66 m-h/100 kg.
Productivity: 10.02 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	412.8	228	260	3	20	13	13	13	39
Warping	Warper tenders	60	410.7	0.78	1	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Fixers					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	408.6	2.88	3	3	2	1.5	1.5	1.5	
	Helpers					3	3–4	1	1	1	
	Size man					3	5–6	0.5	0.5	0.5	9
Tying-in	Tying-in machine operator	50	2.49 beams	0.48	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	90	652.8	300	300	3	38 looms	8	8	8	24
	Battery hands					3	25 looms	12	12	12	36
	Loom fixers					3	50 looms	6	6	6	18
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 39 M)					3	20–25 M bob/8 hrs.	2	2	2	6
	Quill men (empty quills/8 hrs: 39 M)					3	30–40 M bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	250 looms	2	1	1	4
	Blow-off men and sweepers					3	250 looms	2	1	1	4
	Oilers					3	250 looms	1	1	1	3
	Section hand					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											195

Table No. 65

Man-shifts/day: 131
Man-hours/hour: 43.6
Production: 310.5 kg.
Labour consumption: 14.05 m-h/100 kg.
Productivity: 7.13 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	160.8	153	180	3	30	6	6	6	18
Warping	Warper tenders	60	159.9	0.42	1	2	1	1	1	—	2
	Warper creelers					2	1	1	1	—	2
	Fixers					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	159.3	1.38	2	2	2	1	1	—	2
	Helpers					2	3–4	0.5	0.5	—	
	Size man					2	5–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	50	0.966 beams	0.21	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	90	310.5	300	300	3	72	4	4	4	12
	Battery hands					3	45	7	7	7	21
	Loom fixers					3	72	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 24 M)					3	20–25 M bob/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 24 M)					3	30–40 M bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	250 looms	2	1	1	4
	Blow-off men and sweepers					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Section hand					3	250 looms	2	1	1	4
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											131

Table No. 66

Man-shifts/day: 124
Man-hours/hour: 41.3
Production/hour: 222.3 kg.
Labour consumption: 18.60 m-h/100 kg.
Productivity: 5.38 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shif*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	130.8	163.8	200	3	40	5	5	5	15
Warping	Warper tenders	60	130.2	0.470	1	2	1	1	1	—	2
	Warper creelers					2	1	1	1	—	2
	Fixer and third hand					3	all prep.	1	1	1	3
	Second hand					1	all prep.	—	1	—	1
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	128.3	1.18	2	2	2	1	1	—	2
	Helpers					2	3–4	1	1	—	2
	Size man					1	3–6	1	—	—	1
Tying-in	Tying-in machine operator and misc.	50	.792 beams	1.186	1	1	1	1	—	—	—
	Tying-in machine helper					1	1	1	—	—	2
Weaving	Weavers	90	222.3	300	300	3	50 looms	6	6	6	18
	Battery hands					3	62 looms	5	5	5	15
	Loom fixers					3	72 looms	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers and assistant warp men					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands and spare weavers					3	250 looms	2	1	1	4
	Warp men					3	300 looms	1	1	1	3
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 22.4 M)					3	20–25 M bob/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 22.4 M)					3	30–40 M/bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	250 looms	1	1	1	3
	Blow-off men and sweepers					3	250 looms	1	1	1	3
	Oilers					3	312 looms	1	1	1	3
	Section hands					3	250 looms	1	1	1	3
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											124

Table No. 67

Man-shifts/day: 128
Man-hours/hour: 42.6
Production/hour: 169.5 kg.
Labour consumption: 25.10 m-h/100 kg.
Productivity: 3.98 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	96.3	147	160	3	40	4	4	4	12
Warping	Warper tenders	60	95.8	0.46	1	2	1	1	1	—	2
	Warper creelers					2	1	1	1	—	2
	Fixer					3	all prep.	1	1	1	3
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	95.4	1.07	1	3	2	1	1	1	3
	Helpers					3	3–4	0.5	0.5	0.5	—
	Size man					3	5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	0.57 beams	0.12	1	1	1	1	—	—	1
	Tying-in helper					1	1	1	—	—	1
Weaving	Weavers	90	169.5	300	300	3	56 looms	6	6	6	18
	Battery hands					3	56 looms	6	6	6	18
	Loom fixers					3	72 looms	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 17 M)					3	20–25 M bob/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 17 M)					2	30–40 M bob/8 hrs.	1	1	—	2
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	250 looms	2	1	1	4
	Blow-off men and sweepers					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Section hand					3	250 looms	2	1	1	4
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											128

Table No. 68

Man-shifts/day: 114
Man-hours/hour: 38
Production/hour: 117.9 kg.
Labour consumption: 32.2 m-h/100 kg.
Productivity: 3.10 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	69.24	153	160	3	50	3	3	3	9
Warping	Warper tender	60	68.58	0.47	1	2	1	1	1	—	2
	Warper creeler					2	1	1	1	—	2
	Warper doffers and haulers					3	all prep.	1	1	1	3
	Fixer					1	all prep.	1	—	—	1
	Second hand					1					
Slashing	Slasher tenders	65	67.89	1.08	1	3	2	1	1	1	3
	Helpers					3–4	3–4	0.5	0.5	0.5	
	Size man						5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	0.41 beams	0.15	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	90	117.90	300	300	3	63 looms	5	5	5	15
	Battery hands					3	82 looms	4	4	4	12
	Loom fixers					3	82 looms	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 9.6 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 9.6 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	250 looms	2	1	1	4
	Blow-off men and sweepers					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Section hand					3	250 looms	2	1	1	4
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											114

Table No. 69

Man-shifts/day: 138
Man-hours/hour: 46
Production/hour: 121.5 kg.
Labour consumption: 37.83 m-h/kg.
Productivity: 2.64 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	77.9	287	300	3	50	6	6	6	18
Warping	Warper tender	60	77.2	0.85	1	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Doffers and haulers					3	all prep.	1	1	1	3
	Fixer					1	all prep.	1	—	—	1
	Second hand										
Slashing	Slasher tenders	65	76.5	1.81	2	3	2	1	1	1	3
	Helpers					3	3–4	0.5	0.5	0.5	
	Size man					3	5–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	50	0.30 beams	0.21	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	90	121.5	300	300	3	32	10	10	10	30
	Battery hands					3	80	4	4	4	12
	Loom fixers					3	72	4	4	4	12
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	1	1	4
	Filling haulers (full quills/8 hrs.: 9 M)					3	20–25 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills/8 hrs.: 9 M)					3	30–40 M bob/8 hrs.	0.5	0.5	0.5	3
	Loom cleaners					3	100 looms	3	3	3	9
	Cloth doffers and truckers					3	500 looms	1	1	—	2
	Blow-off men and sweepers					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Section hand					3	250 looms	2	1	1	4
	Second hand					3	250 looms	1	1	1	3
	Overseer					1	250 looms	1	—	—	1
											138

Table No. 70

Man-shifts/day: 311
Man-hours/103.6
Production/hour: 1088.0 kg.
Labour consumption: 9.64 m-h/100 kg.
Productivity: 10.49 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
COSNUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Osmaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	688.1	380	400	3	20 spindles	20	20	20	60
Warping	Warper tenders	60	684.7	1.3	2	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Fixer and third hand					3	winders and warpers	1	1	1	3
	Second hand					3	winders and warpers	1	1	1	3
	Overseer					1	winders and warpers	1	—	—	1
Slashing	Slasher tenders	65	681.3	4.8	5	3	2	2	2	2	6
	Helpers					3	3–4	2	2	2	6
	Size man					3	5–6	1	1	1	3
Tying-in	Tying-in machine operator	50	10 jul.	.83	1	3	1	1	1	1	3
	Tying-in helper					3	1	1	1	1	3
Weaving	Weavers	90	1088.0	500	500	3	38	13	13	13	39
	Battery hands					3	25	20	20	20	60
	Loom fixers					3	50	10	10	10	30
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8 hrs.: 65 M)					3	20 M. bob/8 hrs.	3	3	3	9
	Quill men (empty quills/8 hrs.: 65 M)					3	30–40 M bob/8 hrs.	2	2	2	6
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	250 looms	2	2	2	6
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Section hands					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											311

Table No. 71

Man-shifts/day: 213
Man-hours/hour: 71
Production/hour: 517.5 kg.
Labour consumption: 13.71 m-h/100 kg.
Productivity: 7.28 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	268.2	256	300	3	30	10	10	10	30
Warping	Warper tenders	60	266.9	0.73	1	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Fixer and third hand					3	winders and warpers	1	1	1	3
	Second hand					3	id.	1	1	1	3
	Overseer					1	id.	1	—	—	1
Slashing	Slasher tenders	65	265.6	2.3	3	3	2	2	2	1	5
	Helpers					3	3–4	1	1	1	3
	Size man					2	3–6	1	1	—	2
Tying-in	Tying-in machine operator				1	3	1	0.5	0.5	0.5	
	Tying-in helper					3	1	0.5	0.5	0.5	3
Weaving	Weavers	90	517.5	500	500	3	72 looms	7	7	7	21
	Battery hands					3	45 looms	11	11	11	33
	Loom fixers					3	72 looms	7	7	7	21
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warp doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8 hrs.: 40 M)					3	20–25 M bob/8 hrs.	2	2	2	6
	Quill men (empty quills/8 hrs.: 40 M)					3	30–40 M bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	250 looms	2	2	2	6
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Section hands					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											213

Table No. 72

Man-shifts/day: 198
Man-hours/hour: 63
Production/hour: 370.5 kg.
Labour consumption: 17.82 m-h/100 kg.
Productivity: 5.61 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	218.0	273	300	3	43	7	7	7	21
Warping	Warper tenders	60	217.0	0.78	1	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Fixer and third hand					3	1	1	1	1	3
	Second hand					2	1	1	1	—	2
	Overseer					1	1	1	—	—	1
Slashing	Slasher tenders	65	216.0	2.0	2	3	2	1	1	1	3
	Helpers					3	3–4	1	1	1	3
	Size man					2	3–6	1	—	1	2
Tying-in	Tying-in machine operator	50	4.15 beams	.32	1	3	1	0.5	0.5	0.5	3
	Tying-in helper					3	1	0.5	0.5	0.5	3
Weaving	Weavers	90	370.5	500	500	3	50 looms	10	10	10	30
	Battery hands					3	62 looms	8	8	8	24
	Loom fixers					3	72 looms	7	7	7	21
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg.	1	1	1	3
	Drawing-in hands and spare weavers					3	250 looms	2	2	2	6
	Warp men					3	300 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8 hrs.: 24 M)					3	20–25 M/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 24 M)					3	30–40 M/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	250 looms	2	2	2	6
	Blow-off men					3	312 looms	2	2	2	6
	Oilers					3	312 looms	2	2	2	6
	Sweepers					3	312 looms	2	2	2	6
	Section hands					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	—
											198

Table No. 73

Man-shifts/day: 196
Man-hours/hour: 65.3
Production/hour: 282.5 kg.
Labour consumption: 23.15 m-h/100 kg.
Productivity: 4.32 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Winding or spooling	Winder hands	70	160.5	248	240	3	40	6	6	6	18
Warping	Warper tenders	60	159.8	0.77	1	3	1	1	1	1	3
	Warper creelers					3	1	1	1	1	3
	Fixer and third hand					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	159	178	2	3	2	1	1	1	3
	Helpers					3	3–4	1	1	1	3
	Size man					2	5–6	1	—	1	2
Tying-in	Tying-in machine operator	50	4.55 beams	.21	1	3	1	0.5	0.5	0.5	
	Tying-in helper					3	1	0.5	0.5	0.5	3
Weaving	Weavers	90	282.5	500	500	3	56 looms	9	9	9	27
	Battery hands					3	56 looms	9	9	9	27
	Loom fixers					3	72 looms	7	7	7	21
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8 hrs.: 28 M)					3	20–25 M/8 hrs.	1	1	1	3
	Quill men (empty quills/8 hrs.: 28 M)					3	30–40 M/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	250 looms	2	2	2	6
	Blow-off man					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Section hands					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	—	—	1
											196

Table No. 74

Man-shifts/day: 178
Man-hours/hour: 59.3
Production/hour: 196.5 kg.
Labour consumption: 30.2 m-h/100 kg.
Productivity: 3.31 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	115.4	255	300	3	50	6	6	6	18
Warping	Warper tenders	60	114.32	.79	1	3	1	1	1	1	
	Warper creelers					3	3 winders	1	1	1	3
	Fixer or third hand					3	1 warper	0.5	0.5	0.5	3
	Second hand					3	1 warper	0.5	0.5	0.5	3
	Overseer					1	1 warper	1	–	–	1
Slashing	Slasher tenders	65	113.19	1.80	2	3	2	1	1	1	3
	Helpers					3	3–4	1	1	1	3
	Size man					2	5–6	1	–	1	2
Tying-in	Tying-in machine operator	50	0.69 beams	0.27	1	3	1	1	1	1	3
	Tying-in machine 2% knots/min. helper					3	1	1	1	1	3
Weaving	Weavers	90	196.5	500	500	3	63	8	8	8	24
	Battery hands					3	82	6	6	6	18
	Loom fixers					3	82	6	6	6	18
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8hrs.: 16 M)					3	20–25 M. bob/8 hrs.	1	1	1	3
	Quill men (empty quills/8hrs.: 16 M)					3	30–40 M. bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	500 looms	1	1	1	3
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Section hands					3	250 looms	2	2	2	6
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	–	–	1
											178

Table No. 75

Man-shifts/day: 220
Man-hours/hour: 73.3
Production/hour: 202.5 kg.
Labour consumption: 36.2 m-h/100 kgs.
Productivity: 2.76 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	130.0	478	4–100 1–80	3	50	10	10	10	30
Warping	Warper tender	60	128.5	1.42	2	3	1	2	2	1	5
	Warper creelers					3	1	2	2	1	5
	Fixer					3	all. prep.	1	1	1	3
	Second hand					3	all. prep.	1	1	1	
	Overseer					1	all. prep.	1	–	–	1
Slashing	Slasher tenders	65	127.5	3.02	3	3	2	1.5	1.5	1.5	
	Helpers					3	3–4	1	1	1	
	Size man					3	5–6	0.5	0.5	0.5	9
Tying-in	Tying-in machine operator	50	0.51 beam	0.36	1	1	1	1	–	–	1
	Tying-in helper						1	1	–	–	1
Weaving	Weavers	90	202.5	500	500	3	32	16	16	16	48
	Battery hands					3	80	6	6	6	18
	Loom fixers					3	72	7	7	7	21
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn haulers and warper doffers					3	500–700 kg/hr	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	250 looms	2	2	2	6
	Filling haulers (full quills/8 hrs.: 15 M)					3	20–25 quill/8 hrs	1	1	1	3
	Quill men (empty quills/8 hrs.: 15 M)					3	30–40 quill/8 hrs.	1	1	–	2
	Loom cleaners					3	100 looms	5	5	5	15
	Cloth doffers and truckers					3	500 looms	1	1	1	3
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Section hand					3	250 looms	2	2	2	6
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500 looms	1	–	–	1
											220

Table No. 76

Man-shifts/day: 611
Man-hours/hour: 203.6
Production/hour: 2,176.0 kg.
Labour consumption: 9.36 m-h/100 kg.
Productivity: 10.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	1,376.2	760	700	3	20	38	38	38	114
Warping	Warper tenders	60	1,369.4	2.6	3	3	1	3	3	2	8
	Warper creelers					3	1	3	3	2	8
	Fixers					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	1,362.6	9.6	10	3	2	5	5	5	15
	Helpers					3	3–4	3	3	3	9
	Size man					3	5–6	2	2	2	6
Tying-in	Tying-in machine operator	50	8.32 beams	1.66	2	3	1	2	2	1	5
	Tying-in machine helper					3	1	2	2	1	5
Weaving	Weavers	90	2,176.0 kgs.	1,000	1,000	3	38 looms	26	26	26	78
	Battery hands					3	25 looms	40	40	40	120
	Loom fixers					3	50 looms	20	20	20	60
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	2	2	2	6
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 130 M)					3	20 M bob/8 hrs.	7	7	6	20
	Quill men (empty quills/8 hrs.: 130 M)					3	30–40 bob/8 hrs.	4	4	3	11
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	250 looms	4	4	4	12
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Section hand					3	250 looms	4	4	4	12
	Second hand					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	—	—	1
											611

Table No. 77

Man-shifts/day: 407
Man-hours/hour: 135.6
Production/hour: 1035.0 kg.
Labour consumption: 13.05 m-h/100 kg.
Productivity: 7.66 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	536.4	512	560	3	30	19	19	19	57
Warping	Warper tenders	60	733.8	1.46	2	3	1	2	2	1	5
	Warper creelers					3	1	2	2	1	5
	Fixers					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	531.2	4.68	5	3	2	3	3	2	8
	Helpers					3	3–4	2	2	1	5
	Size man					3	5–6	1	1	1	3
Tying-in	Tying-in machine operator	50	3.24 beams	0.76	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	90	1,035.0	1,000	1,000	3	72 looms	14	14	14	42
	Battery hands					3	45 looms	22	22	22	66
	Loom fixers					3	72 looms	14	14	14	42
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 80 M)					3	20–25 M bob/8 hrs.	4	4	4	12
	Quill men (empty quills/8 hrs.: 80 M)					3	30–40 M bob/8 hrs	3	2	2	7
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	250 looms	4	4	4	12
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Section hand					3	250 looms	4	4	4	12
	Second hand					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	—	—	1
											407

Table No. 78

Man-shifts/day: 372
Man-hours/hour: 124
Production/hour: 741.0 kg.
Labour consumption: 16-72 m-h/100 kg.
Productivity: 5-98 kg/m-h

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Sheeting B
Fabric count: 185.7

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Winder hands	70	436	546	4-120 1-80	3	40	14	14	14	42
Warping	Warper tenders	60	434	1.56	2	2	1	2	2	—	4
	Warper creelers					2	1	2	2	—	4
	Fixer and third hand					3	all prep.	1	1	1	3
	Second hand					2	all prep.	1	1	—	2
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	65	432	4.00	4	3	2	2	2	2	6
	Helpers					3	3-4	1	1	1	3
	Size man					3	3-6	1	1	1	3
Tying-in	Tying-in machine operator and misc.	50	2.64	.62	1	3	1	1	1	1	3
	Tying-in machine helper and misc.					3	1	1	1	1	3
Weaving	Weavers	90	741	1,000	1,000	3	50 looms	20	20	20	60
	Battery hands					3	62 looms	16	16	16	48
	Loom fixers					3	72 looms	14	14	14	42
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn haulers and warper doffers					3	500-700 kg.	1	1	1	3
	Drawing-in hands and spare weavers					3	250 looms	4	4	4	12
	Warp men					3	300 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 60 M)					3	20-25 M 8 hrs.	2	2	2	6
	Quill men (empty quills/8 hrs.: 60 M)					3	30-40 M 8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	250 looms	4	4	4	12
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	312 looms	3	3	3	9
	Sweepers							4	4	4	12
	Section hands					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	—	—	1
											372

Table No. 79

Man-shifts/day: 375
Man-hours/hour: 125
Production: 565 kg.
Labour consumption: 22.15 m-h/100 kg.
Productivity: 4.52 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Sheeting C
Fabric count: 230.7

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or Spooling	Winder hands	70	321	484	500	3	40	13	13	13	39
Warping	Warper tenders	60	319.6	1.55	2	3	1	2	2	1	5
	Warper creelers					3	1	2	2	1	5
	Fixers					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	–	–	1
Slashing	Slasher tenders	65	318.0	3.57	4	3	2	2	2	2	6
	Helpers					3	3–4	1	1	1	3
	Size man					3	5–6	1	1	1	3
Tying-in	Tying-in machine operator	50	1.94 beams	0.42	1	2	1	1	1	–	2
	Tying-in machine helper					2	1	1	1	–	2
Weaving	Weavers	90	565.0	1,000	1,000	3	56 looms	18	18	18	54
	Battery hands					3	56 looms	18	18	18	54
	Loom fixers					3	72 looms	14	14	14	42
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 56 M)					3	20–25 bob/8 hrs.	3	2	2	7
	Quill men (empty quills/8 hrs.: 56 M)					3	30–40 bob/8 hrs.	2	1	1	4
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	250 looms	4	4	4	12
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Section hand					3	250 looms	4	4	4	12
	Second hand					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	–	–	1
											375

Table No. 80

Man-shifts/day: 329
Man-hours/hour: 109.6
Production: 393.0 kg.
Labour consumption: 28.62 m-h/100 kg.
Productivity: 3.49 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Print cloth
Fabric count: 332.7

								Men			
Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Winding or Spooling	Winder hands	70	230.8	510	560	3	50	11	11	11	33
Warping	Warper tenders	60	228.6	1.58	2	3	1	2	2	1	5
	Warper creelers					3	1	2	2	1	5
	Fixers					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	–	–	1
Slashing	Slasher tenders	65	226.3	3.60	4	3	2	2	2	2	6
	Helpers					3	3–4	1	1	1	3
	Size man					3	5–6	1	1	1	3
Tying-in	Tying-in machine operator	50	1.38 beams	0.54	1	2	1	1	1	–	2
	Tying-in machine helper					2	1	1	1	–	2
Weaving	Weavers	90	393.0	1,000	1,000	3	63 looms	16	16	16	48
	Battery hands					8	82 looms	12	12	12	36
	Loom fixers					3	82 looms	12	12	12	36
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffer					3	500–700 kg/hr	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 32 M)					3	20–25 M/bob/8 hrs.	2	1	1	4
	Quill men (empty quills/8 hrs.: 32 M)					3	30–40 M/bob/8 hrs.	1	1	1	3
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	500 looms	2	2	2	6
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Section hand					3	250 looms	4	4	4	12
	Second hand					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	–	–	1
											329

