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ECONOMIES OF SCALE IN THE COTTON SPINNING AND WEAVING INDUSTRY

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ECONOMIES OF SCALE IN THE COTTON SPINNING AND WEAVING INDUSTRY

I. INTRODUCTION AND CONCLUSIONS

1. Introduction

The experience gathered in the field of the textile industry seemed to suggest that both in investment and in production costs the economies resulting from an increase in the scale of production are minimal. The fact that not only in Latin America but also in other more highly industrialized regions there are a great many small mills - some of them with fewer than 5,000 spindles - capable of competing in the market with large establishments would seem, at first glance, to constitute the most striking evidence in support of this statement. Furthermore, an analysis of the structure of production costs in an integrated spinning and weaving mill shows that the variable cost components represent between 60 and 80 per cent of total costs, according to the nature of the goods produced. The reduction in fixed costs, which are those most affected by production scales, would therefore have to be very great for economies of scale to be achieved in the textile industry. A preliminary survey carried out by ECLA[1/] in relation to three different products showed negligible variations in unit production costs, amounting to 9 per cent in the at most 9 cases studied. But in view of the limitations of this preliminary research, especially with regard to the scales of production envisaged, ECLA decided to undertake a more thorough investigation which would virtually cover all sizes of mills existing in Latin America, from the largest to the smallest.

Accordingly, the primary objective of the present study is to determine the savings in investment and production costs obtainable by increasing mill sizes in the cotton textile industry. Nevertheless, it provides general information on investment, costs, employment of manpower, production techniques and many other aspects of the question, which, if properly analysed, will make it possible to establish coefficients that

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1/ See Economías de escala en la industria textil (ST/ECLA/Conf.11/L.20).

/will be

will be of use to those concerned in solving the problems of the textile industry, either at the level of the enterprise itself or in the macro-economic field.

In the preparation of this study, special attention was devoted to the methodology applied, and on several occasions the calculations were based on an amount of detail that might seem excessive. This care was necessary, however, because, as already pointed out, previous experience had indicated that economies of scale were of little importance in the textile sector. Less meticulous estimates would have affected the results obtained and distorted the conclusions formulated.

The precision with which the production units in the 24 examples studied were described, especially as regards output data and investment requirements, will also place at the disposal of textile entrepreneurs and project engineers information that will be of particular value in the selection of products and mill sizes. They will be able to obtain such information either by using coefficients derived from the study or by introducing appropriate modifications in any of the cases considered. It is worth while pointing out that, where a specific project is concerned, the data contained in the present study will need further processing and will have to be supplemented and adjusted to local conditions.

The concept of economy of scale adopted in this study is the variation in investment and production costs per unit of output which takes place in a given project, as the capacity of the mill is expanded, always on the assumption that installed capacity is being utilized to the full. Consequently, in all the cases studied it is assumed that the mill works 23 hours a day. It should be noted, however, that in the studies carried out by ECLA on the textile industry in various Latin American countries a working-day of only 22 hours was adopted, since it was felt to be more in line with the mill conditions currently prevailing in the region.

For the purposes of the present study on economies of scale in integrated spinning and weaving mills, three products were chosen and the same eight mill sizes for each product, so that 24 different cases

/were analysed.

were analysed. By virtue of this approach, it was possible to trace the evolution of economies of scale within the size categories in relation to each product, and, in addition, to draw comparisons between different products which, as already stated, will serve various ends.

2. Main conclusions

Strictly speaking, there are no substantial economies of scale in the textile industry. Nevertheless, a large number of the mills existing in Latin America fall short of the minimum recommendable size, and by merely doubling their plant dimensions could reap the benefit of a considerable decrease in production costs.

Both in costs and in investment, economies of scale are very marked in the size category comprising mills with from 2,000 to 10,000 spindles. In mills with 10,000 to 20,000 spindles, the influence of size still makes itself felt, but to a lesser degree, and in those with 20,000 to 100,000 spindles, i.e., where the scale of production is from 10 to 50 times greater than in the first category, the reduction of costs is negligible.

The better the quality of the product - that is, the higher the yarn counts and the closer the weave of the fabric produced - the greater are the economies of scale obtainable.

For the three products studied, the following mill sizes were considered ideal: from the standpoint of savings on investment, 10,500 spindles and 630 looms for product A (coarse fabric), 10,500 spindles and 600 looms for product B (medium fabric), and 10,500 spindles and 396 looms for product C (fine fabric); and from that of savings on costs, 10,000 spindles and 450 looms for product A (coarse fabric), 10,500 spindles and 630 looms for product B (medium fabric), and 10,500 spindles and 396 looms for product C (fine fabric).

The following are the reductions in investment and costs that could be effected as between the mill sizes lowest in the scale and the ideal sizes established: in unit investment, 21, 30 and 40 per cent for products A, B and C, respectively; in production costs, 19, 27 and 40 per cent, respectively, for products A, B and C.

/Any variation

Any variation in the characteristics of the product to be manufactured in relation to those considered in the present study will mean that the ideal mill size will be the one nearest to the sizes discussed here which at the same time ensures the best possible balance between the various stages of production.

Fixed labour costs are the component in which the biggest cuts can be effected as the result of an increase in scales of production. But this item accounts for only 3 to 9 per cent of total costs in the mill size categories where the balance of production is most successfully maintained.

Next in order come variable labour costs and depreciation. However, these items, in conjunction with fixed labour costs, represent barely 17 to 25 per cent of total costs in mills of the sizes most conducive to balanced production.

The importance of idle plant capacity - inevitable at some stages of the production process because of the indivisibility of the machinery - is decisive as regards economies of scale in the smaller mill sizes, but progressively decreases until, in mills with 20,000 spindles, it is negligible. Thenceforward, the addition of a production unit at any stage of the production process, however great the idle capacity in absolute terms, will not significantly affect total production costs. In other words, the unused capital it implies represents a very small proportion of total investment. On the other hand, the higher the yarn count, the more the importance of idle capacity tends to increase. For example, in a 2,000-spindle mill the idle investment is 8.5 per cent in the case of product A; whereas for products B and C the same mill size shows indexes of 17.3 and 30.2 per cent, respectively.

For the products analysed in the present study, an ideal-sized mill, that is, one with 10,000 spindles for product A, and 18,500 spindles for products B and C, would necessitate total investment (for spinning and weaving, and including working capital) amounting to about 6.5 million dollars for the first product, 7.1 million for the second, and 4.9 million for the third. This investment could be reduced to 3.5 million, 4.0 million and 2.8 million dollars, respectively, in the size category immediately

/below, i.e.

below, i.e. in mills with 6,000 spindles for product A and 10,000 spindles for products B and C, costs per unit of output rising by only 2.5, 4.1 and 6.7 per cent for products A, B and C, respectively.

The percentage distribution of investment among its various components undergoes no substantial change as scales of production alter. Significant differences are observable, however, from one product to another; the finer the fabric manufactured, the smaller becomes the share of working capital and capital outlays during the construction of the mill.

Average costs per ring spindle - the unit of measurement in current use for comparisons of textile mills - decrease sharply as the size of the mill increases. In the case of product A, the figure drops from 144 to 114 dollars; in that of product B, from 110 to 77 dollars; and in that of product C, from 116 to 72 dollars. The same is true, although on a lesser scale, of average costs per loom.

The cost per spindle installed also falls as the yarn count rises; for example, between 8's and 40's, it decreases by 37 per cent. The cost per loom, on the other hand, is reduced by only 6 per cent in the case of product C as compared with product A.

The higher degree of processing to which product C is subjected entails heavier investment per unit of output. In mills of the optimum sizes mentioned above, the production of one unit of finer fabric implies investment 2.8 times greater than that required for the manufacture of one unit of product A. This ratio increases as the mill sizes decrease, reaching 3.7 in the 2,000-spindle mills.

The capital factors determined for the various steps in the production scale likewise denote the weakness of economies of scale in the textile industry. For the size-category ratio II/I (6,000/2,000) the capital factors obtained were 0.84, 0.75 and 0.67 for product A, B and C, respectively, but when the ratio V/IV is reached (26,000/18,400) the factor in question is equal to unity.

/Investment per

Investment per worker increases to a marked extent as the scale of production expands and, in lesser proportion, as the quality of the product improves. From 14,000 to 16,000 dollars per worker may be said to be required, on an average, for the optimum mill sizes established here.

As regards the medium product envisaged in the present study, productivity rises from 4,000 to 9,000 grammes per man/hour in spinning, and from 20 to 60 metres per man/hour in weaving, with the transition from size category I to size category VIII. Equivalent increases can be seen in the case of the other products studied.

The proportion of production costs represented by gross value added averages 31 per cent for product A, and 41 and 51 per cent for products B and C, respectively, the annual rate of return on capital taken into account in costs estimates being 12 per cent.

The product-capital ratio, at the costs level, averages about 0.26, and does not vary with the nature of the goods produced.

II. DEFINITION OF THE MILLS CONSIDERED IN THE PRESENT STUDY

1. The type of mill adopted

The present study is based on the concept of an integrated spinning and weaving mill. As is pointed out in connexion with the characteristics of the production process (see Annex), the inclusion of the finishing section would alter the nature of the study, not only on account of the technical characteristics of the process itself - which are such that it has to be carried out by means of a series of independent mills - but also because, in view of the minimum production unit sizes for finishing operations, which are utterly different from those for spinning and weaving, the economies of scale prevailing in these latter more important sections would undergo modification. Consequently, a separate study of these economies will need to be made for the finishing section, and its findings compared with those obtained for spinning and weaving. It will thus be possible to select the ideal mill size, if the establishment of a completely integrated industry is under consideration. Accordingly, the present study will relate to the manufacture of grey goods, i.e., the manufacturing process will begin with the reception of the baled cotton and end with the delivery of the grey cloth.

The basic assumption is that 3 different articles are produced in mills of 8 different sizes, and that each mill manufactures a single type of fabric; that is, 24 different cases will be analysed. In the textile industry, there are few specialized mills producing only one type of yarn and one type of fabric. The objection might therefore be raised that the conclusions reached in the present study would not be valid for mills manufacturing more than one type of product. In view of the results obtained, however, this objection is not tenable.

The main problem confronting mills which produce a large number of articles is the reduction of machine efficiency.[2/] This derives from the difficulty of scheduling production in such a way as to obviate bottlenecks

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2/ Or, in other words, the under-utilization of machinery, as a result of both the operational deficiency and the ratio between time used and time available.

/and from

and from the frequent changes in the "production run", or "lot size", as they are currently termed. The secondary problems are those relating to the large stocks entailed, in the case of both finished products and those in course of processing. Consequently, the success of an enterprise of this type will fundamentally depend upon its ability to plan production in such a way as to avoid machine standstills that will be detrimental to the over-all efficiency of the mill.

The way in which a mill is affected by the manufacture of a larger number of products will also depend upon its size. Provided that the production flows of the individual articles are independent of one another, the whole complex will be subject to the same laws, in respect of economies of scale, as a production unit of similar size engaged in the manufacture of a single product. If the number of articles produced is so high in relation to the size of the mill as to detract from the rationality of the production flow, efficiency will be reduced and production costs will rise in proportion. As the size of the mill increases, the irrationality will become less and less marked, until the production flow is that of a perfectly balanced mill operating in much the same conditions as one manufacturing a single type of fabric. Obviously, in this case the economies of scale obtained will be greater than any that could be effected in mills of the same size whose production flow had been rational from the outset.

To sum up, no matter what number of articles it manufactures, a mill whose production programme is irrational - either by reason of bottlenecks in the production flow or because there is more than the normal delay in adapting the machinery to changes in the characteristics of the fabrics manufactured - is an unsatisfactory establishment, and cannot be taken as a basis for comparison. Similarly, where economies of scale are concerned, whatever the size of such a mill, its production costs will increase, quite irrespectively of the advantages accruing from economies of scale.

/2. Selection

2. Selection of products

Owing to the characteristics of the textile manufacturing process (see Annex), the task of selecting representative products is distinctly complex. Broadly speaking, for the purposes of the present study, fabrics meeting the following requisites may be described as representative: (a) they should be made from yarns in current production which fall within the classic categories of yarn counts - coarse, medium and fine; (b) their characteristics should correspond to those of the fabrics in greatest demand in the region; (c) they should resemble the fabrics most commonly marked in respect of yarn counts, density, width and weave structure; (d) they should lend themselves to the application of all procedures used in cotton spinning and weaving.

Accordingly, three types of fabrics were selected, which cover a wide range of production and, taken separately, may be considered representative of the type to which they belong. Their main characteristics are summed up in table 1 below (for fuller details, see Annex, table A). The products in question will be called "coarse fabric", "medium fabric" and "fine fabric", and for easier reference will be designated products "A", "B" and "C", respectively.

Table 1

MAIN CHARACTERISTICS OF THE PRODUCTS SELECTED FOR THE PURPOSES OF THE PRESENT STUDY

Specifications	Product A Coarse fabric	Product B Medium fabric	Product C Fine fabric
Type of yarn	Carded	Carded	Combed
Yarn count (warp and weft)	8	18	40
Width of grey cloth (cm)	80	90	100
Warp ends per cm	13	20	47
Filling picks per cm	10	20	32
Weight per linear metre (grammes)	140	130	130
Weight per square metre (grammes)	175	144	130

"Coarse fabric" is the material of which sacks for agricultural use are normally made; it also has its applications in industry, and in its unbleached state is used, in small proportions, for household purposes, mainly in rural areas.

"Medium fabric" is the standard weave established by ECLA in its studies on the textile industry,[3/] and may be taken to exemplify the fabrics ordinarily produced in Latin America; although its characteristics are not in strict conformity with those of a type actually on the market, inasmuch as it is an "ideal" fabric intended to represent the region's average output, it may be regarded as representative of the type which it is desired to analyse in the study of economies of scale. It corresponds to a fabric in great demand for household furnishings, dressmaking, etc., especially among the lower income groups.