Table No. 81

Man-shifts/day: 422
Man-hours/hour: 140.6
Production: 405.0 kg.
Labour consumption: 34.70 m-h/100 kg.
Productivity: 2.88 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Modern
Product: Broadcloth
Fabric count: 429.0

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or Spooling	Winder hands	70	260.0	956	960	3	50	19	19	19	57
Warping	Warper tenders	60	257.5	2.84	3	3	1	3	3	3	9
	Warper creelers					3	1	3	3	3	9
	Fixers					3	all prep.	1	1	1	3
	Seond hand					3	all prep.	1	1	1	3
	Overseer					1	all prep.	1	–	–	1
Slashing	Slasher tenders	65	255.0	6.04	6	3	2	3	3	3	9
	Helpers					3	3–4	2	2	2	6
	Size man					3	5–6	1	1	1	3
Tying-in	Tying-in machine operator	50	1.02 beams	0.71	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	90	405.0	1,000	1,000	3	32 looms	32	32	32	96
	Battery hands					3	80 looms	12	12	12	36
	Loom fixers					3	72 looms	14	14	14	42
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn haulers and warper doffers					3	500–700 kg/hr	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	250 looms	4	4	4	12
	Filling haulers (full quills/8 hrs.: 30 M)					3	20–25 bob/8 hrs.	2	1	1	4
	Quill men (empty quills/8 hrs.: 30 M)					3	30–40 bob/8 hrs.	1	1	–	2
	Loom cleaners					3	100 looms	10	10	10	30
	Cloth doffers and truckers					3	500 looms	2	2	2	6
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Section hand					3	250 looms	4	4	4	12
	Second hand					3	500 looms	2	2	2	6
	Overseer					1	500 looms	1	–	–	1
											422

Table No. 82

OLD STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's Carded* *Warp Filling*	*30's Carded* *Warp Filling*	*35's Carded* *Warp Filling*	*35's Combed* *Warp Filling*	*50's Combed* *Warp Filling*	*70's Combed* *Warp Filling*
STAPLE-BALE BREAKER:	⅞" to 1" Mid.	1" to 1$\frac{1}{16}$" S.M.	1$\frac{1}{16}$" to 1⅛" S.M.	1⅛" to 1$\frac{3}{16}$" S.M.	1⅛" to 1$\frac{3}{16}$" S.M.	1⅛" to 1¼" S.M.
100% production—kg/hr.	909.09	909.09	909.9	909.9	909.09	909.09
Percent efficiency	80	80	80	80	80	80
Actual production—kg/hr.	727.27	727.27	727.27	727.27	727.27	727.27
Required hourly production/1,000 sp.	23.76	13.13	10.28	11.60	7.19	4.70
Required continuous units/1,000 sp.	0.033	0.018	0.014	0.016	0.0099	0.0065
BREAKER PICKER:	0.00119 (16 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00141 (13.5 oz.)	0.00152 (12.5 oz.)
Diam. of feed pulley	8"	8"	8"	8"	8"	8"
R.p.m. of beater	350	1,200	1,200	1,200	1,000	800
Diam. of calender roll	9"	9"	9"	9"	9"	9"
100% production—kg/hr.	206.72	160.45	160.45	160.45	129.10	95.80
Percent efficiency	85	85	85	85	85	85
Percent waste	3	3	3	3	3	3
Actual production—kg/hr.	175.71	136.38	136.38	136.38	109.60	81.40
Number of blades	2	2	2	2	2	2
Diam. of feed roll	2"	2"	2"	2"	2"	2"
Required hourly production/1,000 sp.	23.07	12.75	9.98	11.49	6.98	4.57
Required continuous units/1,000 sp.	0.131	0.094	0.073	0.084	0.064	0.0056
FINISHER AND INTERMEDIATE PICKERS:	0.00119 (16 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00136 (14 oz.)	0.00141 (13.5 oz.)	0.00152 (12.5 oz.)
Doublings	4	4	4	4	4	4
Draft	4	4	4	4	4	4
Diam. of feed pulley	8"	8"	8"	8"	8"	8"
R.p.m. of beater	350	1,200	1,200	1,200	1,000	800
Diam. of calender roll	9"	9"	9"	9"	9"	9"
100% production—kg/hr.	206.72	160.45	160.45	160.45	129.10	95.80
Percent efficiency	85	85	85	85	85	85
Percent waste	3(I) 3(F)	3(I) 3(F)	3(I) 3(F)	3(I) 3(F)	3(I) 3(F)	3(I) 3(F)
Actual production—kg/hr.	175.71	136.38	136.38	136.38	109.60	81.40
Number of blades	2	2	2	2	2	2
Diam. of feed roll	2"	2"	2"	2"	2"	2"
Required hourly production/1,000 sp.	2.40(I) 21.75(F)	12.38(I) 12.02(F)	9.69(I) 9.41(F)	11.37(I) 0.083(F)	6.78(I) 6.58(F)	4.43(I) 4.30(F)
Required continuous units/1,000 sp.	2.7(I) 12.4(F)	0.091(I) 0.088(F)	0.071(I) 0.07(F)	11.04(I) 0.081(F)	0.062(I) 0.060(F)	0.054(I) 0.053(F)
CARDS:	.120 (66 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.181 (46 grns.)	0.198 (42 grns.)
R.p.m. doffer	11	8.5	7.5	7	6.5	5.5
Draft	97.4	115.4	115.4	97.4	122.0	123.7
100% production—kg/hr.	8.03	4.69	4.14	3.84	3.28	2.52
Percent efficiency	85	90	90	90	90	90
Percent waste	8	6	6	5	5	5
Actual production—kg/hr.	6.82	4.22	3.72	3.46	2.95	2.27
Diam. of cans	10"	10"	10"	10"	10"	10"
Required hourly production/1,000 sp.	20.14	11.67	8.87	10.52	6.27	4.10
Required continuous units/1,000 sp.	2.95	2.76	2.38	3.04	2.12	1.01

Table No. 82 (continued)

OLD STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's Carded* *Warp* *Filling*	*30's Carded* *Warp* *Filling*	*35's Carded* *Warp* *Filling*	*35's Combed* *Warp* *Filling*	*50's Combed* *Warp* *Filling*	*70's Combed* *Warp* *Filling*
9¾" SLIVER LAP MACHINE:	—	—	—	0.016 (520 grns.)	0.0173 (480 grns.)	0.0189 (440 grns.)
R.p.m. calender roll	—	—	—	110	105	95
Diam. calender roll	—	—	—	5"	5"	5"
Draft	—	—	—	1.53	1.53	1.53
Doublings	—	—	—	16	16	16
100% production—kg/hr.	—	—	—	97.40	85.70	71.20
Percent efficiency	—	—	—	75	75	75
Percent waste	—	—	—	0.25	0.25	0.25
Actual production—kg/hr.	—	—	—	72.90	64.30	53.40
Required hourly production/1,000 sp.	—	—	—	10.49	6.25	4.09
Required continuous units/1,000 sp.	—	—	—	0.144	0.097	0.077
RIBBON LAP MACHINE	—	—	—	0.016 (520 grns.)	0.0173 (480 grns)	0.0189 (440 grns.)
R.p.m. calender roll	—	—	—	110	105	95
Diam. calender roll	—	—	—	5"	5"	5"
Draft	—	—	—	4	4	4
Doublings	—	—	—	4	4	4
100% production—kg/hr.	—	—	—	97.40	85.70	71.20
Percent efficiency	—	—	—	75	75	75
Percent waste	—	—	—	0.25	0.25	0.25
Actual production—kg/hr.	—	—	—	72.90	64.30	53.40
Required hourly production/1,000 sp.	—	—	—	10.46	6.24	4.08
Required continuous units/1,000 sp.	—	—	—	0.144	0.097	0.076
COMBER:	—	—	—	0.167 (50 grns.)	0.181 (46 grns.)	0.198 (42 grns.)
Nips/min.	—	—	—	90	85	80
Draft	—	—	—	51.1	53.3	53.4
Number of heads	—	—	—	6	6	6
100% production—kg/hr.	—	—	—	5.72	4.97	4.27
Percent efficiency	—	—	—	84	84	84
Percent waste	—	—	—	18	15	15
Actual production—kg/hr.	—	—	—	4.81	4.17	3.58
Diam. of cans	—	—	—	10"	10"	10"
Required hourly production/1,000 sp.	—	—	—	8.87	5.42	3.55
Required continuous units/1,000 sp.	—	—	—	1.84	1.301	0.99
DRAWING FRAME (I):	0.126 (66 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	0.181 (46 grns.)	0.198 (42 grns.)
Doublings	6	6	6	6	6	6
Draft	6.00	6.00	6.00	6.00	6.00	6.00
R.p.m. front roll	300	300	300	300	290	270
Diam. front roll	1⅜"	1⅜"	1⅜"	1⅜"	1⅜"	1⅜"
100% production—kg/hr.	9.27	7.27	7.27	7.27	6.25	5.28
Percent efficiency	80	80	80	80	80	80
Percent waste	0.5	0.5	0.5	0.5	0.5	0.5
Actual production—kg/hr.	7.41	5.82	5.82	5.82	5.00	4.22
Diam. of cans	10"	10"	10"	10"	10"	10"
Required hourly production/1,000 sp.	20.04	77.01	8.83	8.82	5.40	3.53
Required continuous units/1,000 sp.	2.70	7.90	1.52	1.52	1.08	0.84
DRAWING FRAME (II):	0.126 (66 grns.)	0.167 (50 grns.)	0.167 (50 grns.)	—	—	—
Doublings	6	6	6	—	—	—
Draft	6.00	6.00	6.00	—	—	—
R.p.m. front roll	300	300	300	—	—	—
Diam. front roll	1⅜"	1⅜"	1⅜"	—	—	—
100% production—kg/hr.	9.27	7.27	7.27	—	—	—
Percent efficiency	80	80	80	—	—	—
Percent waste	0.5	0.5	0.5	—	—	—
Actual production—kg/hr.	7.41	5.82	5.82	—	—	—
Diam. of cans	10"	10"	10"	—	—	—
Required hourly production/1,000 sp.	19.94	10.95	8.79	—	—	—
Required continuous units/1,000 sp.	2.69	1.88	1.51	—	—	—

Table No. 82 (continued)

OLD STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's Carded* Warp Filling	*30's Carded* Warp	*30's Carded* Filling	*35's Carded* Warp	*35's Carded* Filling	*35's Combed* Warp Filling	*50's Combed* Warp Filling	*70's Combed* Warp Filling
SLUBBER:	0.40	0.55	0.60	0.60	0.70	0.60	0.70	0.85
Frame size	12"x6"	12"x6"	12"x6"	12"x6"	12"x6"	12"x6"	12"x6"	12"x6"
Doublings	1	1	1	1	1	1	1	1
Draft	3.16	3.29	3.59	3.59	4.18	3.59	3.88	4.29
Twist multiplier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R.p.m. front roll	230	195	187	187	172	187	172	170
Diam. front roll	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"	1 3/16"
100% production—kg/hr.	1.934	1.192	1.048	1.048	0.826	1.048	0.826	0.672
Percent efficiency	72.8	82.6	83.2	83.2	86.2	83.2	86.2	86.4
Percent waste	1	1	1	1	1	1	1	1
100% production—kg/hr.	1.407	0.985	0.872	0.872	0.712	0.872	0.712	0.581
Grams/bobbin	1,246	1,246	1,246	1,246	1,246	1,246	1,246	907
Hours/Doff	0.645	1.136	1.185	1.185	1.510	1.185	1.510	1.349
Doffs in 8 hrs.	9.05	5.82	5.61	5.61	4.57	5.61	4.57	5.00
Allowance for stoppage in hours	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25
Required hourly production/1,000 sp.	19.74	5.99	4.85	4.98	3.72	8.74	5.34	3.49
Required continuous units/1,000 sp.	14.03	6.08	5.57	5.71	5.22	10.02	7.51	6.01
INTERMEDIATE FRAME:	2.00	1.45	—	1.60	—	1.60	1.95	2.60
Frame size	10"x4½"	10"x5"	—	10"x5"	—	10"x5"	10"x4½"	8"x4"
Doublings	1	2	—	2	—	2	2	2
Draft	5.00	5.28	—	5.32	—	5.32	5.57	6.12
Twist multiplier	1.20	1.10	—	1.10	—	1.10	1.20	1.20
R.p.m. front roll	122	146	—	138	—	138	121	132
Diam. front roll	1 3/16"	1 3/16"	—	1 3/16"	—	1 3/16"	1 3/16"	1⅛"
100% production—kg/hr.	0.205	0.338	—	0.290	—	0.290	0.161	0.161
Percent efficiency	90.0	88.0	—	89.4	—	89.4	91.4	89.8
Percent waste	1	1	—	1	—	1	1	1
100% production—kg/hr.	0.184	0.298	—	0.259	—	0.259	0.190	0.145
Grams/bobbin	650	735	—	735	—	753	425	425
Hours/Doff	3.17	3.25	—	2.54	—	2.54	2.64	2.64
Doffs in 8 hrs.	2.31	2.16	—	2.52	—	2.52	2.68	2.68
Allowance for stoppage in hours	0.30	0.30	—	0.30	—	0.30	0.34	0.34
Required hourly production/1,000 sp.	19.55	5.95	—	4.93	—	8.65	5.29	3.46
Required continuous units/1,000 sp.	106.22	19.91	—	19.03	—	33.40	27.85	23.86
FLY FRAME:	—	5.00	3.00	5.50	3.50	5.50	—	—
Frame size	—	8"x3½"	8"x3½"	8"x3½"	8"x3½"	8"x3½"	—	—
Doublings	—	2	1	2	1	2	—	—
Draft	—	6.90	5.00	6.88	5.00	6.88	—	—
Twist multiplier	—	1.30	1.30	1.30	1.30	1.30	—	—
R.p.m. front roll	—	96	124	90	115	92	—	—
Diam. front roll	—	1⅛"	1⅛"	1⅛"	1⅛"	1⅛"	—	—
100% production—kg/hr.	—	0.061	0.131	0.052	0.104	0.053	—	—
Percent efficiency	—	94.1	88.4	95.0	90.5	95.0	—	—
Percent waste	—	1	1	1	1	1	—	—
Actual production—kg/hr.	—	0.057	0.116	0.049	0.094	0.050	—	—
Grams/bobbin	—	368	368	368	368	368	—	—
Hours/Doff	—	6.04	2.86	7.08	3.54	6.95	—	—
Doffs in 8 hrs.	—	1.25	2.48	1.07	2.04	1.09	—	—
Allowance for stoppage in hours	—	0.37	0.37	0.37	0.37	0.37	—	—
Required hourly production/1,000 sp.	—	5.87	4.81	4.88	3.68	8.56	—	—
Required continuous units/1,000 sp.	—	103.05	41.43	99.61	39.18	171.28	—	—

Table No. 82 (continued)

OLD STANDARD SPINNING MILLS
YARN ORGANIZATION AND MACHINE UNITS REQUIRED

Item	*18's Carded* *Warp*	*Filling*	*30's Carded* *Warp*	*Filling*	*35's Carded* *Warp*	*Filling*	*35's Combed* *Warp*	*Filling*	*50's Combed* *Warp*	*Filling*	*70's Combed* *Warp*	*Filling*
JACK FRAME:	—	—	—	—	—	—	—	—	7.75		10.50	
Frame size	—	—	—	—	—	—	—	—	7″x3″		6″x3″	
Doublings	—	—	—	—	—	—	—	—	2		2	
Draft	—	—	—	—	—	—	—	—	7.96		8.08	
Twist multiplier	—	—	—	—	—	—	—	—	1.20		1.20	
R.p.m. front roll	—	—	—	—	—	—	—	—	95		85	
Diam. front roll	—	—	—	—	—	—	—	—	1⅛″		1⅛″	
100% production—kg/hr.	—	—	—	—	—	—	—	—	0.039		0.025	
Percent efficiency	—	—	—	—	—	—	—	—	93.1		93.8	
Percent waste	—	—	—	—	—	—	—	—	1		1	
Actual production— kg/hr.	—	—	—	—	—	—	—	—	0.036		0.024	
Grams/bobbin	—	—	—	—	—	—	—	—	226		198	
Hours/Doff	—	—	—	—	—	—	—	—	5.80		7.62	
Doffs in 8 hrs.	—	—	—	—	—	—	—	—	1.28		0.98	
Allowance for stoppage in hr.	—	—	—	—	—	—	—	—	0.43		0.50	
Required hourly production/1,000 sp.	—	—	—	—	—	—	—	—	5.24		3.43	
Required continuous units/1,000 sp.	—	—	—	—	—	—	—	—	145.53		142.75	
SPINNING FRAME:	18	18	30	30	35	35	35	35	50	50	70	70
Doublings	1	1	2	1	2	1	2	2	2	2	2	2
Draft	9.3	9.2	12.4	10.3	13.2	10.3	13.2	13.1	13.4	13.3	13.8	13.7
Twist multiplier	4.75	3.50	4.75	3.35	4.75	3.25	4.75	3.25	4.25	3.25	4.00	3.20
R.p.m. front roll	131	152	111	137	105	128	105	128	98	103	87	89
Diam. front roll	1″	1″	1″	1″	1″	1″	1″	1″	1″	1″	1″	1
100% production—kg/hr.	0.0206	0.0239	0.0105	0.0129	0.0085	0.0104	0.0085	0.0010	0.0055	0.0058	0.0035	0.0036
Percent efficiency	90	86	93	90	93	91	93	91	94	93	95	95
Percent waste	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Actual production—kg/hr.	0.0185	0.0205	0.0098	0.0116	0.0079	0.0095	0.0079	0.0094	0.0052	0.0054	0.0033	0.0034
Percent contraction	4	3	4	3	4	3	4	3	4	3	4	3
Ring diameter	2″	1⅝″	1¾″	1⅜″	1⅝″	1⅜″	1⅝″	1⅜″	1½″	1¼″	1⅜″	1¼″
Gauge	3⅓″	2¾″	3¼″	2¾″	2¾″	2¾″	2¾″	2¾″	3″	2¾″	3″	2¾″
Traverse	7″	7″	6½″	6½″	6½″	6½″	6½″	6½″	6″	6″	5½″	5½″
R.p.m. spindles	8,750	7,425	9,550	8,300	9,675	8,150	9,675	8,150	9,740	7,800	9,577	7,825
Per cent warp and filling	55	45	55	45	57	43	57	43	50	50	50	50
Average production—kg/hr.	0.0194		0.0106		0.0085		0.0085		0.0052		0.0034	
Grams/bobbin	91.6	60.0	56.6	36.8	53.2	36.8	53.2	36.8	40.1	25.1	29.1	22.3
Hours/Doffs	4.95	2.92	5.78	3.17	6.74	3.88	6.74	3.92	7.72	4.64	8.82	6.56
Doffs in 8 hrs.	1.62	2.74	1.38	2.52	1.19	2.06	1.19	2.04	1.03	1.72	0.91	1.22
Required hourly production/1,000 sp.	19.400		10.60		8.50		8.50		5.20		3.40	
Required continuous units/1,000 sp.	1,000		1,000		1,000		1,000		1,000		1,000	

Table No. 83

Man-shifts/day: 28
Man-hours/hour: 9.3
Production/hour: 38.8 kg.
Labour consumption: 23.97 m-h/100 kg.
Productivity: 4.172 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	5 bales in 24 hrs.			1	8–10 bales/hr.	0.20	–	–	
	Opener tender		0.07	1	1	4–5 bales/hr.	0.20	–	–	
Picking	Picking tender—breaker		0.26	1	1	3	0.20	–	–	
	Picking tender—intermediate		0.25	1	1	3	0.20	–	–	
	Picking tender—final		0.25	1	1	3	0.20	–	–	
Carding	Card tender		5.90	6	3	34	0.25	0.25	0.25	1
	Card stripper				3	50	0.25	0.25	0.25	
Drawing	Drawing tender		5.40	6	3	36–40	0.25	0.25	0.25	
	Drawing tender		5.38	6	3	36–40	0.25	0.25	0.25	3
Slubber roving	Slubber tender	36 sp.	28.06	1	3	5	0.50	0.50	0.50	
Intermediate roving	Intermediate tender	108 sp.	212.44	2	3	3	0.50	0.50	0.50	3
Spinning	Spinners		2,000	4W–3F4	3	1,440 sp.	1.5	1.5	1.5	
	Top cleaners				3	5 M sp.	0.5	0.5	0.5	6
	Doffers	4.2 M bob/8 hrs.			3	1,000 bob/hr.	0.50	0.50	0.50	
	Roving hoister	0.8 M bob/8 hrs.			3	600–700 bob/hr.	0.25	0.25	0.25	
	Yarn man	4.2 M bob/8 hrs.			3	20 M bob/8 hrs.	0.25	0.25	0.25	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.4 M rov. bob and 2.1 M fill bob/8 hrs.			3	750–1,000 bob/hr.	1	–	–	1
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	3
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										28