The "fine fabric exemplifies a substantial proportion of the products manufactured in its category. Since fine fabrics are made from yarn whose count may be as high as 100 and over, product C clearly stands at the bottom of the scale. For that very reason, consumption of this fabric, already considerable, is expanding as a result of its great versatility, for it lends itself to the most widely different types of finishing, from bleaching to printing. It is used a great deal in making both men's and women's wear, and evidence of its adaptability is to be seen in the increasing interest shown by importers in industrialized countries, who buy it in its unbleached state to apply whatever type of finishing is in fashion in the countries concerned.

3. Selection of mill sizes

A study of the sizes of integrated spinning and weaving mills in Latin America indicates that they range from 2,000 to 100,000 spindles,[4/] while the average size varies between 4,500 and 22,000 spindles. Table 2 shows medium and maximum sizes in selected Latin American countries.

3/ ECLA, The Textile Industry in Latin America, (Vols. I to IX).

4/ For an explanation of how mill sizes are measured in the textile industry, see below.

/In all

In all the countries studied, the minimum size is 2,000 spindles, and it should be noted that the great majority of the mills fall within the smaller size categories. In Brazil and Mexico, whose cotton sectors are of outstanding importance and account for about 80 per cent of the region's installed spindle capacity, approximately 65 and 83 per cent of the mills, respectively, are found in the group with fewer than 10,000 spindles.5/

Table 2

LATIN AMERICA (SELECTED COUNTRIES): MEDIUM AND MAXIMUM SIZES OF COTTON SPINNING MILLS

(Number of spindles, in round figures)

Country	Medium size	Maximum size
Argentina	22 000	86 000
Brazil	16 500	100 000
Chile	14 000	between 20 000 and 40 000
Mexico	4 500	65 000
Peru	6 000	between 15 000 and 20 000
Uruguay	10 500	20 000

Source: ECLA, The Textile Industry in Latin America: Vol. I, Chile; Vol. II, Brazil; Vol. IV, Uruguay; Vol. V, Peru, Vol. VII, Argentina; volume on Mexico in course of preparation.

It can be seen from table 2 that the average mill size (or that obtained by dividing the total number of spindles by the total number of mills) is 16,500 and 4,500 spindles, respectively, in the two countries mentioned. This shows how large a proportion of the mills is concentrated in the lower size categories, especially in Mexico.

5/ ECLA, The Textile Industry in Latin America: Vol. II, Brazil; volume on Mexico in course of preparation.

/As already

As already pointed out, a number of problems are created by the fact that so wide a variety of textile products is manufactured. Among them are the difficulties encountered in comparing two types of fabric, if the many existing variables are taken into account. As physical output depends not only on the technical characteristics of the machinery but also on the nature of the product, the mere measurement of production - in terms of weight or volume - is of little significance. For example, a spinning mill could increase its output (measured in physical terms) from 100 to 300 units, by introducing certain adjustments in the production layout and modifying intermediate machinery requirements. Obviously, such a change-over would involve under-utilization of equipment, and therefore, in practice, mills do not take advantage of this relative flexibility to alter their production programmes. Nevertheless, the introduction of such changes is technically feasible. Owing to this peculiar feature of the textile industry, the sector has adopted the custom of measuring mill capacity on the basis of the production units installed, in contradistinction to the procedure in most branches of industry, where plant size is expressed in terms of the weight or number of units produced in a given unit of time.

The term "production units" is understood in the present study to mean those final machinery units which are used in the two separate phases of the production process: spinning and weaving. Consequently, the number of ring spindles or of looms determines the size of the textile mill. This eminently practical way of measuring mill sizes facilitates rapid comparison of the production potential of different establishments, without necessitating strict specifications of the product manufactured.

For the purposes of the present study, a size group was selected which would be sufficiently representative to preclude uncertainty as to the trends which economies of scale were likely to follow once the points established had been passed. Eight mill sizes were therefore chosen, ranging from 2,000 to 100,000 spindles. Furthermore, these categories cover virtually all the mills installed in Latin America, since the very few cases which fall outside these limits do so by only tiny margins.

In order to compare the evolution of the various products, the same scale is adopted for the three articles chosen. Scales of production are designated in accordance with the "nominal size" expressed in terms of numbers of spindles, i.e., the number of ring spindles theoretically required, in round figures. To facilitate reference to these size categories, each is assigned an ordinal number represented by a Roman figure (I to VIII).

The scales of production adopted (2,000 to 100,000 spindles) are specified in table 3. The largest and smallest mill sizes were fixed upon in the light of the criteria already indicated, in order to cover all the cases to be found in Latin America. To establish the intermediate sizes, the following principle was applied: On the basis of production of the medium fabric, three mill sizes were selected which, according to a preliminary estimate, showed the highest possible degree of balance between the various stages of production, or, in other words, the least possible idle capacity; the other three size categories were deliberately left unbalanced, the production capacity of the two biggest machines - the opener-scutchers and the slashers - being taken as the basis of calculation. The object of including the unbalanced sizes was to see how far idle plant capacity would affect economies of scale, or if in fact diseconomies of scale would result. This criterion once established, the question of mill balance in respect of the other two products was necessarily left to chance, since in view of the above-mentioned characteristics of the production process, it was impossible to ensure balance in the case of all three products at once (see again table 3).

4. Definition of the technological level adopted

After lagging for some time in the rearguard of the technological advances which marked the evolution of so many other sectors, in recent years the textile industry has undergone sweeping changes, by virtue of which it is now in a position to choose between several alternatives as regards the technological level to be adopted. The significance of this problem is all the greater in countries where labour is plentiful and capital is in short supply.

/Table 3

Table 3

MILL SIZES SELECTED AND CORRESPONDING VOLUMES OF PRODUCTION

Size Category	Nominal size (Number of spindles)	Product A (coarse fabric)			Product B (medium fabric)			Product C (fine fabric)			Scale of production
		Annual output		Number of looms	Annual output		Number of looms	Annual output		Number of looms	
		Yarn (tons)	Fabric (thousands of metres)		Yarn (tons)	Fabric (thousands of metres)		Yarn (tons)	Fabric (thousands of metres)		
I.	2 000	865	5 961	90	365	2 714	73	135	1 022	43	100
II.	6 000	2 596	17 886	270	1 133	8 416	226	405	3 067	130	300
III.	10 000	4 326	29 809	450	1 827	13 567	364	675	5 102	214	500
IV.	18 500	8 003	55 146	830	3 399	25 239	680	1 249	9 434	396	925
V.	26 000	11 248	77 503	1 170	4 750	35 273	950	1 755	13 265	560	1 300
VI.	37 000	16 006	110 292	1 660	6 797	50 478	1 360	2 498	18 870	800	1 850
VII.	60 000	25 956	178 850	2 700	10 962	81 399	2 190	4 050	30 602	1 280	3 000
VIII.	100 000	43 260	298 084	4 500	18 270	135 658	3 650	6 750	50 998	2 140	5 000

In the textile industry, the aim of technological research has been to make yarn production a continuous process, but despite the great progress achieved, everything seems to suggest that it will be some time before this objective can be attained. On the other hand, the process of manufacturing yarn has been considerably simplified, automation of the series of operations required to convert it into fabric has taken place on a large scale, and controls have been introduced by means of which it has been possible to increase the production capacity of textile machinery. The analysis of these problems is outside the scope of the present study, and will be dealt with in another ECLA report.6/

In selecting the equipment on which this study could be based, a position which might be described as conservative was adopted; that is, machinery was chosen which, although regarded as up-to-date, is not characterized by the very latest technological innovations in the field of automation. A definition of this technological level will next be given, together with an explanation of what is understood by "up-to-date machinery" in the present study.

The definition of the technological level of the production process must be fundamentally based on specifications of the technical characteristics of the machinery, in order to clarify the following points: (a) the degree of automation of the process, i.e., the greater or lesser extent to which manual operations are involved in tending the machines and in the transport of the product in process of manufacture; (b) the production capacity of a given machine, once operational conditions have been established, i.e., the nature of the products (yarn count, twist, etc.), the quality of the raw material, atmospheric conditions (humudity and temperature), etc.; (c) the quality of the product obtained; and (d) the amount of maintenance work required.

These specifications are outlined in table 4, which is considered adequate in view of the scope of the present study.

6/ Choice of techniques in the textile industry (in course of preparation).

/Table 4

Table 4

TECHNOLOGICAL CHARACTERISTICS OF THE PRODUCTION PROCESS ADOPTED

Machine	Main technical characteristics	Number of production units per machine	Production capacity	Level of automation	Cleaning and lubrication systems
Openers/scutchers	Pneumatic delivery of cotton; single-process scutcher; dust removal by filter bags	1	Maximum output: 200 kg per hour	Openers fed by hand; hand lap doffing	By hand
Cards	Rigid clothing; 16"-diameter sliver cans	1	Maximum output: 25 kg per hour	Laps fed by hand; sliver cans changed by hand	Pneumatic waste removal; centralized pressure lubrication
Lap machines	Wide laps; doublings of 16 slivers	1	Operational speed: up to 1 600 feet per minute	Hand doffing	By hand
Combers	Duplex machine with 8 heads; 14"-diameter sliver cans	2	Operational speed: 140 nips per minute	Sliver cans changed by hand	Cleaning by hand; centralized pressure lubrication
Drawing frames	Controlled draft system; doubling of 6 slivers; 16"-diameter sliver cans	2	Operational speed: between 400 and 800 feet per minute	Sliver cans changed by hand; automatic stop motions set in operation by sliver breaks, over-feeding of rollers and filling-up of sliver cans	Pneumatic waste removal; centralized pressure lubrication
Roving frames	Controlled draft system; 14" lift and 6" bobbin diameter	Minimum, 36 spindles; variable by fours	Maximum operational speed: 1 200 spindle revolutions per minute	Hand doffing	By hand
Ring spinning frames	Swivel-arm drafting system or equivalent; 11" lift, and ring diameters up to 2 1/4"; pneumatic broken end collectors	Minimum, 360 spindles; variable by fours	Maximum operational speed: 12 000 spindle revolutions per minute	Bobbins fed by hand; hand doffing	Cleaning by hand, centralized pressure lubrication
Cone winders	Grooved drum system	Minimum, 24 spindles; variable by fours	Winding speed: up to 700 yards per minute	Hand bobbins changing and cone doffing; manual tying-in; automatic transport of empty bobbins	By hand
Pirn winders	-	Minimum, 12 spindles; variable by sixes	Operational speed: up to 10 000 revolutions per minute	Automatic pirn changing; empty pirns fed into magazines by hand	Cleaning by traveller blowers; lubrication by oil bath and centralized pressure pump
Warpers	Metallic beam; hydraulic warp stop motion, automatic package changing	1	Operational speed: up to 600 yards per minute	Automatic stop motion for yarn breaks; hydraulic beam removal system	By hand
Slashers	Multi-cylinder type; controlled yarn tension	1	Evaporation capacity: 320 kg per hour	Automatic temperature, humidity and size level controls	By hand
Looms	Automatic pirn change system; controlled warp tension	1	Operational speed: 200 picks per minute	Automatic weft feeding; automatic stop motion in case of warp and weft breaks	By hand

/To complete

To complete the definition of the technological level adopted, equipment specifications must be supplemented with certain important indexes relating to workloads, productivity, investment and manpower. These indexes are presented in tables 5, 6 and 7, together with others on value added and the product-capital ratio, which may be of use for different purposes. It should be noted that the workload coefficients in these tables do not include administrative staff or auxiliary services personnel (see tables 5, 6 and 7 and figures I, II and III).

The change observable in the rate of increase of some of the indexes is attributable to the fact that in unbalanced mills it is impossible to establish a manning-table strictly proportional to the equipment required. It will also be seen in tables 5, 6 and 7 that the workload does not exactly correspond to the quotient of unit production and productivity, owing to the series of roundings effected in order to arrive at the indexes of operatives per thousand spindles or per hundred looms.

Table 5

PRODUCT A (COARSE FABRIC): MOST IMPORTANT COEFFICIENTS AFFECTED BY THE TECHNOLOGICAL LEVEL OF THE PRODUCTION PROCESS

Concept \ Size category and number of spindles	I 2 000	II 6 000	III 10 000	IV 18 500	V 26 000	VI 37 000	VII 60 000	VIII 100 000
1. Spinning (operatives per thousand spindles)	9.5	5.9	5.3	5.1	5.1	4.9	4.9	4.8
1.1 Opening through roving	4.5	2.3	2.0	1.9	1.9	1.8	1.8	1.7
1.2 Spinning and winding	5.0	3.6	3.3	3.2	3.2	3.1	3.1	3.1
2. Weaving (operatives per hundred looms)	19.6	14.2	13.4	13.1	12.9	13.0	12.9	12.8
2.1 Warping and filling	7.8	4.7	4.1	3.9	3.9	3.7	3.6	3.5
2.2 Weaving	11.8	9.5	9.3	9.2	9.0	9.3	9.3	9.3
3. Investment per worker (dollars)	9 971	13 311	14 266	14 769	14 763	14 976	15 262	15 836
3.1 Fixed capital	8 885	11 665	12 648	12 838	12 816	12 932	13 217	13 716
3.2 Working capital	1 086	1 646	1 818	1 931	1 947	1 994	2 045	2 120
4. Productivity a/								
4.1 In spinning (grammes per man/hour)	6 598	10 548	11 829	12 339	12 318	12 676	12 680	13 016
4.2 In weaving (metres per man/hour)	48.90	67.62	71.60	73.32	74.22	73.77	74.42	75.09
5. Gross value added b/								
5.1 Per unit of output (dollars per metre)	0.075	0.054	0.050	0.048	0.047	0.047	0.046	0.046
5.2 Per unit of investment	0.32	0.27	0.27	0.26	0.26	0.26	0.26	0.25
5.3 Per unit of input	0.70	0.51	0.48	0.46	0.45	0.45	0.44	0.44
5.4 Per worker/year	3 205	3 649	3 798	3 879	3 864	3 901	3 951	4 043

a/ Not including administrative staff or auxiliary services personnel (see tables HH, II and JJ).

b/ At production cost level, excluding rates and taxes.

Table 6

PRODUCT B (MEDIUM FABRIC): MOST IMPORTANT COEFFICIENTS AFFECTED BY THE TECHNOLOGICAL LEVEL OF THE PRODUCTION PROCESS

Concept \ Size category and number of spindles	I 2 000	II 6 000	III 10 000	IV 18 500	V 26 000	VI 37 000	VII 60 000	VIII 100 000
1. Spinning (operatives per thousand spindles)	6.5	3.2	3.4	3.1	3.1	2.9	3.0	2.9
1.1 Opening through roving	2.5	1.6	1.2	1.1	1.1	0.9	1.0	0.9
1.2 Spinning and winding	4.0	2.9	2.2	2.0	2.0	2.0	2.0	2.0
2. Weaving (operatives per hundred looms)	19.2	11.3	10.3	9.3	9.4	9.2	9.0	9.2
2.1 Warping and filling	7.8	3.9	3.4	2.8	3.0	2.7	2.6	2.5
2.2 Weaving	11.4	7.4	6.9	6.5	6.4	6.5	6.4	6.5
3. Investment per worker (dollars)	10 092	13 710	14 932	16 277	16 378	17 025	17 474	18 263
3.1 Fixed capital	9 361	12 505	13 595	14 759	14 858	15 421	15 817	16 524
3.2 Working capital	731	1 205	1 337	1 518	1 520	1 604	1 657	1 739
4. Productivity a/								
4.1 In spinning (grammes per man/hour)	4 070	6 938	7 788	8 445	8 429	8 928	8 810	9 078
4.2 In weaving (metres per man/hour)	28.09	47.52	52.70	57.75	57.01	58.37	59.48	60.03
5. Gross value added b/								
5.1 Per unit of output (dollars per metre)	0.139	0.084	0.079	0.073	0.073	0.071	0.070	0.069
5.2 Per unit of investment	0.33	0.28	0.27	0.26	0.26	0.26	0.26	0.25
5.3 Per unit of input	1.25	0.82	0.77	0.72	0.71	0.69	0.68	0.67
5.4 Per worker/year	3 342	5 815	4 032	4 254	4 258	4 374	4 457	4 584

a/ Not including administrative staff or auxiliary services personnel (see tables IIB, II and IJ).

b/ At production costs level, excluding rates and taxes.

Table 7

PRODUCT C (FINE FABRIC): MOST IMPORTANT COEFFICIENTS AFFECTED BY THE TECHNOLOGICAL LEVEL OF THE PRODUCTION PROCESS

Concept \ Size category and number of spindles	I 2 000	II 6 000	III 10 000	IV 18 500	V 26 000	VI 37 000	VII 60 000	VIII 100 000
1. Spinning (operatives per thousand spindles)	6.5	3.0	2.8	2.3	2.3	2.1	2.1	1.9
1.1 Opening through roving	3.3	1.4	1.2	1.0	1.0	0.9	0.9	0.8
1.2 Spinning and winding	3.2	1.6	1.6	1.3	1.3	1.2	1.2	1.1
2. Weaving (operatives per hundred looms)	23.4	9.7	7.9	7.1	7.3	6.7	6.3	6.3
2.1 Warping and filling	12.8	4.4	3.3	2.6	2.8	2.4	2.2	2.2
2.2 Weaving	10.6	5.3	4.6	4.5	4.5	4.3	4.1	4.1
3. Investment per worker (dollars)	9 410	14 992	15 201	17 776	17 643	19 130	20 571	22 457
3.1 Fixed capital	8 834	13 866	13 946	16 260	16 133	17 483	18 774	20 508
3.2 Working capital	576	1 126	1 255	1 516	1 510	1 647	1 797	1 949
4. Productivity a/								
4.1 In spinning (grammes per man/hour)	1 505	3 260	3 453	4 276	4 263	4 563	4 746	5 095
4.2 In weaving (metres per man/hour)	14.33	35.09	43.49	48.83	46.89	50.64	54.98	55.16
5. Gross value added b/								
5.1 Per unit of output (dollars per metre)	0.304	0.173	0.152	0.137	0.135	0.131	0.126	0.122
5.2 Per unit of investment	0.35	0.28	0.28	0.26	0.26	0.25	0.25	0.24
5.3 Per unit of input	2.09	1.26	1.13	1.02	1.01	0.98	0.94	0.92
5.4 Per worker/year	3 309	4 178	4 206	4 657	4 605	4 871	5 139	5 448

a/ Not including administrative staff or auxiliary services personnel (see tables HH, II and JJ).

b/ At production costs level, excluding rates and taxes.

Figure I

PRODUCTIVITY IN SPINNING

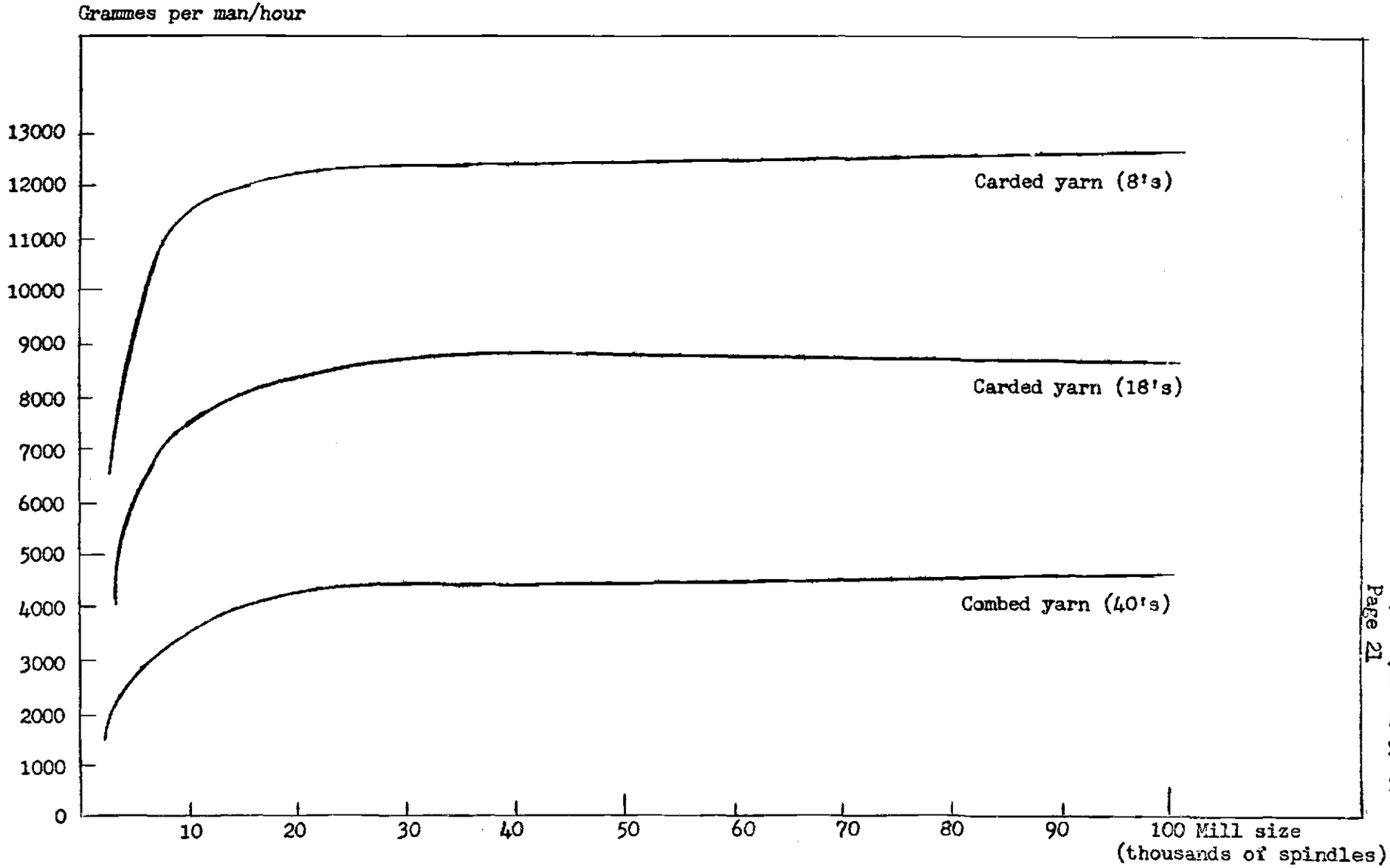
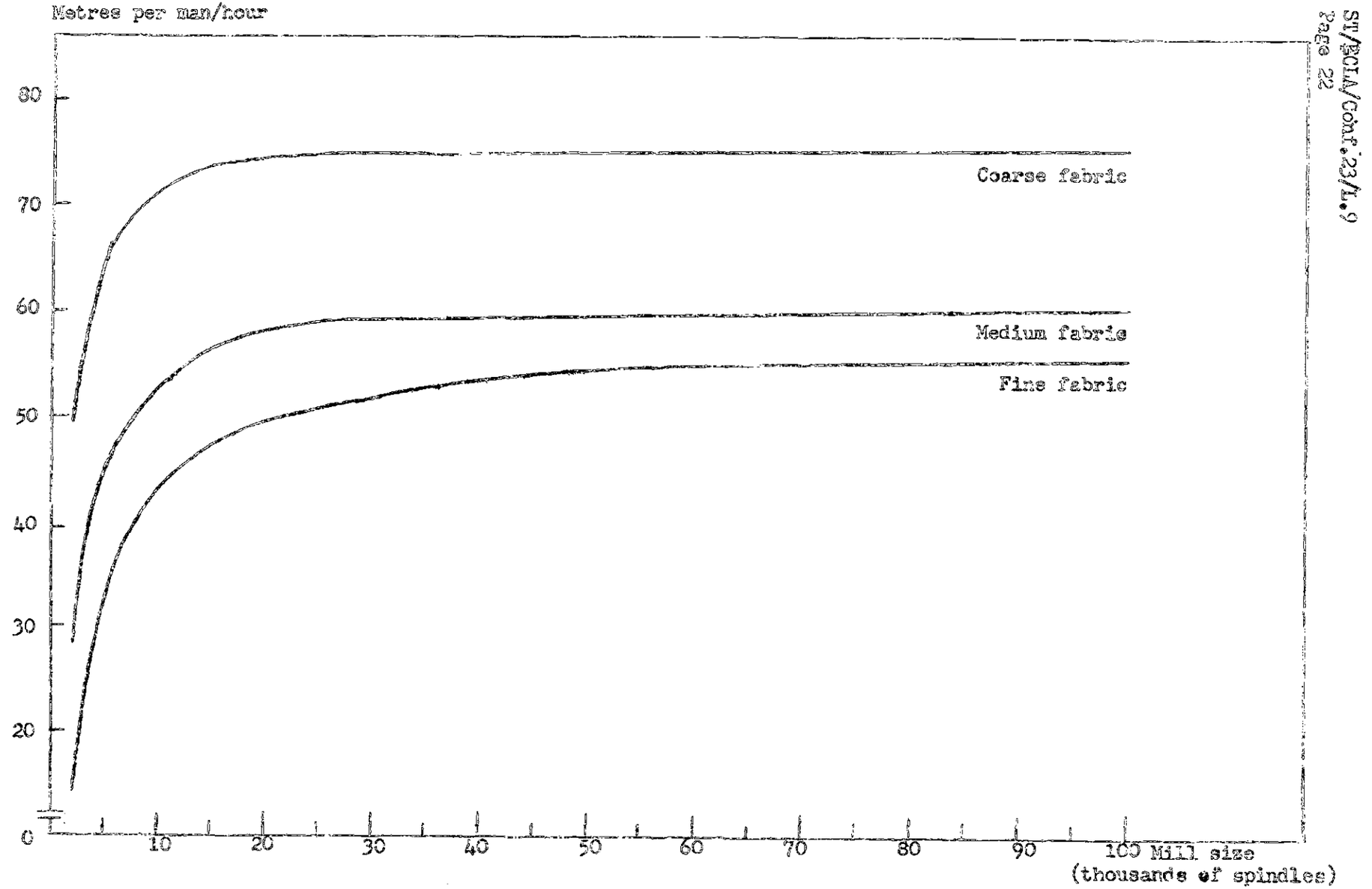