Table No. 84

Man-shifts/day: 29
Man-hours/hour: 9.7
Production/hour: 21.2 kg.
Labour consumption: 45.75 m-h/100 kg.
Productivity: 2.185 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Prdouct: 30's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* — *First shift*	*Men* — *Second shift*	*Men* — *Third shift*	*Total man-shifts*
Opening	Bale opener	2.7 bales in 24 hrs.			1	8–10 bales/hr.	0.20	–	–	
	Opener tender		0.04	1	1	4–5 bales/hr.	0.20	–	–	
Picking	Picker tender—breaker		0.19	1	1	3	0.20	–	–	
	Picker tender—intermediate		0.19	1	1	3	0.20	–	–	
	Picker tender—finish		0.18	1	1	3	0.20	–	–	1
Carding	Card tender		5.53	6	3	34	0.25	0.25	0.25	
	Card stripper				3	50	0.25	0.25	0.25	
Drawing	Drawing tender		3.81	4	3	36–40	0.25	0.25	0.25	
	Drawing tender		3.76	4	3	36–40	0.25	0.25	0.25	3
Slubber roving	Slubber tender (W)	36 sp.	12.17	1	1	5	0.33	–	–	
	Slubber tender (F)	36 sp.	11.13	1	1	5	0.33	–	–	
Intermediate roving	Intermediate tender (W)	40 sp.	39.82	1	3	8	0.33	0.33	0.33	
Fly frame roving	Fly frame tender (W)	104 sp.	206.11	2	3	4	0.50	0.33	0.33	
	Fly frame tender (F)	84 sp.	82.86	1	3	3	0.50	0.33	0.33	4
Spinning	Spinners		2,000	4W–3F	3	1,728 sp.	1.5	1.5	1.5	
	Top cleaners				3	5 M sp.	0.5	0.5	0.5	6
	Doffers	3.4 M bob/8 hrs.			3	1,000 bob/hr.	0.33	0.33	0.33	
	Roving hoister	0.7 M bob/8 hrs.			3	600–700 bob/hr.	0.33	0.33	0.33	
	Yarn man	3.4 M bob/8 hrs.			3	20 M bob/8 hrs.	0.33	0.33	0.33	3
General										
	Oilers				3	3 All mill	1	1	1	
	Bobbin cleaners	0.4 roving bob and 1.7 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	–	–	1
	Overhaulers				1	12–5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12–5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										29

Table No. 85

Man-shifts/day: 29
Man-hours/hour: 9.66
Production/hour: 17.0 kg.
Labour consumption: 56.8 m-h/100 kg.
Productivity: 1.760 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	2.1 bales in 24 hrs.			1	8–10 bales/hr.	0.20	–	–	
	Opener tender		0.03	1	1	4–5 bales/hr.	0.20	–	–	
Picking	Picker tender—breaker		0.15	1	1	3	0.20	–	–	
	Picker tender—intermediate		0.14	1	1	3	0.20	–	–	
	Picker tender—finish		0.14	1	1	3	0.20	–	–	1
Carding	Card tender		4.77	5	3	34	0.25	0.25	0.25	
	Card stripper				3	50	0.25	0.25	0.25	
Drawing	Drawing tender		3.03	3	3	36–40	0.25	0.25	0.25	
	Drawing tender		3.02	3	3	36–40	0.25	0.25	0.25	3
Slubber roving	Slubber tender (W)	36 sp.	11.42	1	1	5	0.33	–	–	
	Slubber tender (F)	36 sp.	10.45	1	1	5	0.33	–	–	
Intermediate roving	Intermediate tender (W)	40 sp.	38.07	1	3	8	0.33	0.33	0.33	
Fly frame roving	Fly frame tender (W)	100 sp.	199.22	2	3	4	0.50	0.33	0.33	
	Fly frame tender (F)	80 sp.	78.36	1	3	3	0.50	0.33	0.33	4
Spinning	Spinners	288 sp.	2,000	4W-3F	3	1872 sp.	1	1	1	
	Top cleaners				3	5 M sp.	0.5	0.5	0.5	
	Doffers	3.1 M bob/8 hrs.			3	1,000 bob/hr.	0.5	0.5	0.5	
	Roving hoister	0.65 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	3.1 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	9
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.4 M roving bob and 1.5 fill bob/8 hrs.			1	750–100 bob/hr.	1	–	–	1
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										29

Table No. 86

Man-shifts/day: 29
Man-hours/hour: 9.66
Production/hour: 17.0 kg.
Labour consumption: 56.8 m-h/100 kg.
Productivity: 1.760 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Product: 35's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	2.4 bales in 24 hrs.			1	8–10 bales/hr.	0.20	–	–	
	Opener tender		0.03	1	1	4–5 bales/hr.	0.20	–	–	
Picking	Picker tender—breaker		0.17	1	1	3	0.20	–	–	
	Picker tender—intermediate		0.17	1	1	3	0.20	–	–	
	Picker tender—finish		0.16	1	1	3	0.20	–	–	1
Carding	Card tender		6.08	7	3	34	0.25	0.25	0.25	
	Card stripper				3	50	0.25	0.25	0.25	
Sliver lapping	Lapper tender		0.29	1	1	3	0.5	–	–	
Ribbon lapping	Lapper tender		0.29	1	1	3	0.5	–	–	
Combing	Comber tender		3.69	4	3	12	0.25	0.25	0.25	
Drawing	Drawing tender		3.03	3		36–40	0.25	0.25	0.25	4
Slubber roving	Slubber tender	36 sp.	20.04	1	2	4	0.33	0.33	–	
Intermediate roving	Intermediate tender	68 sp.	66.80	1	3	5	0.33	0.33	0.50	
Fly frame roving	Fly frame tender	176 sp.	342.56	2	3	3	0.33	0.33	0.50	3
Spinning	Spinners	288 sp.	2,000	4W–3F	3	2,016	1	1	1	
	Top cleaners				1	5 M sp.	0.5	0.5	0.5	
	Doffers	3 M bob/8 hrs.			3	1,000 bob/hr.	0.5	0.5	0.5	
	Roving hoister	017 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	3 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	9
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.4 M roving bob and 1.5 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	–	–	1
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										29

Table No. 87

Man-shifts/day: 29
Man-hours/hour: 9.66
Production/hour: 10.4 kg.
Labour consumption: 93.0 m-h/100 kg.
Productivity: 1.077 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	1.5 bales in 24 hrs.	0.02	1	1	8–10 bales/hr.	0.20	–	–	
	Opener tender				1	4–5 bales/hr.	0.20	–	–	
Picking	Picker tender—breaker		0.13	1	1	3	0.20	–	–	
	Picker tender—intermediate		0.12	1	1	3	0.20	–	–	
	Picker tender—finish		0.12	1	1	3	0.20	–	–	1
Carding	Card tender		4.25	5	3	34	0.25	0.25	0.25	
	Card stripper				3	50	0.25	0.25	0.25	
Silver lapping	Lapper tener		0.19	1	1	3	0.50	–	–	
Ribbon lapping	Lapper tender		0.19	1	1	3	0.50	–	–	
Combing	Comber		2.60	3	3	12	0.25	0.25	0.25	
Drawing	Drawing tender		2.16	3	3	36–40	0.25	0.25	0.25	4
Slubber roving	Slubber tender	36 sp.	15.01	1	2	4	0.33	0.33	–	
Intermediate roving	Intermediate tender	56 sp.	55.69	1	3	6	0.33	0.33	0.50	
Jack frame roving	Jack tender	152 sp.	291.06	2	3	4	0.33	0.33	0.50	3
Spinning	Spinners	288 sp.	2,000	4W–3F	3	2304 sp.	1	1	1	
	Top cleaners				1	5 M sp.	0.5	0.5	0.5	
	Doffers	2.7M bob/8 hrs.			3	1,000 bob/hr.	0.5	0.5	0.5	
	Roving hoister	0.6M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	2.7M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	9
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.3 M rov. x bob and 1.4 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	–	–	1
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										29

Table No. 88

Man-shifts/day: 29
Man-hours/hour: 9.66
Production/hour: 6.8 kg.
Labour consumption: 142.0 m-h/100 kg.
Productivity: 0.704 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 2,000 spindles
Mill type: Old
Product: 70's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men			Total man-shifts
							First shift	Second shift	Third shift	
Opening	Bale opener	1 bale in 24 hrs.	0.01	1	1	8–10 bales/hr.	0.20	–	–	
	Opener tender				1	4–5 bales/hr.	0.20	–	–	
Picking	Picker tender—breaker		0.11	1	1	3	0.20	–	–	
	Picker tender—intermediate		0.11	1	1	3	0.20	–	–	
	Picker tender—finish		0.11	1	1	3	0.20	–	–	1
Carding	Card tender		3.61	4	3	34	0.25	0.25	0.25	
	Card stripper				3	50	0.25	0.25	0.25	
Sliver lapping	Lapper tender		0.15	1	1	3	0.33	–	–	
Ribbon lapping	Lapper tender		0.15	1	1	3	0.33	–	–	
Combing	Comber tender		1.98	2	3	12	0.25	0.25	0.25	
Drawing	Drawing tender		1.67	2	3	36–40	0.25	0.25	0.25	4
Slubber roving	Slubber tender	36 sp.	12.03	1	1	4	0.33	–	–	
Intermediate roving	Intermediate tender	48 sp.	47.72	1	3	6	0.5	0.5	0.5	
Jack frame roving	Jack frame tender	144 sp.	285.50	2	3	5	0.5	0.5	0.5	3
Spinning	Spinners	288 sp.	2,000	4W–3F	3	2,448 sp.	1	1	1	
	Top cleaners				1	5 M sp.	0.5	0.5	0.5	
	Doffers	2.4 M bob/8 hrs.			3	1,000 bob/hr.	0.5	0.5	0.5	
	Roving hoister	0.5 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn men	2.4 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	9
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.3 rov. bob and 1.2 fill bob/8 hrs.			1	750–1,000 bob/hr.	1	–	–	1
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M. sp	0.5	0.5	0.5	3
	Fixer or third hand				3	5 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	–	–	1
										29

Table No. 89

Man-shifts/day: 62
Man-hours/hour: 20.6
Production/hour: 97.0 kg.
Labour consumption: 21.3 m-h/100 kg.
Productivity: 4.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 18's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	12 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.17	1	2	4–5 bales/hr.	0.5	0.5	–	
	Waste man	21 kg/hr.			1	680 kg/hr.	–	0.5	–	2
Picking	Picker tender—breaker		0.66	1	2	3	0.33	0.33	–	
	Picker tender—intermediate		0.64	1	2	3	0.33	0.33	–	
	Picker tender—finish		0.62	1	2	3	0.33	0.33	–	2
Carding	Card tender		14.75	16	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	–	–	1
Drawing	Drawing tender		13.50	14	3	36–40	0.5	0.5	0.5	
	Drawing tender		13.45	14	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender	72 sp.	70.15	1	3	2	0.5	0.5	0.5	
Intermediate roving	Intermediate tender	136 sp.	531.10	4	3	3	1.5	1.5	1.5	6
Spinning	Spinners	288 sp.	5,000	10W–8F	3	1,440 sp.	4	4	4	12
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	10.5 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Roving hoister	1.9 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	10.5 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	1 M rov. bob and 6 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	1	1	4
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				1	10 M sp.	1	–	–	1
										62

Table No. 90

Man-shifts/day: 59
Man-hours/hour: 19.6
Production/hour: 53.0 kg.
Labour consumption: 37.0 m-h/100 kg.
Productivity: 2.700 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 30's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	7 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.09	1	2	4–5 bales/hr.	0.5	0.5	–	
	Waste man	13 kg/hr.			1	680 kgs/hr.	–	0.5	–	2
Picking	Picker tender—breaker		0.47	1	2	3	0.33	0.33	–	
	Picker tender—intermediate		0.46	1	2	3	0.33	0.33	–	
	Picker tender—finish		0.44	1	2	3	0.33	0.33	–	2
Carding	Card tender		13.83	15	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	–	–	1
Drawing	Drawing tender		9.53	10	3	36–40	0.5	0.5	0.5	
	Drawing tender		9.41	10	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender (W)	36 sp.	30.42	1	3	4	0.33	0.33	0.33	
	Slubber tender (F)	36 sp.	27.84	1	3	4	0.33	0.33	0.33	
Intermediate roving	Intermediate tender (W)	100 sp.	99.55	1	3	3	0.33	0.33	0.33	3
Fly frame roving	Fly frame tender (W)	132 sp.	515.27	4	3	4	1	1	1	3
	Fly frame tender (F)	104 sp.	207.16	2	3	4	1	1	1	3
Spinning	Spinners	288 sp.	5,000	10W–8F	3	1,728 sp.	3	3	3	9
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	8.5 M bob/8 hrs.			3	1,000 bob/hr.	2	1	1	4
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Roving hoister	1.7 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn men	8.5 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.9 M rov. bob and 4.5 M fill. bob/8 hrs.			3	750–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	50 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				1	10 M sp.	1	–	–	1
										59

Table No. 91

Man-shifts/day: 57
Man-hours/hour: 19.0
Production/hour: 42.5 kg.
Labour consumption: 4.46 m-h/100 kgs.
Productivity: 2.240 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	5.5 bales in 24 hrs.			1	8–10 bales/hr.	0.33	—	—	
	Opener tender		0.07	1	1	4–5 bales/hr.	0.33	—	—	
	Waste man	10 kg/hr.			1	680 kg/hr.	0.33	—	—	1
Picking	Picker tender—breaker		0.37	1	1	3	0.33	—	—	
	Picker tender—intermediate		0.36	1	1	3	0.33	—	—	
	Picker tender—finish		0.35	1	1	3	0.33	—	—	1
Carding	Card tender		11.93	13	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	—	—	1
Drawing	Drawing tender		7.59	8	3	36–40	0.5	0.5	0.5	
	Drawing tender		7.55	8	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender (W)	36 sp.	28.55	1	3	4	0.33	0.33	0.33	
	Slubber tender (F)	36 sp.	26.13	1	3	4	0.33	0.33	0.33	
Intermediate roving	Intermediate tender (W)	96 sp.	95.18	1	3	4	0.33	0.33	0.33	3
Fly frame roving	Fly frame tender (W)	124 sp.	498.06	4	3	4	1	1	1	3
	Fly frame tender (F)	100 sp.	195.91	2	3	3	1	1	1	3
Spinning	Spinners	288 sp.	5000	10W–8F	3	1872 sp.	3	3	3	9
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	7.8 M bob/8 hrs.			3	1000 bob/hr.	1	1	1	3
	Overhaulers				1	12.5 M sp.	1	—	—	1
	Roving hoister	1.5 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	7.8 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.8 M rov. bob and 4 M fill bob/8 hrs.			3	750–1000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	—	1	1	2
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				1	10 M sp.	1	—	—	1
										57

Table No. 92

Man-shifts/day: 67
Man-hours/hour: 22.3
Production/hour: 42.5 kg.
Labour consumption: 52.5 m-h/100 kg.
Productivity: 1.905 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 35's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	6 bales in 24 hrs.			1	8–10 bales/hr.	0.5	—	—	
	Opener tender		0.08	1	2	4–5 bales/hr.	0.5	0.5	—	
	Waste man	16 kg/hr.			1	680 kg./hr.	—	0.5	—	
Picking	Picker tender—breaker		0.42	1	2	3	0.33	0.33	—	2
	Picker tender—intermediate		0.42	1	2	3	0.33	0.33	—	
	Picker tender—finish		0.41	1	2	3	0.33	0.33	—	2
Carding	Card tender		15.19	17	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	—	—	1
Sliver lapping	Lapper tender		0.72	1	2	3	0.5	0.5	—	
Ribbon lapping	Lapper tender		0.72	1	2	3	0.5	0.5	—	2
Combing	Comber tender		9.22	10	3	12	1	1	1	3
	Comber fixer				1	20–26	1	—	—	1
Drawing	Drawing tender		7.58	8	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	52 sp.	50.09	1	3	3	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	84 sp.	167.00	2	3	3	1	1	1	3
Fly frame roving	Fly frame tender	144 sp.	856.40	6	3	4	2	2	2	6
Spinning	Spinners	288 sp.	5000	10 W–8F	3	20–16 sp.	3	3	3	9
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	7.5 M bob/8 hrs.			3	1000 bob/hr.	1	1	1	3
	Overhaulers				1	12.5 M sp.	1	—	—	1
	Roving hoister	1.7 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	7.5 M bob/8 hrs.			3	20 M bob/8 hr.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.8 rov. bob and 4 M fill bob/8 hrs.			3	750–1000 bob/hr.	1	1	1	3
	Overhaulers				1	75 M sp.	1	—	—	1
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	
	Fixer or third hand				3	25 M sp.	0.5	0.5	0.5	3
	Second hand				1	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	1	2
	General work and misc.				1	10 M sp.	1	—	—	1
										67

Table No. 93

Man-shifts/day: 57
Man-hours/hour: 19.0
Production/hour: 26.0 kg.
Labour consumption: 73.5 m-h/100 kg.
Productivity: 1.36 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	3.7 bales in 24 hrs.			1	8–10 bales/hr.	0.33	—	—	
	Opener tender		0.06	1	1	4–5 bales/hr.	0.33	—	—	
	Waste man	10 kg/hr.			1	680 kg/hr.	0.33	—	—	1
Picking	Picker tender—breaker		0.32	1	1	3	0.33	—	—	
	Picker tender—intermediate		0.31	1	1	3	0.33	—	—	
	Picker tender—finish		0.30	1	1	3	0.33	—	—	1
Carding	Card tender		10.63	12	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	—	—	1
Sliver lapping	Lapper tender		0.49	1	2	3	0.5	0.5	—	
Ribbon lapping	Lapper tender		0.49	1	2	3	0.5	0.5	—	2
Combing	Comber tender		6.51	7	3	12	1	1	1	3
	Comber fixer				1	20–26	1	—	—	1
Drawing	Drawing tender		5.39	6	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	40 sp.	37.53	1	3	4	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	140 sp.	139.24	1	3	3	0.5	0.5	0.5	
Jack frame roving	Jack tender	152 sp.	727.64	5	3	4	1.5	1.5	1.5	6
Spinning	Spinners	288 sp.	5000	9W–9F	3	2304 sp.	2	2	2	6
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	6.8 M bob/8 hrs.			3	1000 bob/hr.	1	1	1	3
	Overhaulers				1	12.5 M sp.	1	—	—	1
	Roving hoister	1.5 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	6.8 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.7 M rov. bob and 4 M fill bob/8 hrs.			3	750–1000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M sp.	1	—	—	1
	Cleaners and sweepers				3	125–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M sp.	—	1	1	2
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				1	10 M sp.	1	—	—	1
										57

Table No. 94

Man-shifts/day: 53
Man-hours/hour: 17.6
Production/hour: 17.0 kg.
Labour consumption: 103.5 m-h/100 kg.
Productivity: 0.966 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 5,000 spindles
Mill type: Old
Product: 70's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	2.5 bales in 24 hrs.			1	8–10 bales/hr.	0.33	–	–	
	Opener tender		0.03	1	1	4–5 bales/hr.	0.33	–	–	
	Waste man	6 kg/hr.				680 kg/hr.	0.33	–	–	1
Picking	Picker tender—breaker		0.28	1	1	3	0.33	–	–	
	Picker tender—intermediate		0.27	1	1	3	0.33	–	–	
	Picker tender—finish		0.27	1	1	3	0.33	–	–	1
Carding	Card tender		9	10	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	–	–	1
Sliver lapping	Lapper tender		0.39	1	2	3	0.5	0.5	–	
Ribbon lapping	Lapper tender		0.39	1	2	3	0.5	0.5	–	2
Combing	Comber tender		4.96	5	3	12	0.5	0.5	0.5	
Drawing	Drawing tender		4.18	5	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender	36 sp.	30.18	1	3	5	0.5	0.5	0.5	
Intermediate roving	Intermediate tender	120 sp.	119.31	1	3	3	0.5	0.5	0.5	3
Jack frame roving	Jack tender	144 sp.	713.75	5	3	5	1	1	1	3
Spinning	Spinners	288 sp.	5,000	9W–9F	3	2448 sp.	2	2	2	6
	Top cleaners				3	5 M sp.	1	1	1	3
	Doffers	6 M bob/8 hrs.			3	1,000 bob/hr.	1	1	1	3
	Overhaulers				1	12.5 M sp.	1	–	–	1
	Roving hoister	1.2 M bob/8 hrs.			3	600–700 bob/hr.	0.5	0.5	0.5	
	Yarn man	6 M bob/8 hrs.			3	20 M bob/8 hrs.	0.5	0.5	0.5	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
General										
	Oilers				3	all mill	1	1	1	3
	Bobbin cleaners	0.6 M rov. bob and 3 M fill bob/8 hrs.			3	750–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				1	10 M sp.	1	–	–	1
										53

Table No. 95

Man-shifts/day: 102
Man-hours/hour: 34.0
Production/hour: 194 kg.
Labour consumption: 17.5 m-h/100 kg.
Productivity: 5.71 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 18's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men			Total man-shifts
							First shift	Second shift	Third shift	
Opening	Bale opener	24 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.33	1	3	4–5 bales/hr.	0.5	0.5	0.5	
	Waste man	43 kg/hr.			1	680 kg/hr.	–	0.5	–	
Picking	Picker tender—breaker		1.31	2	2	3	0.66	0.66	–	
	Picker tender—intermediate		1.27	2	2	3	0.66	0.66	–	
	Picker tender—finish		1.24	2	2	3	0.66	0.66	–	
	Waste machine operator	7.2 kg/hr.		1	1	1	–	–	0.5	7
	Opening and picking fixer			1	1	op. and pick.	1	–	–	1
Carding	Card tender		29.5	30	3	34	1	1	1	3
	Card stripper				3	50	0.5	0.5	0.5	
	Card grinder				3	50–68	0.5	0.5	0.5	3
Drawing	Drawing tender		27.0	27	3	36–40	1	1	1	3
	Drawing tender		26.9	27	3	36–40	1	1	1	3
Slubber roving	Slubber tender	72 sp.	140.3	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender	120 sp.	1,062.2	9	3	3	3	3	3	9
Spinning	Spinners	288 sp.	10,000	19W–16F	3	1440 sp.	7	7	7	21
	Top cleaners				3	5 M sp.	2	2	2	6
	Doffers	21 M bob/8 hrs.			3	1,000 bob/hr.	3	3	3	9
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	3.7 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	21 M bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except cards.	1	1	1	3
	Bobbin cleaners	1.8 rov. bob and 10.5 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										102

Table No. 96

Man-shifts/day: 96
Man-hours/hour: 32
Production/hour: 106 kg.
Labour consumption: 30.2 m-h/100 kg.
Productivity: 3.31 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 30's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	14 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.18	1	3	4–5 bales/hr.	0.5	0.5	0.5	
	Waste man	25 kg/hr.			1	680 kg/hr.	–	0.5	–	
Picking	Picker tender—breaker		0.94	1	3	3	0.33	0.33	0.33	
	Picker tender—intermediate		0.91	1	3	3	0.33	0.33	0.33	
	Picker tender—finish		0.88	1	3	3	0.33	0.33	0.33	
	Waste machine operator	4 kg/hr.		1	1	1	–	–	0.5	6
Carding	Card tender		27.65	29	3	34	1	1	1	3
	Card stripper				3	50	0.5	0.5	0.5	
	Card grinder				3	50–68	0.5	0.5	0.5	3
Drawing	Drawing tender		19.05	19	3	36–40	0.5	0.5	0.5	
	Drawing tender		18.82	19	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender (W)	64 sp.	60.83	1	3	2	0.5	0.5	0.5	
	Slubber tender (F)	60 sp.	55.67	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender (W)	100 sp.	199.09	2	3	3	1	1	1	3
Fly frame roving	Fly frame tender (W)	152 sp.	1,030.53	7	3	4	2	2	2	6
	Fly frame tender (F)	144 sp.	414.31	3	3	3	1	1	1	3
Spinning	Spinners	288 sp.	10,000	19W–16F	3	1728 sp.	6	6	6	18
	Top cleaners				3	5 M sp.	2	2	2	6
	Doffers	19 M bob/8 hrs.			3	1,000 bob/hr.	3	3	3	9
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	3.4 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	19 M bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except cards.	1	1	1	3
	Bobbin cleaners	1.7 rov. bob and 9.5 fill bob/8 hrs.			3	700–1,000 bob/hr.	2	2	1	5
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										96

Table No. 97

Man-shifts/day: 90
Man-hours/hour: 30.0
Production/hour: 85 kg.
Labour consumption: 35.3 m-h/100 kg.
Productivity: 2.901 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale Opener	10.5 bales in 24 hrs.			1	8–10 Bales/hr.	0.5	–	–	
	Opener tender		0.14	1	2	4–5 bales/hr.	0.5	0.33	–	
	Waste man	17 kg/hr.			1	689 kg/hr.	–	0.33	–	
Picking	Picker tender—breaker		0.73	1	2	3	0.33	0.33	–	
	Picker tender—intermediate		0.71	1	2	3	0.33	0.33	–	
	Picker tender—finish		0.69	1	2	3	0.33	0.33	–	
	Waste machine operator	3.2 kg/hr.		1	1	1	–	0.33	–	4
Carding	Card tender		23.85	25	3	34	1	1	1	3
	Card stripper				3	50	0.5	0.5	0.5	
	Card grinder				3	50–68	0.5	0.5	0.5	3
Drawing	Drawing tender		15.17	16	3	36–40	0.5	0.5	0.5	
	Drawing tender		15.10	16	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender	60 sp.	57.10	1	3	2	0.5	0.5	0.5	
	Slubber tender	56 sp.	52.25	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	96 sp.	190.35	2	3	3	1	1	1	3
Fly frame roving	Fly frame tender	128 sp.	996.12	8	3	4	2	2	2	6
	Fly frame tender	136 sp.	391.81	3	3	3	1	1	1	3
Spinning	Spinners	288 sp.	10,000	20W–15F	3	1872 sp.	6	6	6	18
	Top cleaners				2	5 M sp.	2	2	2	6
	Doffers	15.6 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	2.9 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	15.6 M bob/8 hrs.			3	20 M sp.	1	1	1	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except card	1	1	1	3
	Bobbin cleaners	1. M rov. bob and 8 M fill. bob/8 hrs.			3	750–1,000 bob/hr.	2	1	1	4
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	3
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										90

Table No. 98

Man-shifts/day: 100
Man-hours/hour: 33.3
Production/hour: 85 kg.
Labour consumption: 39.2 m-h/100 kg.
Productivity: 2.55 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 35's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	12 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.16	1	3	4–5 bales/hr.	0.5	0.5	0.5	
	Waste man	31 kg/hr.			1	680 kg/hr.	–	0.5	–	
Picking	Picker tender—breaker		0.84	1	3	3	0.33	0.33	0.33	
	Picker tender—intermediate		0.83	1	3	3	0.33	0.33	0.33	
	Picker tender—finish		0.81	1	3	3	0.33	0.33	0.33	
	Waste machine operator	3.2 kg/hr.		1	1	1	–	–	0.5	6
Carding	Card tender		30.39	32	3	34	1	1	1	3
	Card stripper				3	50	1	1	1	3
	Card grinder				2	50–68	1	1	–	2
Sliver lapping	Lapper tender		1.44	2	3	3	1	1	0.5	
Ribbon lapping	Lapper tender		1.44	2	3	3	1	1	0.5	5
Combing	Comber tender		18.44	19	3	12	2	2	2	6
	Comber fixer				2	20–26	1	1	–	2
Drawing	Drawing tender		15.16	16	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	52 sp.	100.19	2	3	3	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	112 sp.	333.98	3	3	4	1	1	1	3
Fly frame roving	Fly frame tender	144 sp.	1,712.80	12	3	4	3	3	3	9
Spinning	Spinners	288 sp.	10,000	20W–15F	3	2,016	5	5	5	15
	Top cleaners				3	5 M sp.	2	2	2	6
	Doffers	15 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	3.3 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	15 M bob/8 hrs.			2	20 M bob/8 hrs.	1	1	–	2
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except cards	1	1	1	3
	Bobbin cleaners	1.6 M rov. bob and 8 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	1	1	4
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	5	5	5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										100

Table No. 99

Man-shifts/day: 92.0
Man-hours/hour: 30.66
Production/hour: 52 kg.
Labour consumption: 47.80 m-h/100 kg.
Productivity: 1.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	7.5 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.10	1	2	4–5 bales/hr.	0.5	0.33	–	
	Waste man	19.0 kg/hr.			1	680 kg/hr.	–	0.33	–	
Picking	Picker tender-breaker		0.64	1	2	3	0.33	0.33	–	
	Picker tender-intermediate		0.62	1	2	3	0.33	0.33	–	
	Picker tender-finish		0.60	1	2	3	0.33	0.33	–	
	Waste machine operator	1.9 kg/hr.		1	1	1	–	0.33	–	4
Carding	Card tender		21.25	23	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50-68	1	–	–	1
Sliver lapping	Lapper tender		0.97	1	3	3	0.5	0.5	0.5	
Ribbon lapping	Lapper tender		0.97	1	3	3	0.5	0.5	0.5	3
Combing	Comber tender		13.01	13	3	12	1	1	1	3
	Comber fixer				2	20–26	1	1	–	2
Drawing	Drawing tender		10.79	11	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	76 sp.	75.06	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	96 sp.	278.47	3	3	4	1	1	1	3
Jack frame roving	Jack tender	152 sp.	1,455.28	10	3	4	3	3	3	9
Spinning	Spinners	288 sp.	10,000	18W–17F	3	2,304 sp.	5	5	5	15
	Top cleaners				3	5 M sp.	2	2	2	6
	Doffers	13.7 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	3 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	13.7 M bob/8 hrs.			2	20 M bob/8 hrs.	1	1	–	2
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except cards	1	1	1	1
	Bobbin cleaners	1.5 rov. bob and 7 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	1	1	4
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	3
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										92

Table No. 100

Man-shifts/day: 80
Man-hours/hour: 26.6
Production/hour: 34 kg.
Labour consumption: 78.1 m-h/100 kg.
Productivity: 1.28 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 10,000 spindles
Mill type: Old
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	5 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	
	Opener tender		0.06	1	2	4–5 bales/hr.	0.5	0.33	–	
	Waste man	13 kg/hr.			1	680 kg/hr.	–	0.33	–	
Picking	Picker tender—breaker		0.56	1	2	3	0.33	0.33	–	
	Picker tender—intermediate		0.54	1	2	3	0.33	0.33	–	
	Picker tender—finish		0.53	1	2	3	0.33	0.33	–	
	Waste machine operator	1.3 kg/hr.		1	1	1	–	0.33	–	4
Carding	Card tender		18.06	19	3	34	0.5	0.5	0.5	
	Card stripper				3	50	0.5	0.5	0.5	3
	Card grinder				1	50–68	1	–	–	1
Sliver lapping	Lapper tender		0.77	1	2	3	0.5	0.5	–	
Ribbon lapping	Lapper tender		0.76	1	2	3	0.5	0.5	–	2
Combing	Comber tender		9.91	10	3	12	1	1	1	3
	Comber fixer				1	20–26	1	–	–	1
Drawing	Drawing tender		8.36	9	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	64 sp.	60.15	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	120 sp.	238.62	2	3	3	1	1	1	3
Jack frame roving	Jack tender	144 sp.	1,427.50	10	3	5	2	2	2	6
Spinning	Spinners	288 sp.	10,000	18W–17F	3	2,448 sp.	4	4	4	12
	Top cleaners				3	5 M sp.	2	2	2	6
	Doffers	12 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				1	25 M sp.	1	–	–	1
	Overhaulers helpers				1	25 M sp.	1	–	–	1
	Spindle setter and tape man				1	25 M sp.	1	–	–	1
	Roving hoister	2.3 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	12 M bob/8 hrs.			2	20 M bob/8 hrs.	1	1	–	2
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	–	1
General										
	Oilers				1	all except cards	1	1	1	3
	Bobbin cleaners	1.2 M rov. bob and 6 M fill bob/8 hrs.			3	750–1,000 bob/hr.	1	1	1	3
	Overhaulers				1	25 M sp.	1	–	–	1
	Cleaners and sweepers				3	12.5–15 M sp.	0.5	0.5	0.5	
	Humidifier men				3	25 M sp.	0.5	0.5	0.5	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	50 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	1	1	–	2
										80

Table No. 101

Man-shifts/day: 148
Man-hours/hour: 0.3
Production/hour: 291 kg.
Labour consumption: 16.9 m-h/100 kg.
Productivity: 5.91 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Type size: 15,000 spindles
Mill type: Old
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	37 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	1
	Opener tender		0.49	1	3	4–5 bales/hr.	0.5	0.5	0.5	1
	Waste man	65 kg/hr.			1	680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		1.97	2	3	3	0.66	0.66	0.66	2
	Picker tender—intermediate		1.91	2	3	3	0.66	0.66	0.66	2
	Picker tender—finish		1.86	2	3	3	0.66	0.66	0.66	2
	Waste machine operator	11.0 kg/hr.		1		1	–	–	0.5	1
	Opening and picking fixer				1	op. and pick.	1	–	–	1
Carding	Card tender		44.25	46	3	34	2	2	2	6
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50–68	1	1	1	3
Drawing	Drawing tender		40.50	41	3	36–40	1	1	1	3
	Drawing tender		40.35	41	3	36–40	1	1	1	3
Slubber roving	Slubber tender	72 sp.	210.45	3	3	2	1.5	1.5	1.5	
Intermediate roving	Intermediate tender	124 sp.	1,593.00	13	3	3	4.5	4.5	4.5	18
Spinning	Spinners	288 sp.	15,000	29W–23F	3	1,440 sp.	10	10	10	30
	Top cleaners				3	5 M sp.	3	3	3	9
	Doffers	32 M bob/8 hrs.			3	1,000 bob/hr.	4	4	4	12
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oilers				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	5.5 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	32 M bob/8 hrs.			3	20 M bob/8 hrs.	2	2	1	5
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	–	2
	Overseer				1	50 M sp.	1	–	–	1
General										
	Oilers				2	all except cards and spin.	1	1	–	2
	Bobbin cleaners	2.7 M rov. bob and 16 M fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				1	50 M sp.	1	–	–	1
	Overhaulers helpers				1	50 M sp.	1	–	–	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	2	2	–	4
										148

Table No. 102

Man-shifts/day: 137
Man-hour/hour: 45.6
Production/hour: 6 kg.
Labour consumption: 28.69 m-h/kg.
Productivity: 3.49 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000 spindles
Mill type: Old
Product: 30's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	20.5 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	1
	Opener tender		0.27	1	3	4–5 bales/hr.	0.5	0.5	0.5	1
	Waste man	38 kg/hr.			1	680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		1.41	2	3	3	0.66	0.66	0.66	2
	Picker tender—intermediate		1.37	2	3	3	0.66	0.66	0.66	2
	Picker tender—finish		1.32	2	3	3	0.66	0.66	0.66	2
	Waste machine operator	6.0 kg/hr.		1	1	1	–	–	0.5	
	Opening and picking fixer				1	op. and pick.	1	–	–	1
Carding	Card tender		41.48	43	3	34	1	1	1	3
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50–68	1	1	1	3
Drawing	Drawing tender		28.58	29	3	36–40	1	1	1	3
	Drawing tender		28.23	29	3	36–40	1	1	1	3
Slubber roving	Slubber tender (W)	88 sp.	91.25	1	3	2	0.5	0.5	0.5	
	Slubber tender (F)	84 sp.	83.51	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender (W)	100 sp.	298.64	3	3	3	1	1	1	3
Fly frame roving	Fly frame tender (W)	152 sp.	1,545.80	11	3	4	3	3	3	9
	Fly frame tender (F)	160 sp.	621.47	4	3	3	1	1	1	3
Spinning	Spinners	288 sp.	15,000	29W–23F	3	1,728 sp.	9	9	9	27
	Top cleaners				3	5 M sp.	3	3	3	9
	Doffers	28.5 M bob/8 hrs.			3	1,000 bob/hr.	4	4	4	12
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oiler				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	5.1 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	28.5 M bob/8 hrs.			3	20 M bob/8 hrs.	2	1	1	4
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	–	2
	Overseer				1	50 M sp.	1	–	–	1
General										
	Oilers				2	all except cards and spin.	1	1	–	2
	Bobbin cleaners	2.6 M rov. bob and 14 M fill bob/8 hrs.			3	750–1,000 bob/hr.	3	2	2	7
	Overhaulers				1	50 M sp.	1	–	–	1
	Overhaulers helpers				1	50 M sp.	1	–	–	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M. sp	–	1	2	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	2	2	–	4
										137

Table No. 103

Man-shifts/day: 4
Man-hours/hour: 0.3
Production/hour: 127.5 kg.
Labour consumption: 32.4 m-h/100 kg.
Productivity: 3.09 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000 spindles
Mill type: Old
Product: 35's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	16 bales in 25 hrs.			1	8–10 bales/hr.	0.5	–	–	1
	Opener tender		0.21	1	3	4–5 bales/hr.	0.5	0.5	0.5	1
	Waste man	26.5 kg/hr.			1	680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		1.10	1	3	3	0.33	0.33	0.33	1
	Picker tender—intermediate		1.07	1	3	3	0.33	0.33	0.33	1
	Picker tender—finish		1.04	1	3	3	0.33	0.33	0.33	1
	Waste machine operator	4.7 kg/hr.		1	1	1	–	–	0.5	
Carding	Card tender		35.78	37	3	34	1	1	1	3
	Card stripper				3	50	1	1	1	3
	Card grinder				2	50–68	1	1	–	2
Drawing	Drawing tender		22.76	23	3	36–40	0.5	0.5	0.5	
	Drawing tender		22.65	23	3	36–40	0.5	0.5	0.5	3
Slubber roving	Slubber tender (W)	88 sp.	85.65	1	3	2	0.5	0.5	0.5	
	Slubber tender (F)	80 sp.	78.38	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender (W)	96 sp.	285.53	3	3	3	1	1	1	3
Fly frame roving	Fly frame tender (W)	168 sp.	1,494.18	9	3	4	2.5	2.5	2.5	
	Fly frame tender (F)	152 sp.	587.72	4	3	3	1.5	1.5	1.5	12
Spinning	Spinners	288 sp.	15,000	30W–22F	3	1,872 sp.	8	8	8	24
	Top cleaners				3	5 M sp.	3	3	3	9
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oilers				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	4.3 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	23.4 M bob/8 hrs.			3	20 M bob/8 hrs.	2	1	1	4
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	–	2
	Overseer				1	50 M sp.	1	–	–	1
General	Oilers				2	all except cards and spin.	1	1	–	2
	Bobbin cleaners	2.2 rov. bob and 12 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M sp.	1	–	–	1
	Overhaulers helpers				1	50 M sp.	1	–	–	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	2	2	–	4
										116

Table No. 104

Man-shifts/day: 142
Man-hours/hour: 47.3
Production/hour: 127.5 kg.
Labour consumption: 37.2 m-h/100 kg.
Productivity: 2.69 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000 spindles
Mill type: Old
Product: 35's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men			Total man-shifts
							First shift	Second shift	Third shift	
Opening	Bale opener	18 bales in 24 hrs.			1	8–10 bales /hr.	0.5	–	–	1
	Opener tender		0.24	1	2	4–5 bales/hr.	0.5	0.5	–	
	Waste man	42.5 kg/hr.				680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		1.26	2	2	3	0.66	0.66	–	
	Picker tender—intermediate		1.24	2	2	3	0.66	0.66	–	
	Picker tender—finish		1.22	2	2	3	0.66	0.66	–	4
	Waste machine operator	4.8 kg/hr.		1	1	1	0.5	–	–	1
	Opening and picking fixer			1	1	op. and pick.	0.5	–	–	
Carding	Card tender		45.59	48	3	34	2	2	2	6
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50-68	1	1	1	3
Sliver lapping	Lapper tender		2.16	3	2	3	1	1	–	2
Ribbon lapping	Lapper tender		2.16	3	2	3	1	1	–	2
Combing	Comber tender		27.66	28	3	12	2	2	2	6
	Comber fixer				3	20–26	1	1	1	3
Drawing	Drawing tender		22.74	23	3	36–40	1	1	1	3
Slubber roving	Slubber tender	80 sp.	150.29	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender	124 sp.	500.97	4	3	4	1	1	1	3
Fly frame roving	Fly frame tender	160 sp.	2,569.20	16	3	4	4	4	4	12
Spinning	Spinners	288 sp.	15,000	30W–22F	3	2,016 sp.	8	8	8	24
	Top cleaners				3	5 M sp.	3	3	3	9
	Doffers	22.5 M bob/8 hrs.			3	1,000 bob/hr.	3	3	3	9
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oilers				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	4.9 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	22.5 M bob/8 hrs.			3	20 M bob/8 hrs.	2	1	1	4
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	–	2
	Overseer				1	50 M sp.	1	–	–	1
General										
	Oilers				2	all except cards and spin.	1	1	–	2
	Bobbin cleaners	2.4 rov. bob and 12 fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M sp.	1	–	–	1
	Overhaulers helpers				1	50 M sp.	1	–	–	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	2	2	–	4
										142

Table No. 105

Man-shifts/day: 134
Man-hours/hour: 44.3
Production/hour: 78 kg.
Labour consumption: 56.79 m-h/100 kg.
Productivity: 1.761 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 15,000 spindles
Mill type: Old
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	11.5 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	1
	Opener tender		0.15	1	3	4–5 bales/hr.	0.5	0.5	0.5	1
	Waste man	30 kg/hr.			1	680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		0.96	1	3	3	0.33	0.33	0.33	1
	Picker tender—intermediate		0.93	1	3	3	0.33	0.33	0.33	1
	Picker tender—finish		0.90	1	3	3	0.33	0.33	0.33	1
	Waste machine operator	2.9 kg/hr.		1		1	–	–	0.5	
Carding	Card tender		31.88	33	3	34	1	1	1	3
	Card stripper				3	50	1	1	1	3
	Card grinder				2	50-68	1	1	–	2
Sliver lapping	Lapper tender		1.46	2	3	3	1	1	0.5	
Ribbon lapping	Lapper tender		1.46	2	3	3	1	1	0.5	5
Comber	Comber tender		19.52	20	3	12	2	2	2	6
	Comber fixer				3	20–26	1	1	1	3
Drawing	Drawing tender		16.19	17	3	36–40	1	1	1	3
Slubber roving	Slubber tender	64 sp.	112.59	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender	108 sp.	417.71	4	3	4	1	1	1	3
Jack frame roving	Jack tender	140 sp.	2,182.92	16	3	4	4	4	4	12
Spinning	Spinners	288 sp.	25,000	26W–26F	3	2304 sp.	7	7	7	21
	Top cleaners				3	5 M sp.	3	3	3	9
	Doffers	20.5 M bob/8 hrs.			3	1,000 bob/hr.	3	3	3	9
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oilers				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	4.5 M bob/8 hrs.			3	600-700 bob/hr.	1	1	1	3
	Yarn man	20.5 M bob /8 hrs			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	–	2
	Overseer				1	50 M sp.	1	–	–	1
General										
	Oilers				2	all except cards and spin.	1	1	–	2
	Bobbin cleaners	2.2 M rov. bob and 10 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				1	50 M sp.	1	–	–	1
	Overhaulers helpers				1	50 M sp.	1	–	–	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	25 M sp.	–	1	1	2
	Overseer				1	50 M sp.	1	–	–	1
	General work and misc.				2	10 M sp.	2	2	–	4
										134