Figure II

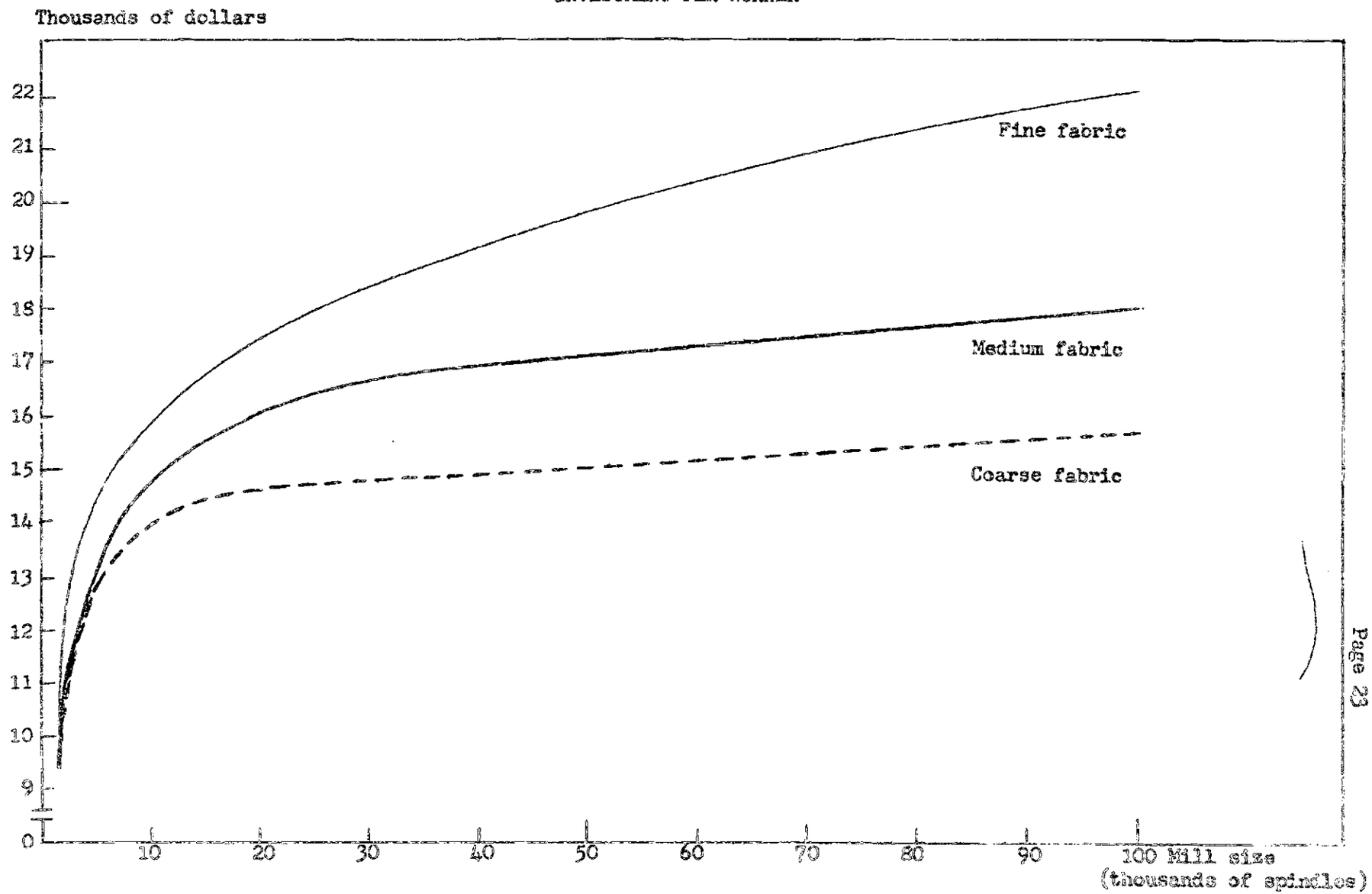
PRODUCTIVITY IN WEAVING



/Figure III

Figure III

INVESTMENT PER WORKER



III. MILL STRUCTURE

1. Investment requirements

The production plans outlined in tables B, C and D indicate the operating conditions for each product. With these plans as a basis, tables E-Z were then prepared in which daily output, consumption of raw materials, amount of waste recoverable and machinery required to carry out the production programme were specified for each mill.

These tables also indicate the margin of unused machine capacity per unit, in other words the amount of time each machine must operate for the purposes of the production programme, and the total number of working hours on a three-shift basis (23-hour day). It has been assumed, wherever possible, that the machines whose minimum size exceeds mill requirements would operate for less than three shifts. This reduction in working time would not of course modify the amount of machine capacity standing idle, but would enable the number of operatives to be cut proportionately and thereby lower production costs.

Tables AA, BB, CC, DD and GG indicate the volume of investment needed in each case studied. Table EE sets forth the criteria adopted for determing the quantity of working capital required, while table FF gives the installation periods estimated for the different mill projects according to each one's size and manufacturing processes.

The machinery prices adopted were those quoted by long-established textile machinery manufacturers for July 1965. To simplify matters, the total cost of the machinery was worked out in terms of one unit of production.[7/] Strictly speaking, the number of machines required should be calculated from the number of individual production units that make up one machine, and the cost estimates drawn up on that basis, since unit cost depends on how many units there are to each machine. This method

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7/ The term "unit of production" should be taken to mean each of the mechanical elements that includes a component for the delivery of product. Scutchers and cards, for instance, have only one production unit, whereas drawing frames, roving frames and ring spinning frames have several, that vary in number according to the needs of the individual mills.

would, however, entail cost consultations after the mill structure had been decided upon, which would be materially impossible. To put it plainly, this degree of elaboration adds nothing to the quality of the calculations, and is simply mentioned here in a spirit of precaution in case this type of methodology is chosen for project preparation.

As regards fixed investment, the sums earmarked for covering the expenses of the mills' entry into operation were proportionate to the time needed for setting them up. The interest payable during the period of construction was estimated to be 12 per cent annually during the project implementation periods noted in table FF; it was also assumed that when half that period had elapsed, at least a part of the mills, depending on their particular size, would be in operation (see table GG). The cost of sites, vehicles, special fittings such as fire sprinkler systems, or internal communications has not been included in the investment figures.

2. Production costs

Tables LL, MM and NN set forth the production costs for each case under consideration. To facilitate analysis, the costs were divided into fixed and variable in keeping with the main criteria adopted for defining the various cost factors involved.

(a) Raw materials

The prices of the cotton grown in different Latin American countries were reviewed, and the types singled out that were technically and economically best suited to the products to be manufactured. Table 8 lists the prices of cotton grown in the three major Latin American producers (1963-64 crop).

Table 8

AVERAGE PRICE OF COTTON, C.I.F. LIVERPOOL, CROP 1963-64

Type of cotton				Dollars per kg
Brazilian -	Paulista	1 1/32"	(26 mm) type 5	0.56
	Sertão	1 3/16"	(28/30 mm) type 4	0.60
	Seridó	1 3/8"	(36 mm) type 3	0.68
Peruvian -	Pima	1 9/16"	(40 mm)	0.93
Mexican -	Matamoros	1 1/16"	(27 mm)	0.65

Source: Stock Exchange quotations.

The prices quoted in the present study relate to the three classes of Brazilian cotton fibre - short, medium and long staple - that meet the requirements of the fabrics to be manufactured. Peruvian Pima, being of high quality and therefore more expensive, cannot justifiably be used to produce the 40's yarn selected for this study and is best reserved for the manufacture of combed yarns with a finer count. Mexican Matamoros cotton is quoted as having a fibre only 27 mm long, but is recognized as a possible replacement for Brazilian Sertão in the manufacture of 18 count yarn. As the raw Matamoros is fairly expensive, however, the inclusion of this type tend to throw the relationship between the three kinds out of proportion.

Allowance was made in calculating the real cost of the raw material for the waste produced during each process (see table 9). This was estimated either as partially recoverable or at the residual value it can usually fetch on the market in relation to the cost of the raw cotton With this method of cost accounting it is obvious that receipts from the sale of the waste cannot be reckoned as part of the enterprise's income

Table 9

ACTUAL COST OF THE COTTON USED IN MANUFACTURING THE DIFFERENT PRODUCTS

(Dollars per kilogramme)

	A Paulista	B Sertão	C Seridó
Price of raw cotton	0.560	0.600	0.680
Real waste (percentage) a/	9	11	28
Price of processed cotton	0.615	0.674	0.944
Less:			
Sales value of waste b/	0.007	0.010	0.057
Actual cost of cotton	0.608	0.664	0.887

a/ See Annex, tables E-Z.

b/ Estimated as 15 per cent of the purchasing price for Paulista and Sertão and 30 per cent of the price for Seridó.

It should be pointed out that waste is invariably calculated as a percentage of the total weight of the raw material fed into the machine and not of the ensuing product. The proportion recovered for further use varies according to the type of product made, being 8.7 per cent in the case of coarse fabrics, 5.3 per cent for medium fabrics and 2.7 per cent for fine fabrics (see Annex, tables E-Z).

(b) Labour

Tables HH, II and JJ indicate the number of workers needed to keep the mills operating on a three-shift basis, with their yearly wages. Instead of the customary classification of labour as direct or indirect, it was decided to divide them into fixed or variable so as to keep more faithfully to the criterion used for the cost classification. For the purposes of determining manpower costs the minimum wage was calculated on the basis of an examination of the prevailing wage rates in the textile industry in a few Latin American countries. The findings are set out in table 10.

/Table 10

Table 10

AVERAGE WAGE OF UNSKILLED LABOUR IN THE TEXTILE INDUSTRY IN FOUR COTTON-MANUFACTURING LATIN AMERICAN COUNTRIES

(Dollars per hour)

	Direct labour	Indirect labour
Brazil	0.36	-
Colombia	0.34	0.27
Mexico	0.35	0.25
Peru	0.36	0.23

Source: ECLA, The textile industry in Latin America, Vols. II. Brazil, III. Colombia, V. Peru (XI. Mexico, unpublished).

As table 10 shows, manpower costs, whether relating to direct or indirect labour, vary little among the four countries considered. The figures were used as the basis for a wage scale (see table 11) classifying the labour force as skilled, semi-skilled or unskilled, which thus provides a clearer picture of the types of labour needed in the mills and the appropriate wage rate for each category.

Table 11

WAGE SCALE ADOPTED IN THE PRESENT STUDY

(Dollars)

Classification	Hourly wage
Unskilled	0.25
Semi-skilled	0.35
Skilled	0.50
Foremen and supervisors	0.75

/As the

As the minimum wage for unskilled labour was taken to be 0.25 dollars an hour and for semi-skilled labour 0.35 dollars, which is 40 per cent more, it was assumed that skilled operatives and supervisors would receive 100 and 200 per cent more, respectively.

The concept of semi-skilled labour as used in this study stems from the fact that a machine operative in the textile industry is rarely a skilled workman in the true sense of the term since he can be trained in the mill itself in three to six months. He is however, at a higher level than the mill hand who helps him by moving materials, for instance, and has never had any kind of training. Then, too, a machine tender is paid in proportion to his output, since he is in direct charge of the machine, and thus earns a higher wage than the legal minimum received by the unskilled hands.

Social security charges were reckoned to be 40 per cent of the labour costs, which is the usual proportion in most Latin American countries.

(c) Capital costs

Depreciation costs were computed on the assumption of a useful life of forty years for buildings and of fifteen years for machinery. Production costs include payment of 12 per cent annual interest on the capital invested.

(d) Other cost components

The criteria adopted for determining the other production cost factors are explained in the footnotes to tables LL, MM and NN. It merely remains to point out that no insurance or taxes and charges of any kind were included in the costs as they vary too widely from one country to another.

IV. ANALYSIS OF RESULTS

1. Economies of scale in investment

Before economies of scale as such are discussed, a glance should be taken at the behaviour of certain figures that are indicative of investment composition. The same figures can be used to compare mills that are of different size and structure and consequently manufacture different kinds of fabric.

(a) Idle machinery capacity

Because of the indivisibility and relatively high minimum size of some textile machines, it is not always possible to establish a perfect balance between the different production stages. The fact that some machines are standing idle during part of the working day means that not all the investment is being used and this, in turn, affects production costs. In order to determine how far the existence of idle capacity affects economies of scale, a table was prepared giving the figures for idle investment for each case under consideration (see table 12 and figure IV).

Idle capacity was calculated in relation to the total time available for using the machinery, in other words, the working day of 23 hours fixed for the mill as a whole. For the stages in which there is a great deal of idle capacity, the working day could be shortened to one or two shifts; this would also reduce manpower costs, although this was not taken into account in calculating idle investment. Under-utilization of the machinery would thus enable the number of workers to be reduced proportionately without any adverse effect on production costs except for depreciation. The idle capacity that is bound to exist when the machines are indivisible will tend to disappear as mill size increases and a coarser yarn count is manufactured. In mill size I idle capacity is 8.5 per cent for product A, but 17.3 and 30.2 per cent for products B and C. In the three largest sizes considered, idle capacity shrinks to little or nothing for products A and B, although a certain amount remains in the case of product C.

Table 12

IDLE CAPACITY IN EACH PRODUCTION STAGE

Production stage	Mill size I Idle capacity		Mill size II Idle capacity		Mill size III Idle capacity		Mill size IV Idle capacity		Mill size V Idle capacity		Mill size VI Idle capacity		Mill size VII Idle capacity		Mill size VIII Idle capacity	
	Percentage a/	Dollars b/	Percentage	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage	Dollars	Percentage	Dollars
Product A - coarse fabric																
Scutcher c/	23	14 000	24	25 000	5	7 000	-	-	-	-	-	-	-	-	-	-
Card	10	6 000	5	8 000	-	-	-	-	-	-	-	-	-	-	-	-
Drawing frames	36	8 000	-	-	8	6 000	-	-	-	-	-	-	-	-	-	-
Warper	70	8 000	10	1 000	25	6 000	5	2 000	-	-	7	7 000	-	-	-	-
Slasher	34	10 000	-	-	18	22 000	-	-	5	13 000	-	-	-	-	-	-
Total idle capacity d/	8.5	46 000	2.3	34 000	1.7	41 000	0.0	2 000	0.2	13 000	0.1	7 000	0.0	-	0.0	-
Product B - medium fabric																
Scutcher	68	42 000	-	-	20	16 000	-	-	16	25 000	-	-	3	10 000	-	-
Card	10	3 000	-	-		-	-	-	-	-	-	-	-	-	-	-
Drawing frames	-	-	20	5 000	15	5 000	-	-	-	-	-	-	-	-	-	-
Warpers	88	10 000	62	7 000	38	4 000	-	-	20	5 000	23	8 000	8	4 000	-	-
Slasher	68	20 000	-	-	20	12 000	-	-	16	24 000	-	-	4	12 000	-	-
Total idle capacity	17.3	75 000	1.1	12 000	2.1	37 000	0.0	-	1.2	54 000	0.1	8 000	0.2	26 000	0.0	-
Product C - fine fabric																
Scutcher	85	53 000	56	35 000	26	16 000	32	25 000	5	4 000	10	12 000	12	23 000	8	22 000
Card	10	2 000	10	6 000	-	-	-	-	-	-	-	-	-	-	-	-
Drawing frames (pre-combing)	75	4 000	23	1 000	36	4 000	21	3 000	17	4 000	-	-	-	-	-	-
Lap machines	83	5 000	48	28 000	19	1 000	20	2 000	24	4 000	20	5 000	14	5 500	-	-
Combers	17	33 000	17	8 000	17	13 000	-	-	-	-	-	-	-	-	-	-
Drawing frames	60	6 000	40	8 000	-	-	6	3 000	12	8 000	-	-	7	9 000	-	-
Warpers	94	11 000	80	10 000	68	8 000	41	5 000	20	2 000	40	10 000	-	-	20	10 000
Slasher	90	27 000	70	21 000	49	15 000	5	2 000	35	21 000	-	-	-	-	15	27 000
Total idle capacity	30.2	111 000	13.6	117 000	4.3	57 000	1.7	40 000	1.3	49 000	0.6	27 000	0.5	37 000	0.5	59 000

a/ From tables E through Z.