Table No. 106

Man-shifts/day: 134
Man-hours/hour: 38.0
Production/hour: 51 kg.
Labour consumption: 74.6 m-h/100 kg.
Productivity: 1.34 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 15,000 spindles
Mill type: Old
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	7.5 bales in 24 hrs.			1	8–10 bales/hr.	0.5	–	–	1
	Opener tender		0.10	1	3	4–5 bales/hr.	0.5	0.5	0.5	1
	Waste man	19.5 kg/hr.			1	680 kg/hr.	–	0.5	–	1
Picking	Picker tender—breaker		0.84	1	3	3	0.33	0.33	0.33	1
	Picker tender—intermediate		0.81	1	3	3	0.33	0.33	0.33	1
	Picker tender—finish		0.79	1	3	3	0.33	0.33	0.33	1
	Waste machine operator	1.9 kg/hr.		1	1	1	–	–	0.5	
Carding	Card tender		27.09	29	3	34	1	1	1	3
	Card stripper				3	50	0.5	0.5	0.5	
	Card grinder				3	50–68	0.5	0.5	0.5	3
Sliver lapping	Lapper tender		1.16	2	2	3	1	1	–	2
Ribbon lapping	Lapper tender		1.14	2	2	3	1	1	–	2
Combing	Comber tender		14.87	15	3	12	1	1	1	3
	Comber fixer				2	20–26	1	1	–	2
Drawing	Drawing tender		12.54	13	3	36–40	0.5	0.5	0.5	
Slubber roving	Slubber tender	88 sp.	90.23	1	3	2	0.5	0.5	0.5	3
Intermediate roving	Intermediate tender	120 sp.	357.93	3	3	3	1	1	1	3
Jack frame roving	Jack tender	152 sp.	2,141.25	14	3	5	3	3	3	9
Spinning	Spinners	288 sp.	15,000	26W–26F	3	2,448 sp.	6	6	6	18
	Top cleaners				3	5 M sp.	3	3	3	9
	Doffers	16 M bob/8 hrs.			3	1,000 bob/hr.	2	2	2	6
	Overhaulers				2	25 M sp.	1	1	–	2
	Overhaulers helpers				2	25 M sp.	1	1	–	2
	Oilers				2	25 M sp.	1	1	–	2
	Spindle setter and tape man				2	25 M sp.	1	1	–	2
	Roving hoister	3.5 M bob/8 hrs.			3	600–700 bob/hr.	1	1	1	3
	Yarn man	16 M bob/8 hrs.			3	20 M bob/8 hrs.	1	1	1	3
	Fixer or third hand				3	15–17 M sp.	1	1	1	3
	Second hand				2	25 M sp.	1	1	—	2
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				2	all except cards and spin.	1	1	—	2
	Bobbin cleaners	1.8 rov. bob and 8 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	1	5
	Overhaulers				1	25 M sp.	1	—	1	2
	Overhaulers helpers				1	50 M sp.	1	—	—	1
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	1	1	1	3
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				1	50 M sp.	—	1	—	1
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	2	2	—	4
										114

Table No. 107

Man-shifts/day: 242
Man-hours/hour: 80.6
Production/hour: 485.0 kg.
Labour consumption: 16.66 m-h/100 kg.
Productivity: 6.020 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 18's carded

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	62 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tender		0.83	1	3	4–5 bales /hr.	1	1	1	3
	Waste man	109 kg/hr.			1	680 kg/hr.	1	—	—	1
Picking	Picker tender—breaker		3.28	4	3	3	1.33	1.33	1.33	4
	Picker tender—intermediate		3.18	4	3	3	1.33	1.33	1.33	4
	Picker tender—finish		3.10	4	3	3	1.33	1.33	1.33	4
	Waste machine operator	18.2 kg/hr.		1	1	1	1	—	—	1
	Opening and picking fixer				2	op. and pick.	1	1	—	2
Carding	Card tender		73.75	77	3	34	2.50	2.50	2.50	
	Card stripper				3	50	1.50	1.50	1.50	12
	Card grinder				3	50–68	2	2	1	5
Drawing	Drawing tender		67.50	68	3	36–40	2	2	2	6
	Drawing tender		67.50	68	3	36–40	2	2	2	6
Slubber roving	Slubber tender	88 sp.	350.75	4	3	2	2	2	2	6
Intermediate roving	Intermediate tender	124 sp.	2,655.50	21	3	3	7	7	7	21
Spinning	Spinners	288 sp.	25,000	48W–39F	3	1,440 sp.	18	18	18	54
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	53.5 M bob/8 hrs.			3	1,000 bob/hr.	7	7	7	21
	Overhaulers				3	25 M sp.	1	1	1	3
	Overhaulers helpers				3	25 M sp.	1	1	1	3
	Oiler				3	25 M sp.	1	1	1	3
	Spindle setter and tape man				3	25 M sp.	1	1	1	3
	Roving hoister	9.3 M bob/8 hrs.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	53.5 M bob/8 hrs.			3	20 M bob/8 hrs.	3	3	2	8
	Fixer or third hand				3	15—17 M sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				4	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	4.5 M rov. bob and 26 M fill bob/8 hrs.			3	750–1,000 bob/hr.	4	4	4	12
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M.sp.	2	2	2	6
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	3	3	—	6
										242

Table No. 108

Man-shifts/day: 221
Man-hours/hour: 73.6
Production/hour: 265.0 kg.
Labour consumption: 27.6 m-h/100 kg.
Productivity: 3.60 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 30's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	34 bales in 24 hrs.			3	8–10 bales/hr.	0.50	0.50	0.50	
	Opener tender		0.45	1	3	4–5 bales/hr.	0.50	0.50	0.50	3
	Waste man	63 kg/hr.			1	680 kg/hr.	0.50	—	—	1
Picking	Picker tender—breaker		2.35	3	3	3	1	1	1	3
	Picker tender—intermediate		2.28	3	3	3	1	1	1	3
	Picker tender—finish		2.20	3	3	3	1	1	1	3
	Waste machine operator	10.6 kg/hr.			1	1	0.50	—	—	
	Opening and picking fixer				1	op. and pick.	1	—	—	1
Carding	Card tender		69.13	72	3	34	2	2	2	6
	Card stripper				3	50	1.50	1.50	1.50	
	Card grinder				3	50–68	1.50	1.50	1.50	9
Drawing	Drawing tender		47.63	48	3	36–40	1.50	1.50	1.50	
	Drawing tender		47.05	48	3	36–40	1.50	1.50	1.50	9
Slubber roving	Slubber tender (W)	76 sp.	152.08	2	3	2	1	1	1	3
	Slubber tender (F)	72 sp.	139.18	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender (W)	124 sp.	497.73	4	3	3	2	2	2	6
Fly frame roving	Fly frame tender (W)	152 sp.	2,576.33	17	3	4	4	4	4	12
	Fly frame tender (F)	168 sp.	1,035.78	6	3	3	2	2	2	6
Spinning	Spinners	288 sp.	25,000	48W–39F	3	1,728 sp.	15	15	15	45
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	47.5 M bob/8 hrs.			3	1,000 bob/hr.	6	6	6	18
	Overhaulers				3	25 M sp.	1	1	1	3
	Overhaulers helpers				3	25 M sp.	1	1	1	3
	Oiler				3	25 M sp.	1	1	1	3
	Spindle setter and tape man				3	25 M sp.	1	1	1	3
	Roving hoister	8.5 M bob/8 hrs.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	47.5 M bob/8 hrs.			3	20 M bob/8 hrs.	3	2	2	7
	Fixer or third hand				3	15–17 M sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	4 M rov. bob and 23 fill bob/8 hrs.			3	750–1,000 bob/hr.	4	4	4	12
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	22.5–15 M sp.	2	2	2	6
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	15 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	3	3	—	6
										221

Table No. 109

Man-shifts/day: 202
Man-hours/hour: 67.3
Production/hour: 212.5 kg.
Labour consumption: 31.6 m-h/100 kg.
Productivity: 3.16 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	27 bales in 24 hrs.			3	8–10 bales/hr.	0.50	0.50	0.50	
	Opener tender		0.35	1	3	4–5 bales/hr.	0.50	0.50	0.50	3
	Waste man	45 kg/hr.			1	680 kg/hr.	0.50	—	—	1
Picking	Picker tender—breaker		1.83	2	3	3	0.66	0.66	0.66	2
	Picker tender—intermediate		1.78	2	3	3	0.66	0.66	0.66	2
	Picker tender—finish		1.83	2	3	3	0.66	0.66	0.66	2
	Waste machine-operator	8 kg/hr.		1	1	1	0.50	—	—	
	Opening and picking fixer				1	op. and pick.	1	—	—	1
Carding	Card tender		59.63	62	3	34	2	2	2	6
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50–68	1	1	1	3
Drawing	Drawing tender		37.93	38	3	36–40	1	1	1	3
	Drawing tender		37.75	38	3	36–40	1	1	1	3
Slubber roving	Slubber tender(W)	72 sp.	142.75	2	3	2	1	1	1	3
	Slubber tender (F)	68 sp.	130.63	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender (W)	120 sp.	475.88	4	3	3	2	2	2	6
Fly frame roving	Fly frame tender (W)	168 sp.	2,490.30	15	3	4	4	4	4	12
	Fly frame tender (F)	168 sp.	979.53	6	3	3	2	2	2	6
Spinning	Spinners	288 sp.	25,000	50W–37F	3	1,872 sp.	14	14	14	42
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	39.1 M bob/8 hrs.			3	1,000 bob/hr.	5	5	5	15
	Overhaulers				3	25 M sp.	1	1	1	3
	Overhaulers helpers				3	25 M sp.	1	1	1	3
	Oiler				3	25 M sp.	1	1	1	3
	Spindle setter and tape man				3	25 M sp.	1	1	1	3
	Roving hoister	7.2 M bob/8 hrs.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	39.1 M bob/8 hrs			3	20 M bob/8 hrs.	2	2	2	6
	Fixer or third hand				3	15–17 M sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	3.5 M. rov. bob and 20 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	2	2	2	6
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	3	3	—	6
										202

Table No. 110

Man-shifts/day: 227
Man-hours/hour: 76
Production/hour: 212.5 kg.
Labour consumption: 35.76 m-h/100 kg.
Productivity: 2.796 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 35's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	30 bales in 24 hrs.				8–10 bales/hr.	0.50	0.50	0.50	
	Opener tender		2.40	1		4–5 bales/hr.	0.50	0.50	0.50	3
	Waste man	78 kg/hr.			1	680 kg/hr.	0.50	—	—	1
Picking	Picker tender—breaker		2.10	2	3	3	0.66	0.66	0.66	2
	Picker tender—intermediate		2.08	2	3	3	0.66	0.66	0.66	2
	Picker tender—finish		2.03	2	3	3	0.66	0.66	0.66	2
	Waste machine-operator	8.0 kg/hr.		1	1	1	0.50	—	—	
	Opening and picking fixer				1	op. and pick.	1	—	—	1
Carding	Card tender		75.98	79	3	34	2	2	2	6
	Card stripper				3	50	1.50	1.50	1.50	
	Card grinder				3	50–68	1.50	1.50	1.50	9
Sliver lapping	Lapper tender		3.60	4	3	3	1.50	1.50	1	
Ribbon lapping	Lapper tender		3.60	4	3	3	1.50	1.50	1	8
Combing	Comber tender		46.10	46	3	12	4	4	4	12
	Comber fixer				3	20–26	2	2	2	6
Drawing	Drawing tender		37.90	38	3	36–40	1	1	1	3
Slubber roving	Slubber tender	84 sp.	250.48	3	3	2	2	2	2	6
Intermediate roving	Intermediate tender	120 sp.	834.95	7	3	4	2	2	2	6
Fly frame roving	Fly frame tender	152 sp.	4,282.00	28	3	4	7	7	7	21
Spinning	Spinners	288 sp.	25,000	50W–37F	3	2,016 sp.	13	13	13	39
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	37.5 M bob/8 hrs.			3	1,000 bob/hr.	5	5	5	15
	Overhaulers				3	25 M sp.	1	1	1	3
	Overhaulers helpers				3	25 M sp.	1	1	1	3
	Oilers				3	25 M sp.	1	1	1	3
	Spindle setter and tape man				3	25 M sp.	1	1	1	3
	Roving hoister	8.2 M bob/8 hrs.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	37.5 M bob/8 hrs.			3	20 M bob/8 hrs.	2	2	2	6
	Fixer or third hand				3	15–17 M sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	4 M rov. bob and 19 fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	2	2	2	6
	Second hand				3	25 M sp.	1	1	1	3
	Overseer		1		1	50 M sp.	1	—	—	2
	General work and misc.				2	10 M sp.	3	3	—	6
										227

Table No. 111

Man-shifts/day: 205
Man-hours/hour: 68.3
Production/hour: 130 kg.
Labour consumption: 52.6 m-h/100 kg.
Productivity: 1.90 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 50's combed

Process	Job	Remarks	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Opening	Bale opener	19 bales in 24 hours			1	8–10 bales/hr.	0.33	—	—	1
	Opener tender		0.25	1	3	4–5 bales/hr.	1	1	1	3
	Waste man	50 kg/hr.			1	680 kg/hr.	0.33	—	—	
Picking	Picker tender—breaker		1.60	2	3	3	0.66	0.66	0.66	2
	Picker tender—intermediate		1.55	2	3	3	0.66	0.66	0.66	2
	Picker tender—finish		1.50	2	3	3	0.66	0.66	0.66	2
	Waste machine-operator	4.9 kg/hr.		1	1	1	0.33	—	—	
	Opening and picking fixer				1	op. and pick.	1	—	—	1
Carding	Card tender		53.13	56	3	34	2	2	2	6
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50–68	1	1	1	3
Sliver lapping	Lapper tender		2.43	3	3	3	1	1	1	3
Ribbon lapping	Lapper tender		2.43	3	3	3	1	1	1	3
Combing	Comber tender		32.53	33	3	12	3	3	3	9
	Comber fixer				3	20–26	2	1	1	4
Drawing	Drawing tender		26.98	27	3	36–40	1	1	1	3
Slubber roving	Slubber tender	64 sp.	187.65	3	3	3	1	1	1	3
Intermediate roving	Intermediate tender	116 sp.	696.18	6	3	4	2	2	2	6
Jack frame roving	Jack tender	152 sp.	3,638.20	24	3	4	6	6	6	18
Spinning	Spinners	288 sp.	25,000	44W–43F	3	2,304 sp.	11	11	11	33
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	34.2 M bob/8 hrs.			3	1,000 bob/hr.	5	5	5	15
	Overhaulers				3	25 M sp.	1	1	1	3
	Overhaulers helpers				3	25 M sp.	1	1	1	3
	Oiler				3	25 M sp.	1	1	1	3
	Spindle setter and tape man				3	25 M sp.	1	1	1	3
	Roving hoister	7.4 M bob/8 hrs.			3	600–700 bob/hr.	2	2	2	6
	Yarn man	34.2 M bob/8 hrs.			3	20 M bob/8 hrs.	2	2	1	5
	Fixer or third hand				3	15–17 M sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	4 M rov. bob and 18 M fill bob/8 hrs.			3	750–1,000 bob/hr.	3	3	3	9
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	2	2	2	6
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	3	3	—	6
										205

Table No. 112

Man-shifts/day: 183
Man-hours/hour: 61
Production/hour. 85.0 kg.
Labour consumption: 71.76 m-h/100 kg.
Productivity: 1.393 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 25,000 spindles
Mill type: Old
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	12 bales in 24 hrs.			1	8–10 bales/hr.	0.33	—	—	1
	Opener tender		0.16	1	2	4–5 bales/hr.	1	1	—	2
	Waste man	32.6 kg/hr.			1	680 kg/hr.	0.33	—	—	
Picking	Picker tender—breaker		1.40	2	2	3	0.66	0.66	—	
	Picker tender—intermediate		1.35	2	2	3	0.66	0.66	—	
	Picker tender—finish		1.32	2	2	3	0.66	0.66	—	4
	Waste machine operator	3.2 kg/hr.		1	1	1	0.33	—	—	
	Opening and picking fixer				1	op. and pick.	1	—	—	1
Carding	Card tender		45.15	47	3	34	2	2	2	6
	Card stripper				3	50	1	1	1	3
	Card grinder				3	50–68	1	1	1	3
Sliver lapping	Lapper tender		1.93	2	3	3	1	1	1	3
Ribbon lapping	Lapper tender		1.90	2	3	3	1	1	1	3
Combing	Comber tender		24.78	25	3	12	2	2	2	6
	Comber fixer				3	20–26	1	1	1	3
Drawing	Drawing tender		20.90	21	3	36–40	1	1	1	3
Slubber roving	Slubber tender	76 sp.	150.38	2	3	2	1	1	1	3
Intermediate roving	Intermediate tender	120 sp.	596.55	5	3	3	2	2	2	6
Jack frame roving	Jack tender	160 sp.	3,568.75	23	3	5	5	5	5	15
Spinning	Spinners	288 sp.	25,000	44W–43F	3	2,448 sp.	10	10	10	30
	Top cleaners				3	5 M sp.	5	5	5	15
	Doffers	26.6 M bob/8 hrs.			3	1,000 bob/hr.	4	4	4	12
	Overhaulers				3	25 M.sp.	1	1	1	3
	Overhaulers helpers				3	25 M.sp.	1	1	1	3
	Oilers				3	25 M.sp.	1	1	1	3
	Spindle setter and tape man				3	25 M.sp.	1	1	1	3
	Roving hoister	5.8 bob/8 hrs.			3	600–700 bob/hr.	2	1	1	4
	Yarn man	26.6 M bob/8 hrs.			3	20 M bob/8 hrs.	2	1	1	4
	Fixer or third hand				3	15–17 M.sp.	2	1	2	5
	Second hand				3	25 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	1	1	1	3
	Bobbin cleaners	3 M rov. bob and 13 M fill bob/8 hrs.			3	750–1,000 bob/hr.	2	2	2	6
	Overhaulers				2	50 M sp.	1	1	—	2
	Overhaulers helpers				2	50 M sp.	1	1	—	2
	Humidifier men				3	25 M sp.	1	1	1	3
	Cleaners and sweepers				3	12.5–15 M sp.	2	2	2	6
	Fixer or third hand				3	25 M sp.	1	1	1	3
	Second hand				2	50 M sp.	1	1	1	3
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	3	3	—	6
										183

Table No. 113

Man-shifts day: 466
Man-hours/hour: 155.3
Production/hour: 970 kg.
Labour consumption: 16.0 m-h/100 kg.
Productivity: 6.24 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 18's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	124 bales in 24 hrs.	1.7		3	8–10 bales/hr.	0.5	0.5	0.5	
	Opener tender			2	3	4–5 bales/hr.	1	1	1	
	Waste man	240 kg/hr.			3	680 kg/hr.	0.5	0.5	0.5	6
Picking	Picker tender—breaker		6.6	7	3	3	2.33	2.33	2.33	7
	Picker tender—intermediate		6.4	7	3	3	2.33	2.33	2.33	7
	Picker tender—finish		6.2	7	3	3	2.33	2.33	2.33	7
	Waste machine operator	38 kg/hr.		1	3	1	1	1	1	3
	Opening and picking fixer					op. and pick.	1	1	1	3
Carding	Card tender		147.50	154	3	34	5	5	5	15
	Card stripper					50	3	3	3	9
	Card grinder					50–68	3	3	3	9
Drawing	Drawing tender		135.00	136	3	36–40	4	4	4	12
Drawing	Drawing tender		134.50	136	3	36–40	4	4	4	12
Slubber roving	Slubber tender	88 sp.	701.50	8	3	2	4	4	4	12
Intermediate roving	Intermediate tender	124 sp.	5,311.00	42	3	3	14	14	14	42
Spinning	Spinners	288 sp.	50,000	96W–78F	3	1,440 sp.	35	35	35	105
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	107 M bob/8 hrs.			3	1,000 bob/hr.	14	14	14	42
	Spindle setters				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and top man				3	50 M sp.	1	1	1	3
	Roving hoister	186 M bob/8 hrs.			3	600–700 bob/hr.	4	4	4	12
	Yarn man	107 M bob/8 hrs.			3	20 M bob/8 hrs.	6	5	5	16
	Fixer or third hand				3	15–17 sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except card and spin.	2	2	2	6
	Bobbin cleaners	9 M rov. bob and 50 M fill bob/8 hrs.			3	750–1,000 bob/hr.	8	8	8	24
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M.sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										466

Table No. 114

Man-shifts/day: 433
Man-hours/hour: 144.3
Production/hour: 530 kg.
Labour consumption: 27.2 m-h/100 kg.
Productivity: 3.68 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 30's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	69 bales in 24 hrs.			1	8–10 bales /hr.	1	—	—	1
	Opener tender		0.90	1	3	4–5 bales/hr.	1	1	1	3
	Waste man	126 kg/hr.			1	680 kg/hr.	1	—	—	1
Picking	Picker tender-breaker		4.70	5	3	3	1.66	1.66	1.66	5
	Picker tender—intermediate		4.55	5	3	3	1.66	1.66	1.66	5
	Picker tender—finish		4.40	5	3	3	1.66	1.66	1.66	5
	Waste machine operator	21 kg/hr.		1	1	1	1	—	—	1
	Opening and picking fixer					op. and pick.	1	1	1	3
Carding	Card tender		138.25	144	3	34	4	4	4	12
	Card stripper					50	3	3	3	9
	Card grinder					50–68	3	3	3	9
Drawing	Drawing tender		95.25	96	3	36–40	3	3	3	9
Drawing	Drawing tender		95.10	96	3	36–40	3	3	3	9
Slubber roving	Slubber tender (W)	76 sp.	304.15	4	3	2	2	2	2	6
	Slubber tender (F)	72 sp.	278.35	4	3	2	2	2	2	6
Intermediate roving	Intermediate tender (W)	124 sp.	995.45	8	3	3	3	3	3	9
Fly frame roving	Fly frame tender (W)	152 sp.	5,152.65	34	3	4	8	8	8	24
	Fly frame tender (F)	160 sp.	2,071.55	13	3	3	4	4	4	12
Spinning	Spinners	288 sp.	50,000	96W–78F	3	1,728 sp.	29	29	29	87
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	95 M bob/8 hrs.			3	1,000 bob/hr.	12	12	12	36
	Spindle setters				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and tape man				3	50 M sp.	1	1	1	3
	Roving hoister	17.1 M bob/8 hrs.			3	600–700 bob/hr.	3	3	3	9
	Yarn man	95 M bob/8 hrs.			3	20 M bob/8 hrs.	5	5	4	14
	Fixer or third hand				3	15–17 M sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except card and spin.	2	2	2	6
	Bobbin cleaners	8 M rov. bob and 45 M fill bob/8 hrs.			3	No–1,000 bob/hr.	7	7	7	21
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M.sp.	2	2	2	6
	Overseer				1	50 Msp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										433

Table No. 115

Man-shifts/day: 388
Man-hours/hour: 129.3
Production/hour: 425 kg.
Labour consumption: 30.42 m-h/100 kg.
Productivity: 3.287 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 35's carded

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	54 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tender		0.70	1	3	4–5 bales/hr.	1	1	1	3
	Waste man	84 kg/hr.				680 kg/hr.	0.50	—	—	—
Picking	Picker tender—breaker		3.65	4	3	3	1.33	1.33	1.33	4
	Picker tender—intermediate		3.55	4	3	3	1.33	1.33	1.33	4
	Picker tender—finish		3.45	4	3	3	1.33	1.33	1.33	4
	Waste machine operator	16 kg/hr.		1	1	1	0.50	—	—	1
	Opening and picking fixer				2	op. and pick.	1	1	—	2
Carding	Card tender		119.25	124	3	34	4	4	4	12
	Card stripper				3	50	3	3	3	9
	Card grinder				3	50–68	2	2	2	6
Drawing	Drawing tender		75.85	76	3	36–40	2	2	2	6
Drawer	Drawing tender		75.50	76	3	36–40	2	2	2	6
Slubber roving	Slubber tender (W)	72 sp.	285.50	4	3	2	2	2	2	6
Slubber roving	Slubber tender (F)	68 sp.	261.25	4	3	2	2	2	2	6
Intermediate roving	Intermediate tender (W)	120 sp.	951.75	8	3	3	3	3	3	9
Fly frame roving	Fly frame tender (W)	168 sp.	4,980.60	30	3	4	8	8	8	24
Fly frame roving	Fly frame tender (F)	168 sp.	1,959.05	12	3	3	4	4	4	12
Spinning	Spinners	288 sp.	50,000	99W–75F	3	1,872 sp.	27	27	27	81
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	78.3 M bob/8 hrs.			3	1,000 bob/hr.	10	10	10	30
	Spindle setters				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and tape man				3	50 M sp.	1	1	1	3
	Roving hoister	14.5 M bob/8 hrs.			3	600–700 bob/hr.	3	3	3	9
	Yarn man	78.3 M bob/8 hrs.			3	20 M bob/8 hrs.	4	4	4	12
	Fixer or third hand				3	15–17 M sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except card and spinn.	2	2	2	6
	Bobbin cleaners	7 M rov. bob and 39 M fill bob/8 hrs.			3	750–1,000 bob/hr.	6	6	6	18
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										388

Table No. 116

Man-shifts/day: 440
Man-hours/hour: 146.6
Production/hour: 425 kg.
Labour consumption: 34.5 m-h/100 kg.
Productivity: 2.90 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 35's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Opening	Bale opener	60 bales in 24 hrs.			1	8–10 bales/hr.	1	—	—	1
	Opener tender		0.80	1	3	4–5 bales/hr.	1	1	1	3
	Waste man	125 kg/hr.			1	680 kgs/hr.	1	—	—	1
Picking	Picker tender—breaker		4.20	4	3	3	1.33	1.33	1.33	4
	Picker tender—intermediate		4.15	4	3	3	1.33	1.33	1.33	4
	Picker tender—finish		4.05	4	3	3	1.33	1.33	1.33	4
	Waste machine operator	16.0 kg/hr.		1	1	1	1	—	—	1
	Opening and picking fixer				2	op. and pick.	1	1	—	2
Carding	Card tender		151.95	158	3	34	5	5	5	15
	Card stripper				3	50	3	3	3	9
	Card grinder				3	50–68	3	3	3	9
Sliver lapping	Lapper tender		7.20	7	3	3	2.50	2.50	2.50	
Ribbon lapping	Lapper tender		7.20	7	3	3	2.50	2.50	2.50	15
Combing	Comber tender		92.20	92	3	12	8	8	8	24
	Comber fixer				3	20–26	4	4	4	12
Drawing	Drawing tender		75.80	76	3	36–40	2	2	2	6
Slubber roving	Slubber tender	84 sp.	500.95	6	3	2	3	3	3	9
Intermediate roving	Intermediate tender	120 sp.	1,669.90	14	3	4	4	4	4	12
Fly frame roving	Fly frame tender	152 sp.	8,564.00	56	3	4	14	14	14	42
Spinning	Spinners	288 sp.	50,000	99W–75F	3	2,016 sp.	25	25	25	75
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	78 M bob/8 hrs.			3	1,000 bob/hr.	10	10	10	30
	Spindle setters				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and tape man				3	50 M sp.	1	1	1	3
	Roving hoister	16.3 M bob/8 hrs.			3	600–700 bob/hr.	3	3	3	9
	Yarn man	78 M bob/8 hrs.			3	20 M bob/8 hrs.	4	4	4	12
	Fixer or third hand				3	15–17 M sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General	Oilers				3	all except card. and spin.	2	2	2	6
	Bobbin cleaners	8 M rov. bob and 39 M fill bob/8 hrs.			3	750–1,000 bob/hr.	6	6	6	18
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										440

Table No. 117

Man-shifts/day: 381
Man-hours/hour: 127
Production/hour: 260 kg.
Labour consumption: 47.80 m-h/100 kg.
Productivity: 2.046 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 50's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
							First shift	*Second shift*	*Third shift*	
Opening	Bale opener	38 bales in 24 hrs.			1	8–10 bales/hr.	0.5	—	—	
	Opener tender		0.49	1	3	4–5 bales/hr.	1	1	1	
	Waste man	99 kg/hr.			1	680 kg/hr.	0.5	—	—	4
Picking	Picker tender—breaker		3.20	3	3	3	1	1	1	3
	Picker tender—intermediate		3.10	3	3	3	1	1	1	3
	Picker tender—finish		3.00	3	3	3	1	1	1	3
	Waste machine operator	10.8 kg/hr.		1	1	1	—	0.5	—	
	Opening and picking fixer				2	op. and pick.	1	0.5	—	2
Carding	Card tender		106.25	111	3	34	3	3	3	9
	Card stripper				3	50	3	2	2	7
	Card grinder				3	50–68	2	2	2	6
Sliver lapping	Lapper tender		4.85	5	3	3	1.5	1.5	1.5	
Ribbon lapping	Lapper tender		4.85	5	3	3	1.5	1.5	1.5	9
Combing	Comber tender		65.05	65	3	12	6	6	6	18
	Comber fixer				3	20–26	3	3	3	9
Drawing	Drawing tender		53.95	54	3	36–40	2	2	2	6
Slubber roving	Slubber tender	76 sp.	375.30	5	3	2	3	3	3	9
Intermediate roving	Intermediate tender	116 sp.	1,392.35	12	3	4	3	3	3	9
Jack frame roving	Jack tender	152 sp.	7,276.40	48	3	4	12	12	12	36
Spinning	Spinners	288 sp.	50,000	87W–87F	3	2,304 sp.	22	22	22	66
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	68.8 bob/8 hrs.			3	1,000 bob/hr.	9	9	9	27
	Spindle setters				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and tape man				3	50 M sp.	1	1	1	3
	Roving hoister	14.7 bob/8 hrs.			3	600–700 bob/hr.	3	3	3	9
	Yarn man	68.8 bob/8 hrs.			3	20 M bob/8 hrs.	4	3	3	10
	Fixer or third hand				3	15–17 M sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	2	2	1	5
	Bobbin cleaners	8 M rov. bob and 35 M fill bob/8 hrs.			3	750–1,000 bob/hr.	5	5	5	15
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										381

Table No. 118

Man-shifts/day: 341
Man-hours/hour: 113.6
Production/hour: 170 kg.
Labour consumption: 66.6 m-h/100 kg.
Productivity: 1.50 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION

Mill size: 50,000 spindles
Mill type: Old
Product: 70's combed

Process	*Job*	*Remarks*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Opening	Bale opener	25 bales in 24 hrs.			1	8–10 bales/hr.	0.33	—	—	1
	Opener tender		0.33	1	3	4·5 bales/hr.	1	1	1	3
	Waste man	65 kg/hr.			1	680 kg/hr.	0.33	—	—	
Picking	Picker tender—breaker		2.80	3	3	3	1	1	1	3
	Picker tender—intermediate		2.70	3	3	3	1	1	1	3
	Picker tender—finish		2.65	3	3	3	1	1	1	3
	Waste machine operator	6.3 kg/hr.		1	1	1	0.33	—	—	
	Opening and picking fixer				2	op. and pick.	1	1	—	2
Carding	Card tender		90.30	94	3	34	3	3	3	9
	Card stripper				3	50	2	2	2	6
	Card grinder				3	50–68	2	2	2	6
Sliver lapping	Lapper tender		3.85	4	3	3	1.5	1.5	1.5	
Ribbon lapping	Lapper tender		3.85	4	3	3	1.5	1.5	1.5	9
Combing	Comber tender		49.55	50	3	12	4	4	4	12
	Comber fixer				3	20–26	2	2	2	6
Drawing	Drawing tender		41.80	42	3	36–40	1	1	1	3
Slubber roving	Slubber tender	76 sp.	300.75	4	3	2	2	2	2	6
Intermediate roving	Intermediate tender	136 sp.	1,193.10	9	3	3	3	3	3	9
Jack frame roving	Jack tender	160 sp.	7,137.50	45	3	5	9	9	9	27
Spinning	Spinners	288 sp.	50,000	87W–87F	3	2,448 sp.	21	21	21	63
	Top cleaners				3	5 M sp.	10	10	10	30
	Doffers	53.2 M bob/8 hrs.			3	1,000 bob/hr.	7	7	7	21
	Spindle setter				3	50 M sp.	1	1	1	3
	Overhaulers				3	25 M sp.	2	2	2	6
	Overhaulers helpers				3	25 M sp.	2	2	2	6
	Oiler				3	25 M sp.	2	2	2	6
	Oiler and tape man				3	50 M sp.	1	1	1	3
	Roving hoister	11.7 bob/8 hrs.			3	600–700 bob/hr.	3	2	2	7
	Yarn man	53.2 M bob/8 hrs.			3	20 M bob/8 hrs.	3	3	2	8
	Fixer or third hand				3	15–17 M sp.	3	3	3	9
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
General										
	Oilers				3	all except cards and spin.	2	2	1	5
	Bobbin cleaners	6 M rov. bob and 27 MF/bob/8 hrs.			3	750–1,000 bob/hr.	4	4	4	12
	Overhaulers				3	50 M sp.	1	1	1	3
	Overhaulers helpers				3	50 M sp.	1	1	1	3
	Humidifier men				3	25 M sp.	2	2	2	6
	Cleaners and sweepers				3	12.5–15 M sp.	4	4	4	12
	Fixer or third hand				3	25 M sp.	2	2	2	6
	Second hand				3	25 M sp.	2	2	2	6
	Overseer				1	50 M sp.	1	—	—	1
	General work and misc.				2	10 M sp.	5	5	—	10
										341

Table No. 119

Mill type: Old
Product: Osnaburg
Fabric count: 79.6

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	7.5	200 y/min. 183 m/min.	0.864 kg.	52%	0.449 kg.	105.10 kg.	234.20
Warpers	405 ends	80 y/min. 73.1 m/min.	140.0 kg.	71%	99.5 kg.	104.06 kg.	1.05
Slashers	1,620 ends	24 y/min. 21.9 m/min.	168.2 kg.	60%	100.9 kg.	103.3 kg.	1.02
Tying-in		270 knots/hr.[1]	10.0 beams[1]	40%[1]	4.0 beams[1]	2.02 beams	0.50[1]
Looms	Osnaburg	170 r.p.m.	9.980 m. 2.146 kg.	76%	7.590 m. 1.630 kg.	163.0 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 40-loom mill. As the hourly production is 0.81 beams, it will be required to use 1.28 total continuous units (men in this case).

FABRIC SPECIFICATIONS

Name in English: Osnaburg.
Name in Spanish: Osnaburgo.
Warp density 40. Filling density 26.
Warp count 7.5's. Filling count 8.25's.
Width in the reed 44"–111.7 cm. Width in the grey 40"–101.6 cm.
Grams/m. 215.1. Grams/sq. m. 192.56. Yds./lb. 2.30.
Per cent warp 62.01. Per cent filling 37.99.
Fabric count 79.6.

Table No. 120

Mill type: Old
Product: Sheeting A
Fabric count: 127.9

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	13	200 y/min. 183 m/min.	0.499 kg.	56%	0.279 kg.	42.1 kg.	150
Warpers	485 ends	80 y/min. 73.1 m/min.	96.6 kg.	65%	62.8 kg.	41.7 kg.	0.66
Slashers	1,940 ends	25.4 y/min. 22.8 m/min.	122.7 kg.	62%	76.1 kg.	41.3 kg.	0.54
Tying-in		270 knots/hr.[1]	8.36 beams[1]	40%[1]	3.34 beams[1]	0.82 beams	0.24[1]
Looms	Sheeting A	170 r.p.m.	5.410 m. 1.021 kg.	78%	4.220 m. 0.796 kg.	79.6 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 10-loom mill. As the hourly production is 0.64 beams, it will be required to use 1.25 total continuous units (men in this case).

FABRIC SPECIFICATIONS

Name in English: Sheeting A.
Name in Spanish: Tela para sábanas A.
Warp density 48. Filling density 48.
Warp count 13's. Filling count 13's.
Width in the reed 42.74"–108.3 cm. Width in the grey 40"–101.6 cm.
Grams/m. 188.8. Grams/sq.m. 174.3. Yds/lb. 2.63.
Per cent warp 50.82. Per cent filling 49.18.
Fabric count 127.9.

Table No. 121

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	17	200 y/min. 183 m/min.	0.381 kg.	58%	0.221 kg.	36.62 kg.	166.00
Warpers	485 ends	80 y/min. 73.1 m/min.	74.0 kg.	65%	48.1 kg.	36.26 kg.	0.75
Slashers	1,940 ends	28 y/min. 26.5 m/min.	103.5 kg.	63%	67.3 kg.	35.9 kg.	0.53
Tying-in		270 knots/min.[1]	8.35 beams[1]	40%	3.34 beams[1]	0.72 beams	0.21[1]
Looms	Sheeting B	180 r.p.m.	6.233 m. 0.771 kg.	80%	4.986 m. 0.616 kg.	61.60 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 40-loom mill. As the hourly production is 0.49 beams, it will be required to use 0.59 total continuous units (men in this case).

FABRIC SPECIFICATIONS

Name in English: Sheeting B.
Name in Spanish: Tela para sábanas B.
Warp density 48. Filling density 44.
Warp count 17's. Filling count 21's.
Width in the reed 42.36″–107.59 cm. Width in the grey 40″–101.6 cm.
Grams/m. 123.83. Grams/sq. m. 115.09. Yds/lb. 4.00.
Per cent warp 57.73. Per cent filling 42.27.
Fabric count 79.6.

Table No. 122

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	21	200 y/min. 183 m/min.	0.308 kg.	60%	0.184 kg.	27.70 kg.	149.50
Warpers	445 ends	80 y/min. 73.1 m/min.	55.0 kg.	66%	36.3 kg.	27.40 kg.	0.75
Slashers	1,780 ends	30 y/min. 224 m/min.	82.3 kg.	65%	53.5 kg.	27.10 kg.	0.51
Tying-in		270 knots/min.[1]	9.11 beams[1]	40%[1]	3.64 beams[1]	0.58 beams	0.16[1]
Looms	Sheeting C	180 r.p.m.	6.233 m. 0.588 kg.	82%	5.111 m. 0.482 kg.	48.2 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 40-loom mill. As the hourly production is 0.38 beams, it will be required to use 0.68 total continuous units (men, in this case).

FABRIC SPECIFICATIONS

Name in English: Sheeting C.
Name in Spanish: Tela para sábanas C.
Warp density 44. Filling density 44.
Warp count 21's. Filling count 26's.
Width in the reed 41.96″–106.57 cm. Width in the grey 40″–101.6 cm.
Grams/m. 94.44. Grams/sq. m. 88.61. Yds/lb. 5.26.
Per cent warp 55.65. Per cent filling 44.35.
Fabric count 230.7.

Table No. 123

Mill type: Old
Product: Print cloth
Fabric count: 332.7

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	30	200 y/min. 183 m/min.	0.216 kg.	65%	0.140 kg.	20.32 kg.	145.00
Warpers	449 ends	80 y/min. 73.1 m/min.	38.7 kg.	63%	24.4 kg.	20.22 kg.	0.83
Slashers	3,144 ends	19.6 y/min. 18.0 m/min.	66.6 kg.	65%	43.4 kg.	20.12 kg.	0.46
Tying-in		270 knots/min.[1]	5.15 beams[1]	40%	2.06 beams[1]	0.40 beams	0.20[1]
Looms	Print cloth	180 r.p.m.	3.429 m. 0.410 kg.	85%	2.914 m. 0.348 kg.	34.80 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 40 loom mill. As the hourly production is 0.04 beams, it will be required to use 0.125 total continuous units (men, in this case).

FABRIC SPECIFICATIONS

Name in English: Print cloth.
Name in Spanish: Tela de estampe.
Warp density 80. Filling density 80.
Warp count 30's. Filling count 40's.
Width in the reed 42.2″–107 cm. Width in the grey 39″–99 cm.
Grams/m. 119.58. Grams/sq. m. 111.75. Yds/lb. 4.14.
Per cent warp 57.3. Per cent filling 42.7.
Fabric count 332.7.

Table No. 124

Mill type: Old
Product: Broadcloth
Fabric count: 429

STANDARD MILLS
MACHINE UNITS REQUIRED FOR THE PRODUCTION OF CLOTH

Process	*Product*	*Speed*	*100 Percent production per unit*	*Standard efficiency*	*Hourly production per unit*	*Required hourly production per 100 looms*	*Required continuous units per 100 looms*
Spoolers	50	200 y/min. 183 m/min.	0.129 kg.	68%	0.088 kg.	21.63 kg.	245.80
Warpers	464 ends	80 y/min. 73.1 m/min.	24.1 kg.	58%	16.1 kg.	21.42 kg.	1.33
Slashers	5,568 ends	14 y/min. 12.8 m/min.	50.5 kg.	67%	34.6 kg.	21.21 kg.	0.61
Tying-in	Broadcloth	270 knots/min.[1]	2.91 beams[1]	40%[1]	1.16 beams[1]	0.42 beams	0.36[1]
Looms		180 r.p.m.	3.615 m. 0.422 kg.	80%	2.892 m. 0.337 kg.	33.70 kg.	100

[1] Hand tying, at 1,000 knots per hour, was considered for the 40-loom mill. As the hourly production is 0.17 beams, it will be required to use 1.0 total continuous units (men, in this case).

FABRIC SPECIFICATIONS

Name in English: Broadcloth.
Name in Spanish: "Broadcloth."
Warp density 144. Filling density 76.
Warp count 50's. Filling count 45's.
Width in the reed 43.9″–111.5 cm. Width in the grey 38.5″–97.79 cm.
Grams/m. 116.72. Grams/sq. m. 119.10. Yds/lb. 4.25.
Per cent warp 61.7. Per cent filling 38.3.
Fabric count 429.