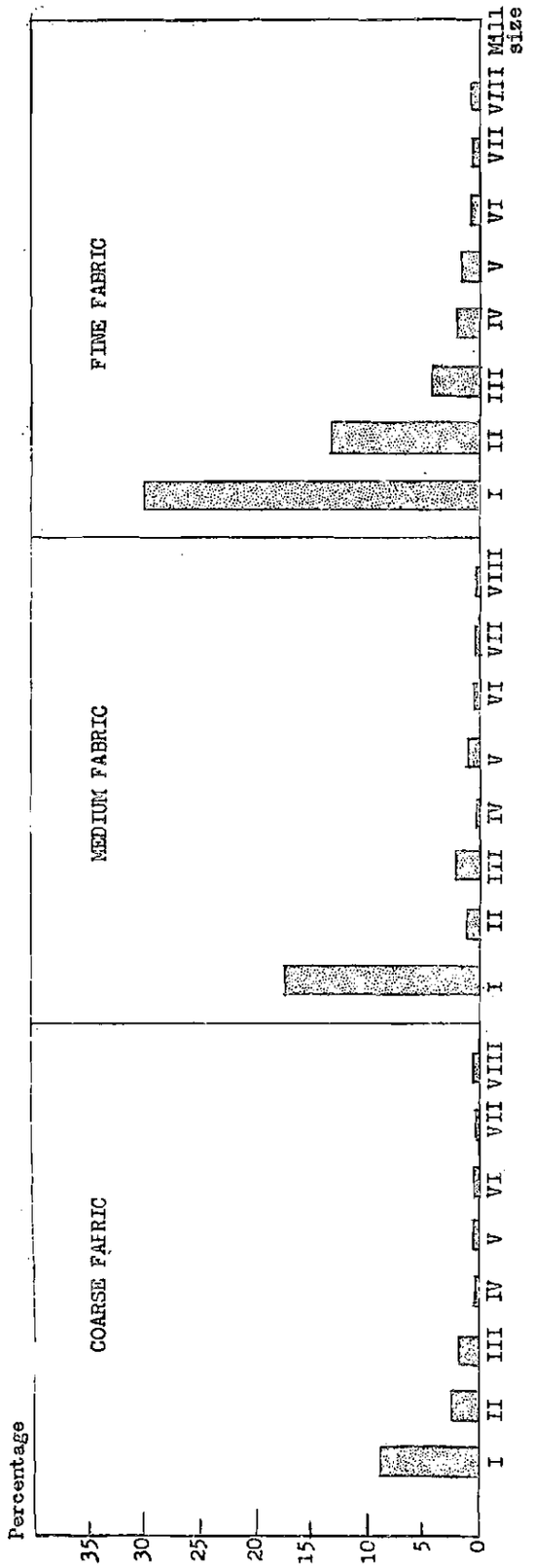
b/ Idle capacity as a percentage of the value of the machinery in dollars (for all sizes).

c/ Includes the whole opening room.

d/ Total idle capacity in terms of dollars divided by total machinery investment.

Figure IV

IDLE CAPACITY AS A PERCENTAGE OF TOTAL INVESTMENT



/(b) Percentage

(b) Percentage distribution of investment

It is clear from table 13 that the percentage distribution of investment components tends to remain much the same as mill size increases, but changes appreciably between one product and another. For instance, both working capital and the amount of interest paid during the period of construction are considerably reduced when fine instead of coarse fabrics are made. This is mainly because the volume of raw cotton and material in process of fabrication is smaller, and mills for producing fine cloth can be built in a shorter space of time (see table 13 and figure V).

(c) Unit cost of machinery

This means the average cost per final unit of production involved in a particular process, that is, per ring spindle in the spinning mills and per loom in the weaving mills, the cost in each case being that of all the machines and accessories installed in the section concerned. Maintenance workshops, laboratories and other items, presented under the head of "miscellaneous" in tables AA, BB and CC, are therefore not included in unit cost.

Average cost per spindle drops sharply as mill size increases for the three sorts of product studied, falling from 144 to 114 dollars for product A, from 110 to 77 dollars for product B and from 116 to 72 dollars for product C. These reductions of 20, 30 and 38 per cent are mainly observable in the first three sizes on the scale, namely, between mills of 2,000 and of 10,000 spindles. From the 18,500-spindle category upwards, there is practically no reduction to be seen. The cost per loom in the weaving and preparation sections varies in the same fashion as the cost per spindle, though less markedly, the reductions for products A, B and C being 10, 19 and 31 per cent respectively.

The foregoing data are set out in table 14, which shows that in some cases the unit cost of production goes up instead of down as mill size expands. As already pointed out, this is due to a lack of balance in certain sizes. The yarn count produced also plays an important part in determining unit cost in the spinning mills, a reduction of about 37 per cent being obtained on switching from 8's to 40's. Although three

/Table 13

Table 13

PERCENTAGE DISTRIBUTION OF INVESTMENT

Item	Mill size		
	I 2 000 spindles	V 26 000 spindles	VIII 100 000 spindles
Product A - coarse fabric			
Fixed investment	89	87	87
Buildings	19	15	13
Machinery	50	51	51
Interest during construction period	10	13	15
Other a/	10	8	8
Working capital	11	13	13
Product B - medium fabric			
Fixed investment	22	91	90
Building	23	17	15
Machinery	53	53	53
Interest during construction period	7	11	14
Other a/	10	10	8
Working capital	7	9	10
Product C - Fine Fabric			
Fixed investment	94	91	91
Buildings	21	15	13
Machinery	56	57	57
Interest during construction period	5	10	13
Other a/	12	9	8
Working capital	6	9	9

a/ Comprising freight and insurance, erection and running-in costs.

/Figure V

Figure V

PERCENTAGE DISTRIBUTION OF INVESTMENT

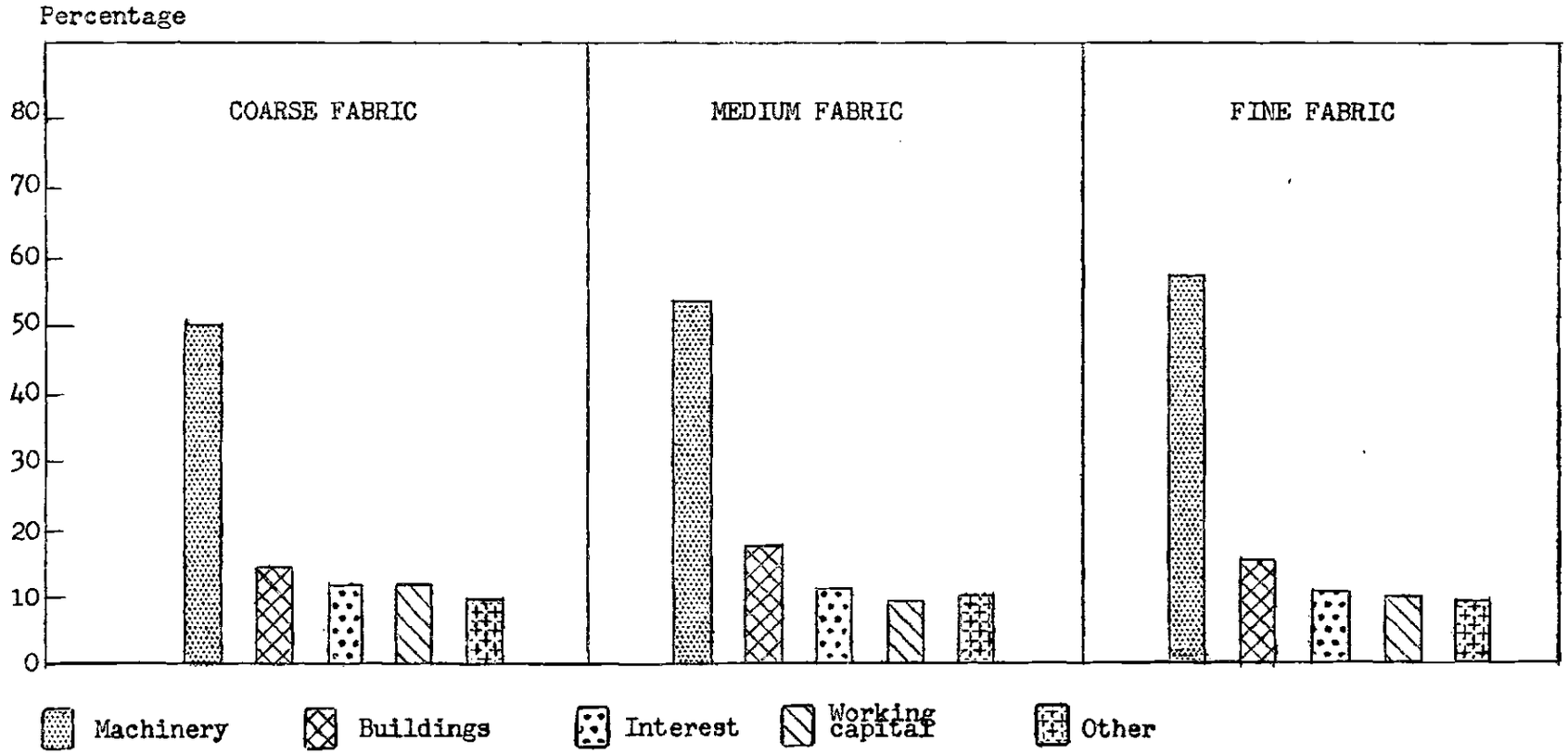


Table 14

F.O.B. UNIT COST OF MACHINERY

(Dollars)

Item	Size categories							
	I 2 000 spindles	II 6 000 spindles	III 10 000 spindles	IV 18 500 spindles	V 26 000 spindles	VI 37 000 spindles	VII 60 000 spindles	VIII 100 000 spindles
Product A - coarse fabric								
Cost per spindle	144	122	117	115	115	114	114	114
Cost per loom	3 280	2 956	2 993	2 927	2 938	2 920	2 925	2 919
Product B - medium fabric								
Cost per spindle	110	87	82	77	79	79	78	77
Cost per loom	3 452	2 889	2 876	2 814	2 841	2 815	2 814	2 806
Product C - fine fabric								
Cost per spindle	116	86	78	75	74	74	73	72
Cost per loom	3 986	3 060	2 892	2 764	2 787	2 750	2 732	2 748

a/ Not including the value of the equipment placed under the head of "miscellaneous" in tables AA, BB and CC.

/additional stages

additional stages - pre-combing drafting, lap forming and combing - are needed to manufacture 40's yarn, the increased machinery requirements for producing coarse yarn raise investment per unit of production. In the weaving mills, however, the unit cost drops much less between the two kinds of product, the difference being barely 6 per cent.

(d) Fixed investment per square metre

Another yardstick often used for comparing textile machinery is the ratio of total mill cost to the building acreage. Table 15 gives the cost of the fixed investment per square metre of area built over and the unit cost of the buildings themselves.

The cost of the buildings per square metre, including such ancillary installations as power and light, air conditioning, water and steam remains virtually the same (66 - 68 dollars) throughout the production scale and for all three products manufactured.

Total fixed investment per unit of area, on the contrary, changes considerably between the 2,000 and 100,000-spindle categories, increasing from 315 to 449 dollars (42 per cent). This shows that better use is made of space in the larger mill sizes. For products B and C in the largest and smallest sizes investment per square metre rises from 47 to 54 per cent, which indicates that in the smaller sizes there is more wastage of space the finer the article produced.

(e) Investment per unit of output

Economies of scale in investment are inclined to vary in accordance with the type of product manufactured, increasing as the fabric becomes finer. This indicates that idle capacity has a fairly marked influence on the value of investment per unit of output; in fact, the balance between the different production stages is more easily achieved the larger the mill and the coarser the cloth produced. Consequently, once a mill has a balanced production flow, unit investment is difficult to reduce even when the production scale is stepped up.

The fact that a fine cloth has to go through more processing stages raises investment per unit of output. The difference in unit investment between coarse and fine fabric therefore becomes greater as mill size

/Table 15

Table 15

RATIO OF INVESTMENT TO THE BUILDING AREA IN THE MILLS STUDIED

(Dollars)

Item	Size of mill							
	I 2 000 spindles	II 6 000 spindles	III 10 000 spindles	IV 18 500 spindles	V 26 000 spindles	VI 37 000 spindles	VII 60 000 spindles	VIII 100 00 spindles
Product A - coarse fabric								
Cost of buildings per square metre a/	67.0	67.5	67.5	67.4	67.3	67.1	66.9	66.5
Total fixed investment per square metre	315.0	342.0	365.0	376.0	392.0	400.0	429.0	449.0
Product B - medium fabric								
Cost of building per square metre a/	67.1	67.1	67.1	67.1	66.8	66.7	66.5	66.1
Total fixed investment per square metre	276.0	317.0	327.0	336.0	348.0	360.0	388.0	406.0
Product C - fine fabric								
Cost of buildings per square metre a/	66.9	66.9	66.8	66.7	66.4	66.2	66.0	65.6
Total fixed investment per square metre	301.0	331.0	388.0	389.0	395.0	403.0	439.0	464.0

a/ Including cost of buildings, and power, light, air conditioning, water and steam installations.

decreases, precisely because the disequilibria are more pronounced in the small mills turning out fine fabrics. For instance, in a 2,000-spindle mill, the investment needed to produce 1,000 metres of fabric C is 3.7 times greater than for the same amount of fabric A. From the 18,500-spindle level upwards, however, it is only 2.8 times more.

It has been stated that economies of scale in investment increase in proportion to the fineness of the yarn and fabric produced, since the difference in unit investment between the largest and smallest mill sizes is greater for fine than for coarse cloth. Even so, the most economic size from the standpoint of unit investment is reached at almost the same point on the production scale for the three types of fabric under consideration. As table 16 shows, the maximum reduction for all three is attained in the 18,500-spindle size, which is equivalent to 830 looms for the coarse cloth, 680 for the medium and 396 for the fine cloth. At this point on the scale, unit investment is 21, 30 and 40 per cent less for products A, B and C than in the smallest size (2,000 spindles) whereas the reductions obtainable between the two extremes of the scale are only a shade larger, being 24, 32 and 42 per cent respectively. Consequently, from size IV onwards, there are practically no further economies obtainable in investment, and the ideal size is to be found between the 10,000-spindle and 18,500-spindle categories at whatever point the best possible balance can be attained for the mill's particular end product (see figure VI).

These conclusions are borne out by the capital factor[8/] calculated for different points on the scale. The ratio of this factor in size II to that in size I (output being three times as much in the former) is 0.84, 0.75 and 0.67 for products A, B and C respectively; in other words, the economies of scale increase as the fabric becomes finer. But the value of the capital factor for size V in relation to that for size IV

8/ Value of α in the equation $\left(\frac{P_1}{P_o}\right)^{\alpha} = \frac{K_1}{K_o}$

in which P_o, 1 = production at two points on the scale.

K_o, 1 = total investment at those points.

The capital factor is also known as the coefficient of proportionality and can be used in analysing production costs.

/Table 16

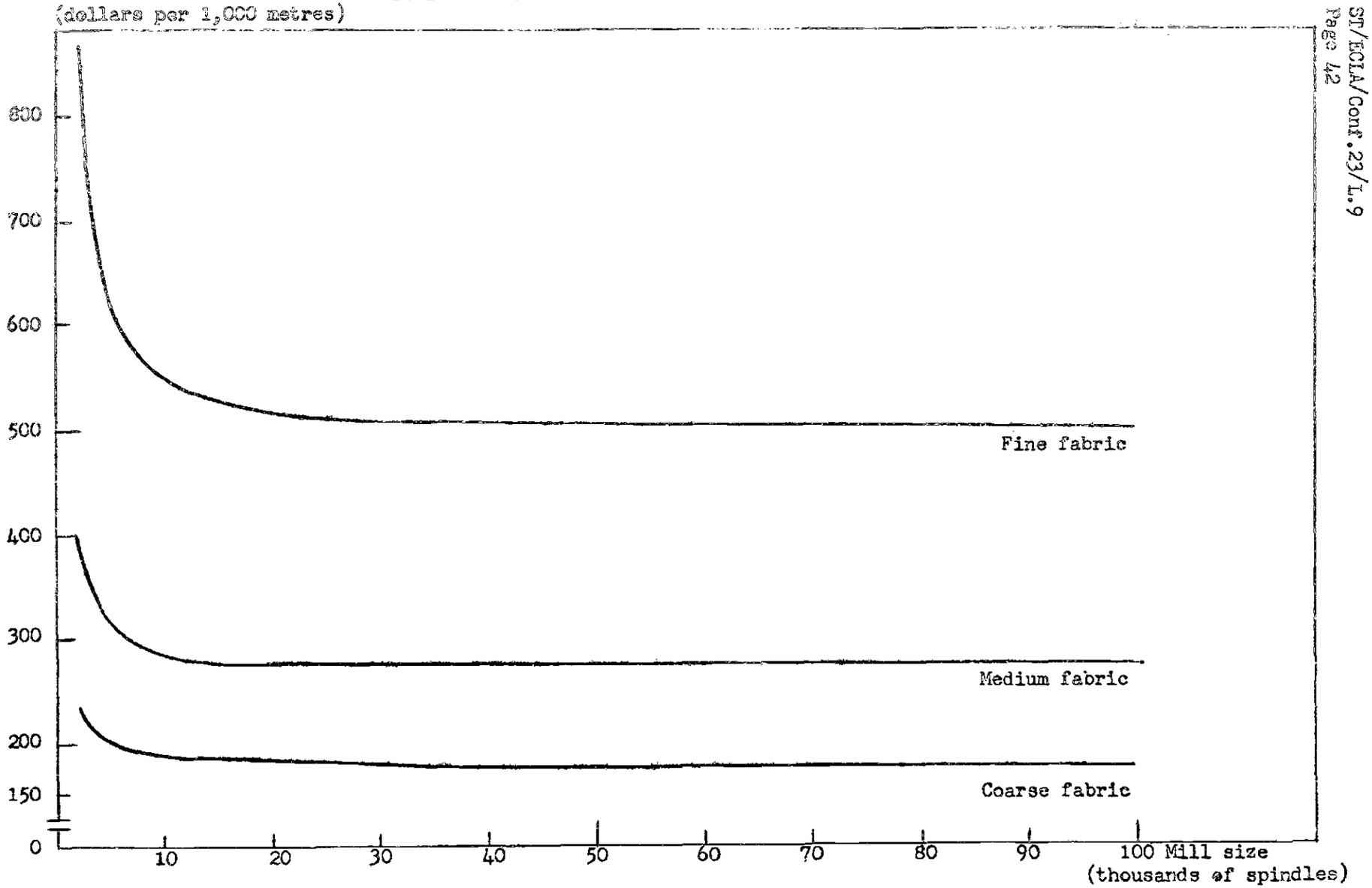
Table 16

UNIT INVESTMENT ACCORDING TO EACH HYPOTHESIS CONSIDERED

Size	Number of spindles	Production scale	Product A		Product B		Product C	
			Dollars per 1 000 metres	Index	Dollars per 1 000 metres	Index	Dollars per 1 000 metres	Index
I.	2 000	100	233	100	402	100	866	100
II.	6 000	300	196	84	303	75	621	72
III.	10 000	500	189	81	294	73	548	63
IV.	18 500	925	184	79	281	70	522	60
V.	26 000	1 300	182	78	282	70	519	60
VI.	37 000	1 850	180	77	277	69	514	59
VII.	60 000	3 000	178	76	275	68	504	58
VIII.	100 000	5 000	178	76	274	68	504	58

Figure VI

UNIT INVESTMENT ACCORDING TO EACH HYPOTHESIS CONSIDERED



is almost the same for all three products, which means that from size IV upwards investment is strictly proportionate to output. Table 17 lists the capital factors obtained at three points on the production scale for the three fabrics under consideration.

A comparison of the figures given in table 17 with their equivalents for other branches of industry show that the economies of scale obtainable in the textile industry are very small. In the chemical industry, for instance, the value of the capital factor was found to vary between 0.50 and 0.80, the most frequent coefficient being about 0.60, which could be attained simply by trebling production.9/

Table 17

CAPITAL FACTORS OBTAINED AT THREE POINTS ON THE PRODUCTION SCALE FOR THE THREE PRODUCTS CONSIDERED

Production scale	Product A	Product B	Product C
Size II / Size I	0.84	0.75	0.67
Size V / Size IV	0.95	1.00	1.00
Size VIII / Size VII	0.99	1.00	1.00

9/ ECLA, Economías de escala en la industria química (ST/ECLA/Conf.11/L.17), Santiago (1962).

2. Economies of scale in costs

Before the trend of production costs is reviewed in relation to mill size, the percentage distribution of costs among the different factors of production should be looked into. Table 18 summarizes the figures obtained for the three products in the two mill sizes at either end of the scale and in an intermediate size, thus making it possible to assess the changes brought about in some cost components by an increase in the production scale. These changes are substantial in the first four mill sizes but insignificant from size V upwards, the same point at which economies of scale can no longer be obtained in investment.

The nature of the textile fabric is particularly important for the structure of production costs, since the share of fixed costs tends to increase as the fabric becomes finer. This explains, of course, why economies of scale are greater in the case of fine goods.

The raw material is the major cost component in a textile mill, constituting in the case of coarse fabric 62 per cent, medium fabric 51 per cent and fine fabric 41 per cent of the total production costs. As the volume of raw material used in the process of manufacturing will not be reduced by enlarging mill size, the economies of scale must necessarily be made in some elements of fixed cost, more particularly fixed labour. Next to raw material in order of incidence come financial charges, which comprise depreciation and the payments of interest on the total capital invested. The share of these in aggregate costs expands from 20 to 34 per cent if fine instead of coarse fabrics are manufactured. Since they are in strict proportion to the amount of capital invested and it has been found that no appreciable reduction can be made in investment by raising output, there will clearly be no cut in financial costs. Given that the raw material and the financial charges together account for 78 to 82 per cent of the over-all production costs, the whole effort to cut down on such costs must be directed towards the remaining components which constitute only 18 to 22 per cent (see figure VII).

/Table 18

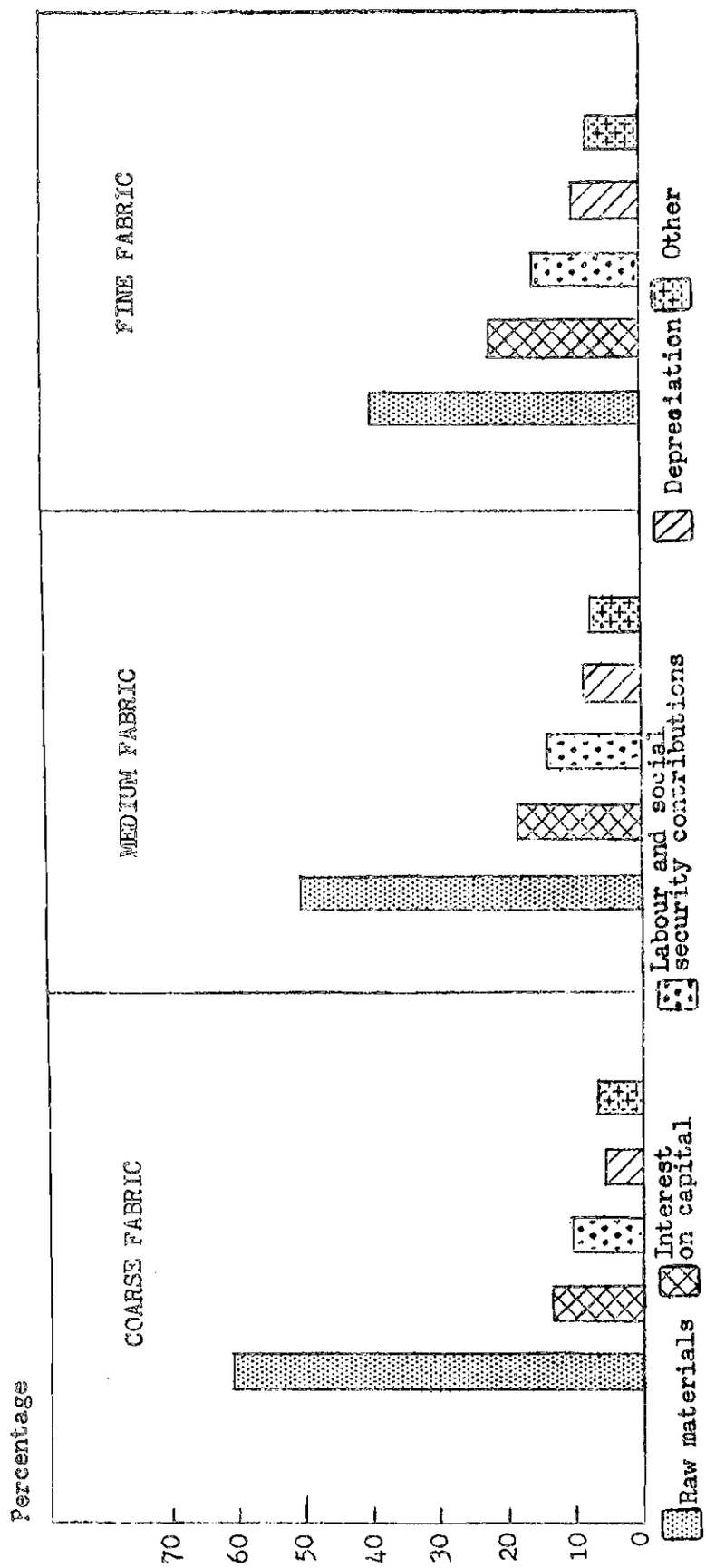
Table 18

PERCENTAGE DISTRIBUTION OF ANNUAL PRODUCTION COSTS

Distribution	Product A - coarse fabric			Product B - medium fabric			Product C - fine fabric		
	Size I 2 000 spindles	Size V 26 000 spindles	Size VIII 100 000 spindles	Size I 2 000 spindles	Size V 26 000 spindles	Size VIII 100 000 spindles	Size I 2 000 spindles	Size V 26 000 spindles	Size VIII 100 000 spindles
I. Fixed costs	32.76	24.60	23.85	46.48	34.87	33.52	57.53	44.36	42.69
Fixed labour	6.93	2.33	1.82	11.50	4.22	3.20	15.87	6.54	4.67
Social security	2.77	0.93	0.73	4.60	1.69	1.28	6.35	2.62	1.87
Depreciation	6.61	6.17	6.23	8.79	8.53	8.66	10.37	10.51	10.94
Upkeep	0.50	0.52	0.52	0.67	0.73	0.74	0.80	0.93	0.97
Interest on capital	15.42	14.34	14.26	20.12	19.23	19.21	23.09	23.12	23.68
Overheads	0.21	0.07	0.05	0.34	0.13	0.10	0.48	0.20	0.14
Other	0.32	0.24	0.24	0.46	0.34	0.33	0.57	0.44	0.42
II. Variable costs	67.24	75.40	76.15	53.52	65.13	66.48	42.47	55.64	57.31
Raw materials	52.19	62.06	62.94	37.32	50.79	52.25	24.60	41.25	43.52
Ancillary materials	1.05	1.24	1.26	0.75	1.02	1.05	0.48	0.83	0.87
Variable labour	6.83	5.35	5.22	7.50	5.71	5.55	8.56	5.36	4.78
Social security	2.73	2.14	2.09	3.00	2.28	2.22	3.42	2.15	1.91
Steam	0.10	0.12	0.12	0.06	0.08	0.09	0.04	0.06	0.07
Upkeep	1.00	1.04	1.05	1.33	1.47	1.49	1.60	1.87	1.94
Power	1.62	1.53	1.51	2.21	2.13	2.14	2.72	2.73	2.79
Sales costs	1.02	1.15	1.16	0.80	0.98	1.00	0.62	0.82	0.85
Other	0.76	0.79	0.66	0.55	0.67	0.69	0.43	0.57	0.58
III. Total costs	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figure VII