Table No. 125

Man-shifts/day: 64
Man-hours/hour: 21.3
Production/hour: 65.2 kg.
Labour consumption: 32.7 m-h/100 kg.
Productivity: 3.06 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	52	42.0	94	1–25 3–35	3	35	3	3	3	9
Warping	Warper tenders	71	41.6	0.42	1	2	1	1	1	—	2
	Fixer or third hand										
Slashing	Slasher tenders	60	41.2	0.41	1	2	1	1	1	—	2
Tying-in	Tying-in hands		0.81 beams	1.28		2	1,000 knots/hr.	2	2	—	4
	Drawing-in hands					1	200 looms	1	—	—	1
Weaving	Weavers	76	65.2	40	40	3	4 looms	10	10	10	30
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	500 looms	0.2	0.2	0.2	
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.3	0.3	0.3	6
	Filling hauler (full quills)					3	10 M bob/8 hrs.	1	1	1	
	Quill men (empty quills 10 M/8 hrs.)					3	30–40 M bob/8 hrs.	0.3	0.3	0.3	
	Warp men 10 M/8 hrs.					3	200 looms	0.4	0.4	0.4	
	Cloth doffers and truckers					3	150 looms	0.3	0.3	0.3	3
	Smash hands and spare weavers					3	200 looms	0.3	0.3	0.3	
	Oilers					3	200 looms	0.3	0.3	0.3	
	Blow-off men					3	250 looms	0.5	0.5	0.5	3
	Sweepers					3	250 looms	0.5	0.5	0.5	
	Second hand					1	500 looms	1	—	—	1
											64

Table No. 126

Man-shifts/day: 45
Man-hours/hour: 15
Production/hour: 31.8 kg.
Labour consumption: 47.2 m-h/100 kg.
Productivity: 2.12 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Spooling	Spooler hands	56	16.7	60	1–60	3	50	1	1	1	3
Warping	Warper tenders	65	16.6	0.26	1	1	1	1	—	—	1
Slashing	Slasher tenders	62	16.5	0.22	1	1	1	1	—	—	1
Tying-in	Tying-in hands		0.64 beams	1.25		2	100 knots/hr.	2	—	—	2
	Drawing-in hands					1	250 looms	1	—	—	1
Weaving	Weavers	78	31.8	40	40	3	5 looms	8	8	8	24
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	500 looms	0.2	0.2	0.2	
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.2	0.2	0.2	3
	Filling hauler (full quills 56 M/8 hrs.)					3	10 M bob/8 hrs.	0.6	0.6	0.6	
	Quill men (empty quills 56 M/8 hrs.)					3	30–40 M/8 hrs.	0.2	0.2	0.2	
	Warp men					3	200 looms	0.25	0.25	0.25	3
	Cloth doffers and truckers					3	200 looms	0.25	0.25	0.25	
	Smash hands and spare weavers					3	200 looms	0.25	0.25	0.25	
	Oilers					3	200 looms	0.25	0.25	0.25	
	Blow-off men					3	250 looms	0.5	0.5	0.5	3
	Sweepers					3	250 looms	0.5	0.5	0.5	
	Second hands					1	500 looms	1	—	—	1
											45

Table No. 127

Man-shifts/day: 43
Man-hours/hour: 14.3
Production/hour: 24.6
Labour consumption: 58.2 m-h/100 kg.
Productivity: 1.72 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	58	14.5	66	1–70	3	60	1	1	1	3
Warping	Warper tenders	65	14.4	0.30	1	1	1	1	—	—	1
	Fixer or third hand										
Slashing	Slasher tenders	63	14.3	0.21	1	1	1	1	—	—	1
Tying-in	Tying-in hands		0.49 beams	0.59		2	1,000 knots/hr.	1	1	—	2
	Drawing-in hands					1	250 looms	1	—	—	1
Weaving	Weavers	80	24.6	40	40	3	5 looms	8	8	8	24
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	250 looms	0.2	0.2	0.2	
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.1	0.1	0.1	3
	Filling hauler (full quills 2.6 M/8 hrs.)					3	10 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills 2.6 M/8 hrs.)					3	30–40 M/8 hrs.	0.1	0.1	0.1	
	Warp men					3	250 looms	0.2	0.2	0.2	
	Cloth doffers and truckers					3	200 looms	0.3	0.3	0.3	
	Smash hands and spare weavers					1	200 looms	1	—	—	1
	Oilers					3	250 looms	0.3	0.3	0.3	3
	Blow-off men					3	250 looms	0.3	0.3	0.3	
	Sweepers					3	250 looms	0.3	0.3	0.3	
	Second hand					1	500 looms	1	—	—	1
											43

Table No. 128

Man-shifts/day: 40
Man-hours/hour: 13.3
Production/hour: 19.3 kg.
Labour consumption: 69.0 m-h/100 kg.
Productivity: 1.45 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	60	11.1	60	1–60	3	70	1	1	1	3
Warping	Warper tenders	66	10.9	0.30	1	1	1	1	—	—	1
Slashing	Slasher tenders	65	10.8	0.20	1	1	1	1	—	—	1
Tying-in	Tying-in hands		0.38 beams	0.68	—	2	100 knots/hr.	1	1	—	2
	Drawing-in hands					1	250 looms	1	—	—	1
Weaving	Weavers	82	19.3	40	40	3	6 looms	7	7	7	21
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	500 looms	0.2	0.2	0.2	
	Yarn man and warper doffers					3	500–700 kg/hr.	0.1	0.1	0.1	3
	Filling hauler (full quills 2.6 M/8 hrs.)					3	10 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills 2.6 M/8 hrs.)					3	30–40 M /8 hrs.	0.1	0.1	0.1	
	Warp men					3	250 looms	0.2	0.2	0.2	
	Cloth doffers and truckers					3	200 looms	0.3	0.3	0.3	
	Smash hands and spare weavers					1	200 looms	1	—	—	1
	Oilers					3	250 looms	0.3	0.3	0.3	3
	Blowoff men					3	250 looms	0.3	0.3	0.3	
	Sweepers					3	250 looms	0.3	0.3	0.3	
	Second hand					1	500 looms	1	—	—	1
											40

Table No. 129

Man-shifts/day: 39
Man-hours/hour: 13
Production/hour: 13.92 kg.
Labour consumption: 93.3 m-h/100 kg.
Productivity: 1.07 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	65	8.13	58	1–60	3	80	1	1	1	3
Warping	Warper tenders	63	8.08	0.33	1	1	1	1	—	—	1
	Fixer or third hand										
Slashing	Slasher tenders	65	8.04	0.18	1	1	1	1	—	—	1
Tying-in	Tying-in hands		0.04 beams	0.12	—	1	100 knots/hr.	1	—	—	1
	Drawing-in hands					1	250 looms	1	—	—	1
Weaving	Weavers	85	13.92	40	40	3	6 looms	7	7	7	21
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	500 looms	0.2	0.2	0.2	
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.1	0.1	0.1	3
	Filling hauler (full quills 2.4 M/8 hrs.)					3	10 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills 2.4 M/8 hrs.)					3	30–40 bob/8 hrs.	0.1	0.1	0.1	
	Warp men					3	250 looms	0.2	0.2	0.2	
	Cloth doffers and truckers					3	200 looms	0.3	0.3	0.3	
	Smash hands and spare weavers					1	200 looms	1	—	—	1
	Oilers					3	250 looms	0.3	0.3	0.3	3
	Blow-off men					3	250 looms	0.3	0.3	0.3	
	Sweepers					3	250 looms	0.3	0.3	0.3	
	Second hand					1	500 looms	1	—	—	1
											39

Table No. 130

Man-shifts/day: 54
Man-hours/hour: 18
Production/hour: 13.4 kg.
Labour consumption/hour: 134.2 m-h/100 kg.
Productivity: 0.744 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION FOR WEAVING

Mill size: 40 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	68	8.7	97	1–100	3	60	2	2	2	6
Warping	Warper tenders	58	8.6	0.52	1	2	1	1	1	—	2
Slashing	Slasher tenders	67	8.5	0.24	1	1	1	1	—	—	1
Tying-in	Tying-in hands		0.17 beams	1.0		3	100 knots/hr.	1	1	1	3
	Drawing-in hands					1	250 looms	1	—	—	1
Weaving	Weavers	80	13.4	40	40	3	4 looms	10	10	10	30
General											
	Fixer or third hand					3	50 looms	0.8	0.8	0.8	3
	Humidifier men					3	500 looms	0.2	0.2	0.2	
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.1	0.1	0.1	3
	Filling hauler (full quills 3.4 M/8 hrs.)					3	10 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills 3.4 M/8 hrs.)					3	30–40 M/8 hrs.	0.1	0.1	0.1	
	Warp men					3	250 looms	0.2	0.2	0.2	
	Cloth doffers and truckers					3	200 looms	0.3	0.3	0.3	
	Smash hands and spare weavers					1	200 looms	1	—	—	1
	Oilers					3	250 looms	0.3	0.3	0.3	3
	Blow-off men					3	250 looms	0.3	0.3	0.3	
	Sweepers					3	250 looms	0.3	0.3	0.3	
	Second hand					1	500 looms	1	—	—	1
											54

Table No. 131

Man-shifts/day: 143
Man-hours/hour: 47.6
Production/hour: 163.0 kg.
Labour consumption: 29.2 m-h/100 kg.
Productivity: 3.43 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Millsize: 100 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Spooling	Spooler hands	52	105.1	234	1–140 1–105	3	35	7	7	7	21
Warping	Warper tenders	71	104.0	1.05	1	3	1	1	1	1	3
	Fixer or third hand					3	all prep.	1	1	1	3
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	60	103.0	1.02	1	3	1	1	1	1	3
	Slasher helpers					3	2–3	0.5	0.5	0.5	
	Size man					3	4–6	0.5	0.5	0.5	3
Tying-in	Tying-in machine operator	40	2.02 beams	0.50	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	76	163.0	100	100	3	4 looms	25	25	25	75
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					3	150 looms	0.5	0.5	0.5	3
	Warp men					3	200 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.5	0.5	0.5	3
	Filling hauler (full quills 25 M/8 hrs.)					3	10 M bob/8 hrs.	3	3	2	8
	Quill men (empty quills 25 M/8 hrs.)					2	30–40 M bob/8 hrs.	1	1	—	2
	Cloth doffers and truckers					3	150 looms	0.5	0.5	0.5	
	Blow-off men					3	200 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hands					3	500 looms	1	1	1	3
	Overseers										
											143

Table No. 132

Man-shifts/day: 105
Man-hours/hour: 35
Production/hour: 79.6 kg.
Labour consumption: 43.8 m-h/100 kg.
Productivity: 2.28 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
					1–10						
Spooling	Spooler hands	56	42.1	150	1–150	3	50	3	3	3	9
Warping	Warper tenders	65	41.7	0.66	1	2	1	1	1	—	2
	Fixer or third hand					3	all prep.	1	1	1	3
	Second hand	62	41.3	0.54	1	2	1	1	1	—	2
Slashing	Slasher tenders										
	Slasher helpers					2	2–3	0.5	0.5	—	
	Size man					2	4–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	40	0.82 beams	0.24	1	1	1	1	—	—	1
	Tying-in machine helper						1	1	—	—	1
Weaving	Weavers	78	79.6	100	100	3	5 looms	20	20	20	60
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					3	200 looms	0.5	0.5	0.5	3
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.5	0.5	0.5	3
	Filling hauler (full quills 14 M/8 hrs.)					3	10 M bob/8 hrs.	2	1	1	4
	Quills men (empty quills 14 M/8 hrs.)					1	30–40 M/8 hrs.	1	—	—	1
	Cloth doffers and truckers					3	200 looms	0.5	0.5	0.5	
	Blow-off men					3	200 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hands					3	500 looms	1	1	1	3
	Overseers										
											105

Table No. 133

Man-shifts/day: 103
Man-hours/hour: 34.3
Production/hour: 61.6 kg.
Labour consumption: 55.5 m-h/100 kg.
Productivity: 1.80 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	58	36.6	166	1–170	3	60	3	3	3	9
Warping	Warper tenders	65	36.2	0.75	1	3	1	1	1	1	3
	Fixer or third hand					1	spooling, warp. and slashing	1	1	—	2
	Second hand										
Slashing	Slasher tenders	63	35.9	0.53	1	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	—	
	Size man					2	4–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	40	0.71 beams	0.21	1	1	1	1	—	—	1
	Tying-in machine helper						1	1	—	—	1
Weaving	Weavers	80	61.6	100	100	3	5 looms	20	20	20	60
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					3	250 looms	0.5	0.5	0.5	3
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.5	0.5	0.5	3
	Filling hauler (full quills 6.5 M/8 hrs.)					3	10 M bob/8 hrs.	0.7	0.7	0.7	
	Quills men (empty quills 6.5 M/8 hrs.)					3	30–40 M bob/8 hrs.	0.3	0.3	0.3	3
	Cloth doffers and truckers					3	200 looms	0.5	0.5	0.5	
	Blow-off men					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hands					3	500 looms	1	1	1	3
	Overseers										
											103

Table No. 134

Man-shifts/day: 91
Man-hours/hour: 30.3
Production/hour: 48.2 kg.
Labour consumption: 62.9 m-h/100 kg.
Productivity: 1.59 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	60	27.7	150	1–150	1	70	2	2	2	6
Warping	Warper tenders	66	27.4	0.75	1	3	1	1	1	1	3
	Fixer or third hand					2	spooling, warp. and slashing	1	1	—	2
Slashing	Slasher tenders	65	27.1	0.50	1	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	—	
	Size man					2	3–4	0.5	0.5	—	2
Tying-in	Tying-in machine operator	40	0.58 beams	0.16	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	82	48.2	100	100	3	6 looms	17	17	17	51
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn man and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Warp men					3	250 looms	0.5	0.5	0.5	3
	Drawing-in hands					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.7	0.7	0.7	3
	Filling hauler (full quills 6.5 M/8 hrs.)					3	10 M bob/8 hrs.	0.3	0.3	0.3	
	Quill men (empty quills 6.5 M/8 hrs.)					3	30–40 M/8 hrs.	0.5	0.5	0.5	3
	Cloth doffers and truckers					3	200 looms	0.5	0.5	0.5	
	Oilers					3	250 looms	0.5	0.5	0.5	3
	Blow-off men					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hand					3	500 looms	1	1	1	3
											91

Table No. 135

Man-shifts/day: 91
Man-hours/hour: 30.3
Production/hour: 34.8 kg.
Labour consumption: 87.0 m-h/100 kg.
Productivity: 1.15 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	65	20.3	145	1–150	3	80	2	2	2	6
Warping	Warper tenders	63	20.2	0.82	1	3	1	1	1	1	3
	Fixer or third hand					3	spooling, warp. and slashing	1	1	—	2
	Second hand										
Slashing	Slasher tenders	65	20.1	0.46	1	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	—	
	Size man					2	4–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	40	0.4 beams	0.2	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	85	34.8	100	100	3	6 looms	17	17	17	51
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					3	250 looms	0.5	0.5	0.5	3
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.5	0.5	0.5	3
	Filling hauler (full quills 6 M/8 hrs.)					3	10 M bob/8 hrs.	0.5	0.5	0.5	
	Quill men (empty quills 6M/8 hrs.)					3	30–40 M/8 hrs.	0.5	0.5	0.5	3
	Cloth doffers and truckers					3	200 looms	0.5	0.5	0.5	
	Blow-off men					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hands					3	500 looms	1	1	1	3
	Overseers										
											91

Table No. 136

Man-shifts/day: 123
Man-hours/hour: 41
Production/hour: 33.7 kg.
Labour consumption: 121.7 m-h/100 kg.
Productivity: 0.822 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 100 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	68	21.6	245	1–120 1–130	3	60	4	4	4	12
Warping	Warper tenders	58	21.4	1.3	2	2	1	2	2	—	4
	Fixer or third hand					2	spooling, warp. and slashing	1	1	—	2
	Second hand										
Slashing	Slasher tenders	67	21.2	0.6	1	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	—	
	Size man					2	4–6	0.5	0.5	—	2
Tying-in	Tying-in machine operator	40	0.42 beams	0.36	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	80	33.7	100	100	3	4 looms	25	25	25	75
	Loom fixers					3	100 looms	1	1	1	3
General											
	Humidifier men					2	500 looms	1	1	—	2
	Yarn hauler and warper doffers					3	500–700 kg/hr.	0.5	0.5	0.5	
	Drawing-in hands					3	250 looms	0.5	0.5	0.5	3
	Warp men					3	250 looms	0.5	0.5	0.5	
	Smash hands and spare weavers					3	200 looms	0.5	0.5	0.5	3
	Filling hauler (full quills 8.5 M/8 hrs.)					3	10 M bob/8 hrs.	1	1	1	3
	Quills men (empty quills 8.5 M/8 hrs.)					1	30–40 M/8 hrs.	1	—	—	1
	Cloth doffers and truckers					3	200 looms	0.5	0.5	0.5	
	Blow-off men					3	250 looms	0.5	0.5	0.5	3
	Oilers					3	250 looms	0.5	0.5	0.5	
	Sweepers					3	250 looms	0.5	0.5	0.5	3
	Second hands					3	500 looms	1	1	1	3
	Overseers										
											123

Table No. 137

Man-shifts/day: 277
Man-hours/hour: 92.1
Production/hour: 32.60 kg.
Labour consumption: 28.2 m-h/100 kg.
Productivity: 3.54 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	52	210.0	469	3–140 1–70	3	35	14	14	14	42
Warping	Warper tenders	71	208.0	2.10	3	3	3	3	3	1	7
	Fixer or third hand					3	all prep.	1	1	1	3
	Second hand					2	all prep.	1	1	—	2
Slashing	Slasher tenders	60	206.0	2.04	2	3	1	2	2	2	6
	Slasher helpers					3	2–3	0.5	0.5	0.5	3
	Size man					3	4–6	0.5	0.5	0.5	1
Tying-in	Tying-in machine operator	40	4.0 beams	1.00	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	76	326.0	200	200	3	4 looms	50	50	50	150
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg.	1	1	—	2
	Drawing-in hands					3	200 looms	1	1	1	3
	Warp men					3	150 looms	2	1	1	4
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 49 M/8 hrs.)					3	10 M bob/8 hrs.	5	5	5	15
	Quill men (empty quills 49 M/8 hrs.)					3	30–40 M bob/8 hrs.	2	2	1	5
	Cloth doffers and truckers					3	150 looms	2	1	1	4
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	200 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hands					3	500 looms	1	1	1	3
	Overseers					1	500–1,000 looms	1	—	—	1
											277

Table No. 138

Man-shifts/day: 200
Man-hours/hour: 66.6
Production/hour: 159.2 kg.
Labour consumption: 41.8 m-h/100 kg.
Productivity: 2.39 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or Spooling	Spooler hand	56	84.3	300	2–150	3	50	6	6	6	18
Warping	Warper tenders	65	83.5	1.34	2	2	1	1	1	—	2
	Fixer or third hand					3	all prep.	1	1	1	3
	Second hand					1	all prep.	1	—	—	1
Slashing	Slasher tenders	62	82.7	1.08	2	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	—	2
	Size man					2	4–6	0.5	0.5	—	
Tying-in	Tying-in machine operator	40	1.64 beams	0.49	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	78	159.2	200	200	3	5 looms	40	40	40	120
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	200 looms	1	1	1	3
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 13 M/8 hrs.)					3	10 M bob/8 hrs.	3	3	3	9
	Quill men (empty quills 13 M/8 hrs.)					3	30–40 M/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	1	1	1	3
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	200 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											200

Table No. 139

Man-shifts/day: 197
Man-hours/hour: 65.6
Production/hour: 123.2 kg.
Labour consumption: 52.2 m-h/100 kg.
Productivity: 1.88 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hand	58	73.2	332	1–180 1–160	3	60	6	6	6	18
Warping	Warper tenders	65	72.5	1.51	2	3	1	2	2	1	5
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
Slashing	Slasher tenders	63	71.8	1.08	1	3	1	1	1	1	3
	Slasher helpers					3	2–3	0.5	0.5	0.5	3
	Size man					3	4–6	0.5	0.5	0.5	
Tying-in	Tying-in machine operator	40	1.43 beams	0.42	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	80	123.2	200	200	3	5 looms	40	40	40	120
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 13 M/8 hrs.)					3	10 M bob/8 hrs.	2	1	1	4
	Quill men (empty quills 13 M/8 hrs.)					1	30–40 M bob/8 hrs.	1	—	—	1
	Cloth doffers and truckers					3	200 looms	1	1	1	3
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											197

Table No. 140

Man-shifts/day: 174
Man-hours/hour: 58
Production/hour: 96.5 kg.
Labour consumption: 60.2 m-h/100 kg.
Productivity: 1.66 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hand	60	55.4	301	2–150	3	70	5	5	5	15
Warping	Warper tenders	66	54.9	1.51	2	3	1	2	2	1	5
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
Slashing	Slasher tenders	65	54.2	1.01	1	3	1	1	1	1	3
	Slasher helpers					3	2–3	0.5	0.5	0.5	3
	Size man					3	4–6	0.5	0.5	0.5	
Tying-in	Tying-in machine operator	40	1.17 beams	0.32	1	1	1	1	—	—	1
	Tying-in machine helper					1	1	1	—	—	1
Weaving	Weavers	82	96.5	200	200	3	6 looms	34	34	34	102
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 13 M/8 hrs.)					3	10 M bob/8 hrs.	2	1	1	4
	Quill men (empty quills 13 M/8 hrs.)					1	30–40 M/8 hrs.	1	—	—	1
	Cloth doffers and truckers					3	200 looms	1	1	1	3
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											174

Table No. 141

Man-shifts/day: 173
Man-hours/hour: 57.6
Production/hour: 69.6 kg.
Labour consumption: 82.6 m-h/100 kg.
Productivity: 1.21 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	*Men* Second shift	*Men* Third shift	*Total man-shifts*
Winding or spooling	Spooler hand	65	40.7	290	1–160 1–80 1–50	3	80	4	4	4	12
Warping	Warper tender	63	40.4	1.66	2	3	1	2	2	1	5
	Fixer or third hand		3			3	spooling, warp. and slashing	1	1	1	3
Slashing	Slasher tenders	65	40.2	0.92	1	3	1	1	1	1	3
	Slasher helpers					3	2–3	0.5	0.5	0.5	3
	Size man					3	4–6	0.5	0.5	0.5	
Tying-in	Tying-in machine operator	40	0.8 beams	0.4	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	85	69.6	200	200	3	6 looms	34	34	34	102
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	350 looms	1	1	1	3
	Yarn men and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 12 M/8 hrs.)					3	10 M bob/8 hrs.	2	1	1	4
	Quill men (empty quills 12 M/8 hrs.)					1	30–40 M/8 hrs.	1	—	—	1
	Cloth doffers and truckers					3	200 looms	1	1	1	3
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											173

Table No. 142

Man-shifts/day: 240
Man-hours/hour: 80
Production/hour: 67.4 kg.
Labour consumption: 118.8 m-h/100 kg.
Productivity: 0.842 kg/100-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 200 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hand	68	43.3	491	2–180 1–130	3	60	9	9	9	27
Warping	Warper tenders	58	42.9	2.6	3	3	1	3	3	2	8
	Fixer or third hands					3	spooling, warp. and slashing	1	1	1	3
Slashing	Slasher tenders	67	42.4	1.2	2	2	1	1	1	—	2
	Slasher helpers					2	2–3	0.5	0.5	0.5	3
	Size man					2	4–6	0.5	0.5	0.5	
Tying-in	Tying-in machine operator	40	0.84 beams	0.72	1	2	1	1	1	—	2
	Tying-in machine helpers					2	1	1	1	—	2
Weaving	Weavers	80	67.4	200	200	3	4 looms	50	50	50	150
	Loom fixers					3	100 looms	2	2	2	6
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	1	1	1	3
	Warp men					3	250 looms	1	1	1	3
	Smash hands and spare weavers					3	200 looms	1	1	1	3
	Filling hauler (full quills 17 M/8 hrs.)					3	10 M bob/8 hrs.	2	2	1	5
	Quill men (empty quills 17 M/8 hrs.)					2	30-40 M/8 hrs.	1	1	—	2
	Cloth doffers and truckers					3	200 looms	1	1	1	3
	Blow-off men					3	250 looms	1	1	1	3
	Oilers					3	250 looms	1	1	1	3
	Sweepers					3	250 looms	1	1	1	3
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											240