PERCENTAGE DISTRIBUTION OF PRODUCTION COSTS
(Size V)



The unit cost of production which, in this study, is calculated per metre of cloth manufactured, displays much the same pattern as unit investment, reductions of 22, 29 and 43 per cent being recorded respectively for products A, B and C between the smallest and biggest mill sizes, i.e., the lowest level of output is increased fifty-fold. The optimum size for costs does not necessarily fall at the same point on the production scale for the three types of fabric. Unit cost remains virtually the same from size III upwards for product A and from size IV upwards for products B and C (see table 19 and figure VIII). Consequently, from the cost standpoint, the optimum mill size is somewhere around that of 10,000 spindles for product A and 18,500 spindles for B and C, since unit cost in those categories is respectively 19, 27 and 40 per cent lower than in the first size.

The cost components that influence economies of scale are set out in table 20. Fixed labour[10/] shows the most substantial reduction in cost, amounting to approximately 80 per cent between the two extremes of the production scale for all three fabrics.

Variable labour costs, on the other hand, are 37 per cent less between the two ends of the scale for coarse fabrics but 69 per cent higher for fine cloth. This is due to the fact that small mills turning out fine goods find it harder to distribute their labour force rationally and to make full use of them. The two elements in financial charges, namely depreciation and interest on capital, also show reductions that increase in proportion to the fineness of the end product, and range from 23 per cent for product A to nearly 40 per cent for product C. It is clear that extensive reductions can be made in the costs of fixed and variable labour as well as in financial charges, and their influence on the economies of scale might well be decisive were it not for the fact that they represent such a small fraction of the total production costs. Even so, if interest on capital (which plays a very flexible part in costs since it is reckoned as a profit for the enterprise) were deducted from these two components that account for 31 to 48 per cent of the total[11/] they would shrink to only 17 and 25 per cent respectively (see figure IX, X and XI).

10/ Including the corresponding social security charges.

11/ Labour calculations include social security charges.

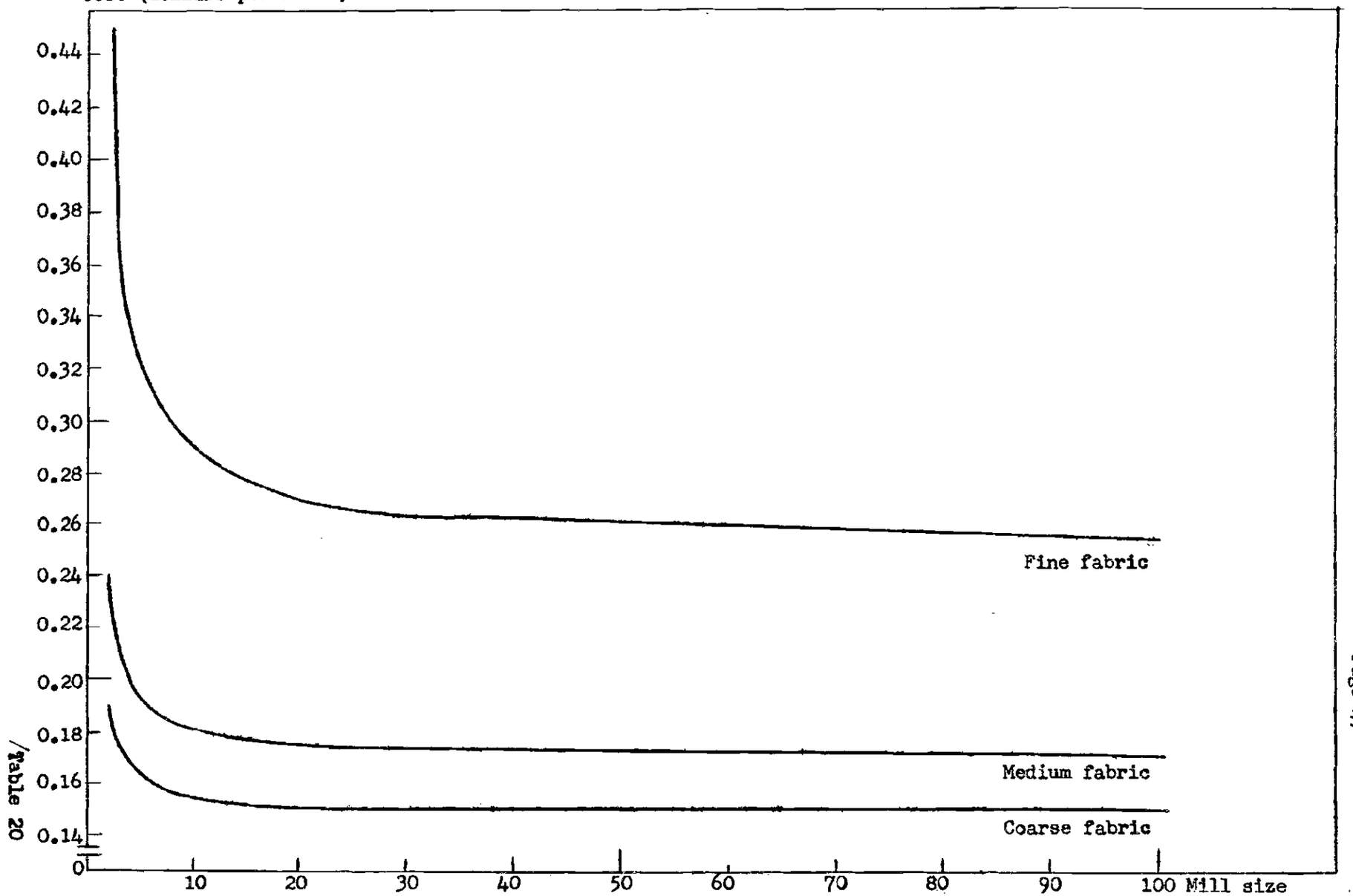
/Table 19

Table 19

UNIT COST OF PRODUCTION ACCORDING TO EACH HYPOTHESIS CONSIDERED

Item	Size (Number of spindles)	Production scale	Product A Coarse fabric		Product B Medium fabric		Product C Fine fabric	
			Dollars per metre	Index	Dollars per metre	Index	Dollars per metre	Index
I.	2 000	100	0.191	100	0.240	100	0.450	100
II.	6 000	300	0.158	83	0.188	78	0.311	69
III.	10 000	500	0.155	81	0.182	76	0.287	64
IV.	18 500	925	0.153	80	0.176	73	0.271	60
V.	26 000	1 300	0.152	79	0.176	73	0.269	60
VI.	37 000	1 850	0.151	79	0.174	72	0.265	59
VII.	60 000	3 000	0.151	79	0.173	72	0.259	58
VIII.	100.000	5 000	0.150	78	0.171	71	0.255	57

Figure VIII
UNIT COST OF PRODUCTION



/Table 20

Table 20

UNIT VALUE OF THE OUTSTANDING ITEMS OF PRODUCTION COSTS

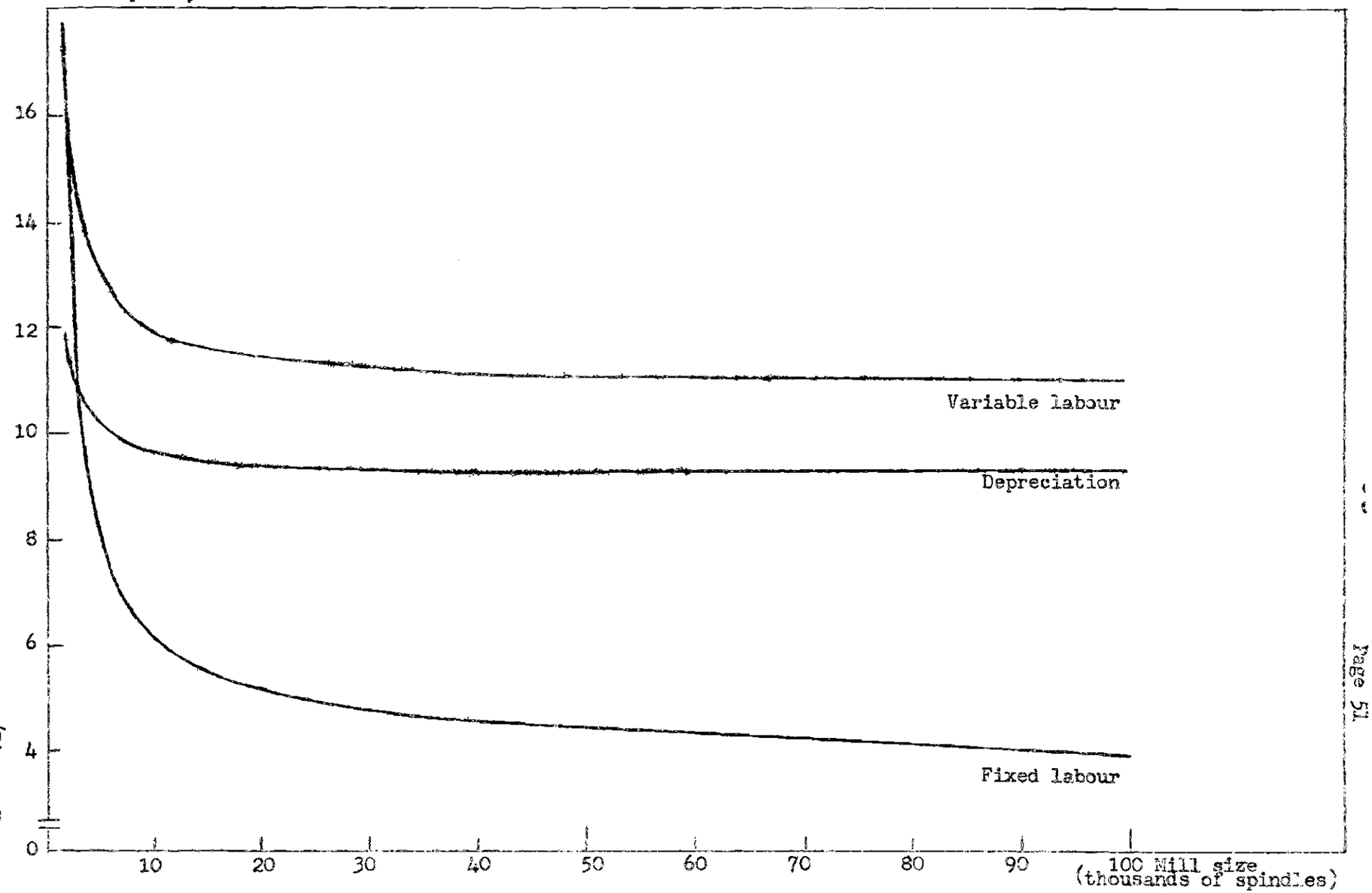
(Dollars per 1 000 metres)

Item	Size and number of spindles							
	I 2 000	II 6 000	III 10 000	IV 18 500	V 26 000	VI 37 000	VII 60 000	VIII 100 000
Product A - coarse fabric								
Fixed labour a/	17.6	7.5	6.0	5.3	5.0	4.7	4.3	3.8
Variable labour a/	17.3	12.7	11.9	11.5	11.4	11.2	11.1	11.0
Depreciation	12.0	10.0	9.7	9.5	9.4	9.3	9.3	9.3
Interest on capital	27.9	23.5	22.7	22.0	21.8	21.6	21.4	21.4
Product B - medium fabric								
Fixed labour a/	38.6	15.3	13.2	10.9	10.4	9.5	8.8	7.7
Variable labour a/	25.2	16.7	15.3	14.0	14.0	13.6	13.5	13.3
Depreciation	21.5	16.0	15.5	15.0	15.0	14.8	14.8	14.8
Interest on capital	48.2	36.4	35.3	33.7	33.9	33.2	33.0	31.9
Product C - fine fabric								
Fixed labour a/	37.6	14.6	12.2	9.7	9.3	8.4	7.5	6.3
Variable labour a/	20.3	9.1	8.9	7.4	7.6	7.0	6.7	6.4
Depreciation	46.6	33.4	29.9	28.4	28.3	28.1	27.8	27.9
Interest on capital	103.9	74.5	65.8	62.6	62.2	61.7	60.5	60.4

a/ Including social security contributions.