Table No. 143

Man-shifts/day: 408
Man-hours/hour: 136
Production hour: 489.0 kg.
Labour consumption: 27.8 m-h/100 kg.
Productivity: 3.59 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or Spooling	Spooler hand	52	316.0	705	5–140	3	35	20	20	20	60
Warping	Warper tenders	71	312.9	3.15	4	3	1	4	4	2	10
	Fixer or third hands					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
Slashing	Slasher tenders	60	309.9	3.07	3	3	1	3	3	3	9
	Slasher helpers					3	2–3	1	1	1	3
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	3.0 beams	1.51	2	3	1	2	2	1	5
	Tying-in machine helper					3	1	2	2	1	5
Weaving	Weavers	76	489	300	300	3	4 looms	75	75	75	225
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	200 looms	2	2	1	5
	Warp men					3	150 looms	2	2	2	6
	Smash hands and spare weavers					3	200 looms	2	2	1	5
	Filling hauler (full quills 13 M/8 hrs.)					3	10 M bob/8 hrs.	8	7	7	22
	Quill men (empty quills 13 M/8 hrs.)					3	30–40 M/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	150 looms	2	2	2	6
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	200 looms	2	2	1	5
	Sweepers					3	250 looms	2	1	1	4
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											408

Table No. 144

Man-shifts/day: 301
Man-hours/hour: 100.3
Production/hour: 238.8 kg.
Labour consumption: 41.5 m-h/100 kg.
Productivity: 2.41 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Winding or spooling	Spooler hand	56	126.4	454	3–150	3	50	9	9	9	27
Warping	Warper tenders	65	125.2	1.99	2	3	1	2	2	2	6
	Fixer or third hands					3	all prep.	1	1	1	3
	Second hand					2	all prep.	1	1	—	2
Slashing	Slasher tenders	62	124.0	1.64	2	3	1	2	2	1	5
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	2.46 beams	0.73	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	78	238.8	300	300	3	5 looms	60	60	60	180
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	200 looms	2	2	1	5
	Smash hands and spare weavers					3	200 looms	2	2	1	5
	Filling hauler (full quills 13 M/8 hrs.)					3	10 M bob/8 hrs.	4	4	4	12
	Quill men (empty quills 13 M/8 hrs.)					3	30–40 M/8 hrs.	2	1	1	4
	Cloth doffers and truckers					3	200 looms	2	2	1	5
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	200 looms	2	2	1	5
	Sweepers					3	250 looms	2	1	1	4
	Second hand					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											301

Table No. 145

Man-shifts/day: 288
Man-hours/hour: 96
Production/hour: 184.8 kg.
Labour consumption: 52.1 m-h/100 kg.
Productivity: 1.92 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	Job	Efficiency in percentage	Production in kg/hr.	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men			Total man-shifts
								First shift	Second shift	Third shift	
Spooling	Spooler hands	58	109.6	496	2–180 1–140	3	60	9	9	9	27
Warping	Warper tenders	65	108.6	2.26	3	3	1	3	3	1	7
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	63	107.6	1.58	2	3	1	2	2	1	5
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	2.13 beams	0.64	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	80	184.8	300	300	3	5 looms	60	60	60	180
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	200 looms	2	2	1	5
	Filling hauler (full quills 20 M/8 hrs.)					3	10 M bob/8 hrs.	2	2	2	6
	Quill men (empty quills 20 M/8 hrs.)					2	30–40 bob/8 hrs.	1	1	—	2
	Cloth doffers and truckers					3	200 looms	2	2	1	5
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Sweepers					3	250 looms	2	1	1	4
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											288

Table No. 146

Man-shifts/day: 252
Man-hours/hour: 84
Production/hour: 144.6 kg.
Labour consumption: 58.2 m-h/100 kg.
Productivity: 1.72 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	60	83.2	452	3–140 1–70	3	70	7	7	7	21
Warping	Warper tenders	66	82.3	2.26	3	3	1	3	3	1	7
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	65	81.4	1.52	2	3	1	2	2	1	5
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	1.76 beams	0.48	1	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	82	144.6	300	300	3	6 looms	50	50	50	150
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	200 looms	2	2	1	5
	Filling hauler full (quills 19 M/8 hrs.)					3	10 M bob/8 hrs.	2	2	2	6
	Quill men (empty quills 19 M/8 hrs.)					2	30–40 bob/8 hrs.	1	1	—	2
	Cloth doffers and truckers					3	200 looms	2	2	1	5
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Sweepers					3	250 looms	2	1	1	4
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											252

Table No. 147

Man-shifts/day: 250
Man-hours/hour: 83.3
Production/hour: 104.4 kg.
Labour consumption: 80.0 m-h/100 kg.
Productivity: 1.25 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* First shift	Second shift	Third shift	*Total man-shifts*
Spooling	Spooler hands	65	61.7	441	2–160 1–120	3	80	6	6	6	18
Warping	Warper tenders	63	61.1	2.50	3	3	1	3	3	2	8
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand							1	—	—	1
Slashing	Slasher tenders	65	60.4	1.39	2	3	1	2	2	1	5
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	1.2 beams	0.59	1	2	1	1	1	—	2
	Tying-in machine helper						1	1	1	—	2
Weaving	Weavers	85	104.4	300	300	3	6 looms	50	50	50	150
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	200 looms	2	2	1	5
	Filling hauler (full quills 18 M/8 hrs.)					3	10 M bob/8 hrs.	2	2	2	6
	Quill men (empty quills 18 M/8 hrs.)					3	30–40 bob/8 hrs.	1	1	—	2
	Cloth doffers and truckers					3	200 looms	2	2	1	5
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Sweepers					3	250 looms	2	1	1	4
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											250

Table No. 148

Man-shifts/day: 356
Man-hours/hour: 118.6
Production/hour: 101.1 kg.
Labour consumption: 117.1 m-h/100 kg.
Productivity: 0.853 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR CONSUMPTION FOR WEAVING

Mill size: 300 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Men* *Second shift*	*Men* *Third shift*	*Total man-shifts*
Spooling	Spooler hands	68	65.1	740	3–180 2–120	3	60	13	13	13	39
Warping	Warper tenders	58	64.4	4.0	4	3	1	4	4	4	12
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	67	63.8	1.8	2	3	1	2	2	2	6
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	1.26 beams	1.08	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	80	111.1	300	300	3	4 looms	75	75	75	225
	Loom fixers					3	100 looms	3	3	3	9
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	1	1	4
	Warp men					3	250 looms	2	1	1	4
	Smash hands and spare weavers					3	250 looms	2	2	1	5
	Filling hauler (full quills 25 M/8 hrs.)					3	10 M bob/8 hrs.	3	3	2	8
	Quill men (empty quills 25 M/8 hrs.)					3	30–40 M/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	2	2	1	5
	Blow-off men					3	250 looms	2	1	1	4
	Oilers					3	250 looms	2	1	1	4
	Sweepers					3	250 looms	2	2	1	4
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											356

Table No. 149

Man-shifts/day: 667
Man-hours/hour: 222.3
Production/hour: 815.0 kg.
Labour consumption: 27.3 m-h/100 kg.
Productivity: 3.66 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	52	525.5	1171	8–140 1–70	3	35	34	34	34	102
Warping	Warper tenders	71	520.3	5.25	6	3	1	6	6	4	16
	Fixer or third hand					3	all prep.	2	1	1	4
	Second hand					3	all prep.	1	1	1	3
Slashing	Slasher tenders	60	515.1	5.10	6	3	1	6	6	4	16
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4-6	1	1	1	3
Tying-in	Tying-in machine operator	40	10.1 beams	2.53	3	3	1	3	3	2	8
	Tying-in machine helper					3	1	3	3	2	8
Weaving	Weavers	76	815.0	500	500	3	4 looms	125	125	125	375
	Loom fixers					3	100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	200 looms	3	3	2	8
	Warp men					3	150 looms	4	3	3	10
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 121 M/8 hrs.)					3	10 M bob/8 hrs.	12	12	12	36
	Quill men (empty quills 121 M/8 hrs.)					3	30–40 M bob/8 hrs.	3	3	3	9
	Cloth doffers and truckers					3	150 looms	4	3	3	10
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	200 looms	3	3	2	8
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											667

Table No. 150

Man-shifts/day: 482
Man-hours/hour: 160.6
Production/hour: 398.0 kg.
Labour consumption: 40.3 m-h/100 kg.
Productivity: 2.48 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	56	210.5	750	5–150	3	50	15	15	15	45
Warping	Warper tenders	65	2085	3.32	4	3	1	4	4	2	10
	Fixer or third hand					3	all prep.	1	1	1	3
	Second hand					3	all prep.	1	1	1	3
Slashing	Slasher tender	62	206.5	2.71	3	3	1	3	3	3	9
	Slasher helpers					3	2–3	1	1	1	3
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	4.1 beams	1.22	2	2	1	1	1	—	2
	Tying-in machine helper					2	1	1	1	—	2
Weaving	Weavers	78	500	500	500	3	5 looms	100	100	100	300
	Loom fixers					3	100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	200 looms	3	3	2	8
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 70M/8 hrs.)					3	10 M bob/8 hrs.	7	7	7	21
	Quill men (empty quills 70 M/8 hrs.)					3	30–40 M bob/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	200 looms	3	3	2	8
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	200 looms	3	3	2	8
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											482

Table No. 151

Man-shifts/day: 460
Man-hours/hour: 153.3
Production/hour: 308.0 kg.
Labour consumption: 49.7 m-h/100 kg.
Productivity: 2.01 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	58	183.1	830	4–180 1–120	3	60	14	14	14	42
Warping	Warper tenders	65	181.3	3.76	4	3	1	4	4	4	12
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	63	179.5	2.67	3	3	1	3	3	2	8
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	3.58 beams	1.07	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	80	308.0	500	500	3	5 looms	100	100	100	300
	Loom fixers					3	100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 33 M/8 hrs.)					3	10 M bob/8 hrs.	4	3	3	10
	Quill men (empty quills 33 M/8 hrs.)					3	30–40 M bob/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	3	3	2	8
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											460

Table No. 152

Man-shifts/day: 400
Man-hours/hour: 133.3
Production/hour: 241.0 kg.
Labour consumption: 55.2 m-h/100 kg.
Productivity: 1.81 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	60	138.5	748	5–140 1–150	3	70	11	11	11	33
Warping	Warper tenders	66	137.0	3.78	4	3	1	4	4	4	12
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	65	135.5	2.53	3	3	1	3	3	2	8
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	2.94 beams	0.82	1	3	1	1	1	1	3
	Tying-in machine helper				1	3	1	1	1	1	3
Weaving	Weavers	82	241.0	500	500	3	6 looms	83	83	83	249
	Loom fixers					3	100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 32 M/8 hrs.)					3	10 M bob/8 hrs.	4	3	3	10
	Quill men (empty quills 32 M/8 hrs.)					3	30–40 M bob/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	3	3	2	8
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											400

Table No. 153

Man-shifts/day: 393
Man-hours/hour: 131
Production/hour: 174.0 kg.
Labour consumption: 75.2 m-h/100 kg.
Productivity: 1.33 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men* *First shift*	*Second shift*	*Third shift*	*Total man-shifts*
Spooling	Spooler hands	65	101.6	725	4–160 1–80	3	80	9	9	9	27
Warping	Warper tenders	63	101.1	4.15	5	3	1	5	5	3	13
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					2		1	—	—	1
Slashing	Slasher tenders	65	100.6	2.31	3	5	1	3	3	1	7
	Slasher helpers					3	2–3	1	1	1	3
	Size man					2	4–6	1	1	—	2
Tying-in	Tying-in machine operator	40	2.06 beams	1	1	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	85	174.0	500	500	3	6 looms	83	83	83	249
	Loom fixers					3	100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 30 M/hrs.)					3	10 M bob/8 hrs.	3	3	3	9
	Quill men (empty quills 30 M/hrs.)					3	30–40 M bob/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	3	3	2	8
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											393

Table No. 154

Man-shifts/day: 568
Man-hours/hour: 189.3
Production/hour: 168.5 kg.
Labour consumption: 112.3 m-h/100 kg.
Productivity: 0.890 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 500 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	68	108.1	1,229	7–180	3	60	21	21	21	63
Warping	Warper tenders	58	107.1	6.6	7	3	1	7	7	6	20
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					1		1	—	—	1
Slashing	Slasher tenders	67	212.1	3.0	3	3	1	3	3	3	9
	Slasher helpers					3	2–3	1	1	1	3
	Size men					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	2.1 beams	1.8	2	3	1	1	1	1	3
	Tying-in machine helper					3	1	1	1	1	3
Weaving	Weavers	80	168.5	500	500	3	4 looms	125	125	125	375
	Loom fixers						100 looms	5	5	5	15
General											
	Humidifier men					3	500 looms	1	1	1	3
	Yarn hauler and warper doffers					2	500–700 kg/hr.	1	1	—	2
	Drawing-in hands					3	250 looms	2	2	2	6
	Warp men					3	250 looms	2	2	2	6
	Smash hands and spare weavers					3	200 looms	3	3	2	8
	Filling hauler (full quills 41 M bob/8 hrs.)					3	10 M bob/8 hrs.	4	4	4	12
	Quill men (empty quills 41 M bob/8 hrs.)					3	30–40 M bob/8 hrs.	1	1	1	3
	Cloth doffers and truckers					3	200 looms	3	3	2	8
	Blow-off men					3	250 looms	2	2	2	6
	Oilers					3	250 looms	2	2	2	6
	Sweepers					3	250 looms	2	2	2	6
	Second hands					3	500 looms	1	1	1	3
	Overseer					1	500–1,000 looms	1	—	—	1
											568

Table No. 155

Man-shifts/day: 1,324
Man-hours/hour: 441.3
Production/hour: 1,630.0 kg.
Labour consumption: 27.0 m-h/100 kg.
Productivity: 3.70 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Osnaburg
Fabric count: 79.6

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	52	1,051.0	2,342	17–140	3	35	68	68	68	204
Warping	Warper tenders	71	1,040.6	10.50	11	3	1	11	11	10	32
	Fixer or third hand					3	all prep.	2	2	2	6
	Second hand					3	all prep.	2	2	1	5
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	60	1,030.3	10.21	11	3	1	11	11	9	31
	Slasher helpers					3	2–3	4	4	3	11
	Size man					3	4–6	2	2	2	6
Tying-in	Tying-in machine operator	40	20.2 beams	5.05	5	3	1	5	5	5	15
	Tying-in machine helper					3	1	5	5	5	15
Weaving	Weavers	76	1,630.0	1,000	1,000	3	4 looms	250	250	250	750
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	2	2	2	6
	Drawing-in hands					3	200 looms	5	5	5	15
	Warp men					3	150 looms	7	7	6	20
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 243 M bob/8 hrs.)					3	10 M bob/8 hrs.	24	24	24	72
	Quill men (empty quills 243 M bob/8 hrs.)					3	30–40 bob/8 hrs.	6	6	6	18
	Cloth doffers and truckers					3	150 looms	7	7	6	20
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	200 looms	5	5	5	15
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500–1,000 looms	1	—	—	1
											1324

Table No. 156

Man-shifts/day: 962
Man-hours/hour: 320.6
Production/hour: 796.0 kg.
Labour consumption: 40.3 m-h/100 kg.
Productivity: 2.48 kg./m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Sheeting A
Fabric count: 127.9

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	56	421.2	1,500	10–150	3	50	30	30	30	90
Warping	Warper tenders	65	417.1	6.64	7	3	1	7	7	6	20
	Fixer or third hand					3	all prep.	2	2	2	6
	Second hand					3	all prep.	2	1	1	4
	Overseer					1	all prep.	1	—	—	1
Slashing	Slasher tenders	62	413.0	5.43	6	3	1	6	6	5	17
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	8.19 beams	2.45	3	3	1	3	3	2	8
	Tying-in machine helper					3	1	3	3	2	8
Weaving	Weavers	78	796.0	1,000	1,000	3	5 looms	200	200	200	600
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	2	2	2	6
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	200 looms	5	5	5	15
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 140 M/8 hrs.)					3	10 M bob/8 hrs.	14	14	14	42
	Quill men (empty quills 140 M/8 hrs.)					3	30–40 M/8 hrs.	4	4	4	12
	Cloth doffers and truckers					3	200 looms	5	5	5	15
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	200 looms	5	5	5	15
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500–1,000 looms	1	—	—	1
											962

Table No. 157

Man-shifts/day: 922
Man-hours/hour: 307.3
Production/hour: 616.0 kg.
Labour consumption: 49.5 m-h/100 kg.
Productivity: 2.02 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Sheeting B
Fabric count: 185.7

Process	Job	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	58	366.2	1,660	9–180 1–60	3	60	28	28	28	84
Warping	Warper tenders	65	362.6	7.53	8	3	1	1	8	7	23
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					3		1	1	1	3
	Overseer					1	spooling, warp. and slashing	1	—	—	1
Slashing	Slasher tenders	63	359.0	5.34	6	3	1	6	6	4	16
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	7.17 beams	2.14	3	3	1	3	3	1	7
	Tying-in machine helper					3	1	3	3	1	7
Weaving	Weavers	80	616.0	1,000	1,000	3	5 looms	200	200	200	600
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 66 M/8 hrs.)					3	10 M bob/8 hrs.	7	7	6	27
	Quill men (empty quills 66 M/8 hrs.)					3	30–40 M/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	200 looms	5	5	5	15
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500–1,000 looms	1	—	—	1
											922

Table No. 158

Man-shifts/day: 795
Man-hours/hour: 265
Production/hour: 482.0 kg.
Labour consumption: 54.9 m-h/100 kg.
Productivity: 1.82 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION NAD LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Sheeting C
Fabric count: 230.7

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	60	277.0	1,495	10–140 1–95	3	70	22	22	22	66
Warping	Warper tenders	66	274.0	7.55	8	3	1	8	8	8	24
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					3		1	1	1	3
	Overseer					1	spooling, warp. and slashing	1	—	—	1
Slashing	Slasher tenders	65	271.0	507	5	3	1	5	5	5	15
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	5.89 beams	1.63	2	3	1	2	2	1	5
	Tying-in machine helper					3	1	2	2	1	5
Weaving	Weavers	82	482.0	1,000	1,000	3	6 looms	167	167	167	501
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 64 M/8 hrs.)					3	10 M bob/8 hrs.	7	7	7	21
	Quill men (empty quills 64 M/8 hrs.)					3	30–40 M/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	200 looms	5	5	5	15
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500–1,000 looms	1	—	—	1
											795

Table No. 159

Man-shifts/day: 782
Man-hours/hour: 260.6
Production/hour: 248.0 kg.
Labour consumption: 74.6 m-h/100 kg.
Productivity: 1.34 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Print cloth
Fabric count: 332.7

Process	Job	Efficiency in percentage	Production in kg/hr.	Required continuous units	Units in one shift	Number of shifts	Optimum work-load	Men: First shift	Men: Second shift	Men: Third shift	Total man-shifts
Spooling	Spooler hands	65	203.2	1,450	8–160 1–170	3	80	18	18	18	54
Warping	Warper tenders	63	202.2	8.29	9	3	1	9	9	7	25
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					3		1	1	1	3
	Overseer					1	spooling, warp. and slashing	1	—	—	1
Slashing	Slasher tenders	65	201.2	4.63	5	3	1	5	5	4	14
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	4 beams	2	2	3	1	2	2	2	6
	Tying-in machine helper					3	1	2	2	2	6
Weaving	Weavers	85	348.0	1,000	1,000	3	6 looms	167	167	167	501
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 60 M/8 hrs.)					3	10 M bob/8 hrs.	6	6	6	18
	Quill men (empty quills 60 M/8 hrs.)					3	30–40 M/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	200 looms	5	5	5	15
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	200 looms	2	2	2	6
	Overseer					1	500-1,000 looms	1	—	—	1
											782

Table No. 160

Man-shifts/day: 1,136
Man-hours/hour: 375.3
Production/hour: 337.0 kg.
Labour consumption: 111.1 m-h/100 kg.
Productivity: 0.899 kg/m-h.

STANDARD MILLS
OPTIMUM ORGANIZATION AND LABOUR
CONSUMPTION FOR WEAVING

Mill size: 1,000 looms
Mill type: Old
Product: Broadcloth
Fabric count: 429.0

Process	*Job*	*Efficiency in percentage*	*Production in kg/hr.*	*Required continuous units*	*Units in one shift*	*Number of shifts*	*Optimum work-load*	*Men*			*Total man-shifts*
								First shift	*Second shift*	*Third shift*	
Spooling	Spooler hands	68	216.3	2,458	13–180 1–120	3	60	41	41	41	123
Warping	Warper tenders	58	214.2	13.3	14	3	1	14	14	12	40
	Fixer or third hand					3	spooling, warp. and slashing	1	1	1	3
	Second hand					3		1	1	1	3
	Overseer					1	spooling, warp. and slashing	1	—	—	1
Slashing	Slasher tenders	67	212.1	6.1	6	3	1	6	6	6	18
	Slasher helpers					3	2–3	2	2	2	6
	Size man					3	4–6	1	1	1	3
Tying-in	Tying-in machine operator	40	4.2 beams	3.6	4	3	1	4	4	3	11
	Tying-in machine helper					3	1	4	4	3	11
Weaving	Weavers	80	337.0	500	500	3	4 looms	250	250	250	750
	Loom fixers					3	100 looms	10	10	10	30
General											
	Humidifier men					3	500 looms	2	2	2	6
	Yarn hauler and warper doffers					3	500–700 kg/hr.	1	1	1	3
	Drawing-in hands					3	250 looms	4	4	4	12
	Warp men					3	250 looms	4	4	4	12
	Smash hands and spare weavers					3	200 looms	5	5	5	15
	Filling hauler (full quills 82 M bob/8 hrs.)					3	10 M bob/8 hrs.	9	8	8	25
	Quill men (empty quills 82 M bob/8 hrs.)					3	30–40 M bob/8 hrs.	2	2	2	6
	Cloth doffers and truckers					3	200 looms	5	5	5	15
	Blow-off men					3	250 looms	4	4	4	12
	Oilers					3	250 looms	4	4	4	12
	Sweepers					3	250 looms	4	4	4	12
	Second hands					3	500 looms	2	2	2	6
	Overseer					1	500–1,000 looms	1	—	—	1
											1136

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