Figure IX

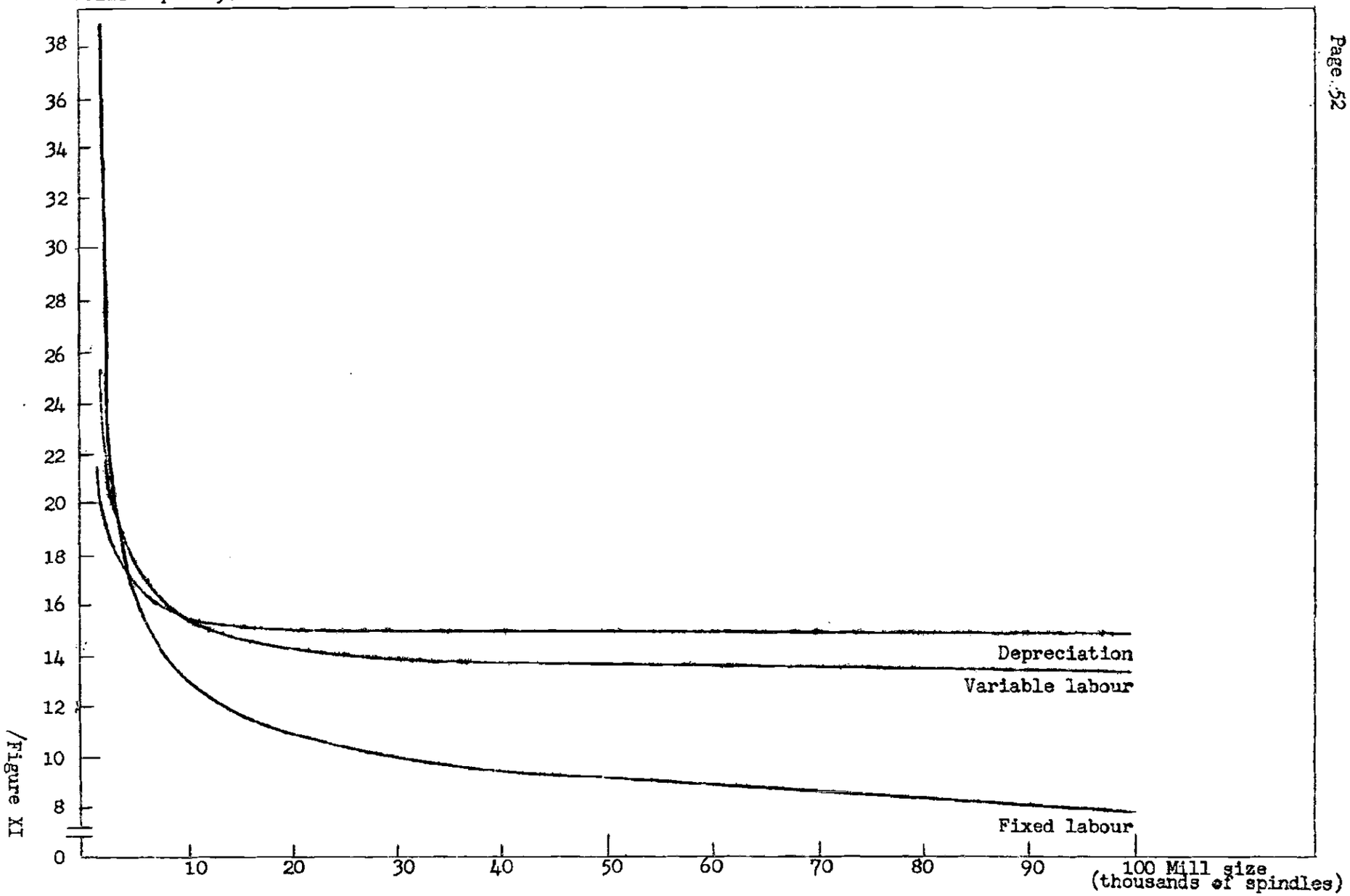
COARSE FABRIC : UNIT COST OF LABOUR AND DEPRECIATION



/Figure X

Figure X

Dollars per 1,000 metres MEDIUM FABRIC : UNIT COST OF LABOUR AND DEPRECIATION



/Figure XI

Figure XI

FINE FABRIC : UNIT COST OF LABOUR AND DEPRECIATION

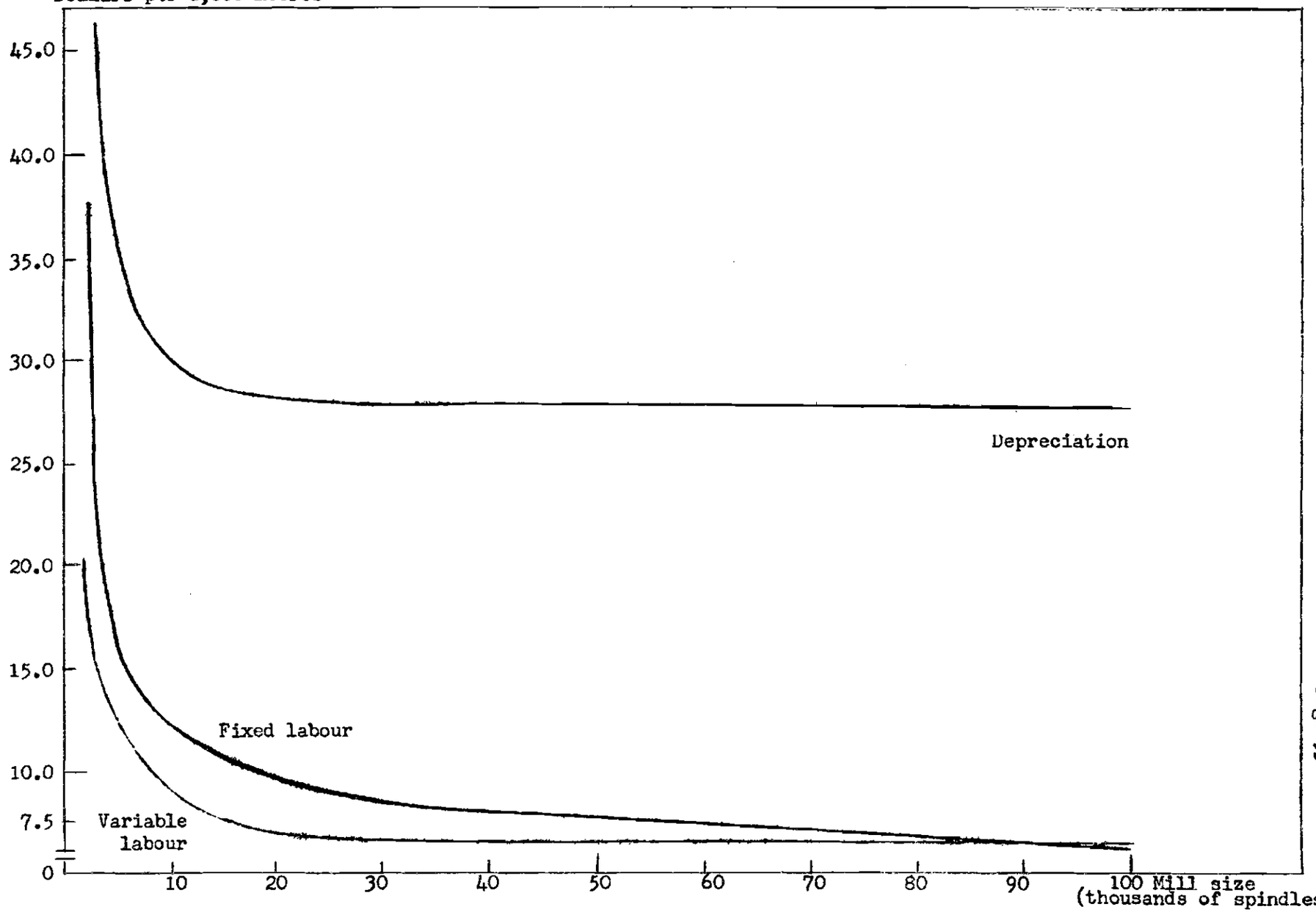


Table 21

PRODUCTION, INVESTMENT AND COST INDEXES COMPARED WITH IDLE CAPACITY

(Product A - coarse fabric)

	Size		Production index	Unit investment index	Unit cost index	Idle capacity (percentage) a/	Total investment requirements (thousands of dollars)
	Spindles	Looms					
I.	2 000	90	100	100	100	8.5	1 386
II.	6 000	270	300	84	83	2.3	3 501
III.	10 000	450	500	81	81	1.7	5 635
IV.	18 500	830	925	79	80	0	10 132
V.	26 000	1 170	1 300	78	79	0.2	14 085
VI.	37 000	1 660	1 850	77	79	0.1	19 829
VII.	60 000	2 700	3 000	76	79	0	31 914
VIII.	100 000	4 500	5 000	76	78	0	53 163

a/ Ratio of unused to total investment, (see table 12).

Table 22

PRODUCTION, INVESTMENT AND COST INDEXES COMPARED WITH IDLE CAPACITY

(Product B - medium fabric)

	Mill size		Production index	Unit investment index	Unit cost index	Idle capacity (percentage) a/	Total investment requirements (thousands of dollars)
	Spindles	Looms					
I.	2 000	73	100	100	100	17.3	1 090
II.	6 000	226	300	75	78	1.1	2 550
III.	10 000	364	500	73	76	2.1	3 987
IV.	18 500	680	925	70	73	0	7 097
V.	26 000	950	1 300	70	73	1.2	9 958
VI.	37 000	1 360	1 850	69	72	0.1	13 978
VII.	60 000	2 190	3 000	68	72	0.2	22 385
VIII.	100 000	3 650	5 000	68	71	0	37 169

a/ Ratio of unused to total investment, (see table 12).

Table 23

PRODUCTION, INVESTMENT AND COST INDEXES COMPARED WITH IDLE CAPACITY

(Product C - fine fabric)

	Mill size		Production index	Unit investment index	Unit cost index	Idle capacity (percentage) a/	Total investment requirements (thousands of dollars)
	Spindles	Looms					
I.	2 000	43	100	100	100	30.2	885
II.	6 000	130	300	72	69	13.6	1 904
III.	10 000	214	500	63	64	4.3	2 797
IV.	18 500	396	925	60	60	1.7	4 924
V.	26 000	560	1 300	60	60	1.3	6 881
VI.	37 000	800	1 850	59	59	0.6	9 699
VII.	60 000	1 280	3 000	58	58	0.5	15 428
VIII.	100 000	2 140	5 000	58	57	0.5	25 691

a/ Ratio of unused to total investment, (see table 12).

In short, the decisive cost components in economies of scale in the textile industry are fixed labour, variable labour and depreciation. As the three depend on installed capacity and the investment tied up in this, it is clear that, although the under-utilization of certain machines may have only a slight effect on aggregate investment, nevertheless one of the basic conditions for lowering production costs is the achievement of a balanced production flow throughout the stages of mill processing.

The other cost components susceptible of reduction are upkeep, overheads and ancillary materials, which can be realigned so as to bring about a substantial cut in the cost of certain enterprises. But as they constitute no more than 3 or 4 per cent of the total production costs in the case of a rationally organized mill, they will never have a decisive effect on the enterprise's savings and far less so on its economies of scale.

As pointed out earlier, machinery is under-utilized in some of the production stages, but this is often unavoidable even in well-designed projects. The findings of the present study demonstrate that once a particular mill size has been reached, which will vary from one product to another, idle capacity becomes insignificant as the addition of one machine has little effect on total investment after the volume of output has passed a certain point.

The results obtained are summed up in tables 21, 22 and 23, in which the index of idle capacity represents the ratio of unused investment to the total investment needed to operate a mill. These figures show that the optimum sizes, namely, those in which the unit cost can be slashed to the minimum and unit investment is also susceptible of reduction, are 10,000-spindle mills in the case of product A and 18,500-spindle mills for products B and C. Over and above these sizes the reductions are too small to make it worth while mobilize the large sums of capital needed. However, the investment required for the most economic mill size could be appreciably reduced with very little difference in production costs.

If the next smallest mill sizes, i.e. 6,000 and 10,000 spindles, are chosen instead, the investment requirements for products A, B and C would drop from 5.6, 7.1 and 4.9 million dollars to 3.5, 4.2 and 2.8 million respectively, the rise in the unit cost of production being barely 2.5 per cent for product A, 4.1 per cent for product B and 6.7 per cent for product C.

/Despite the

Despite the fact that the cotton textile industry does not offer wide possibilities for economies of scale, problems relating to the choice of mill size still occur over a fairly wide stretch of the production scale. A glance at the principal mill sizes in Latin America[12/] will show that most of them are smaller than the optimum sizes determined in this study. Although, in planning the establishment of a mill, such factors as the volume of over-all investment must be taken into account as well as production costs, the majority of the Latin American mills unquestionably need rescaling as regards the minimum size at which a reduction of any significance can be made in production costs.

12/ ECLA, The textile industry in Latin America, op. cit., Vols. I-IX.

Annex

CHARACTERISTICS OF THE SPINNING AND WEAVING PROCESSES

The physical transformation process to which natural fibres are subjected in order to convert them into woven goods, although simple as regards the mechanical principles on which it is based, involves the use of a large number of machines. The process of manufacturing a fabric can be divided into two entirely separate stages: (a) the production of yarn, or, in other words, the transformation of the tufts of fibre into a continuous spiralled bunch, held together by the frictional force of the twist they are given; and (b) the production of the fabric proper, which consists in combining the threads in such a way as to obtain a flat surface, more or less closely woven, with adequate tensile strength and resistant to wear and tear.

The basic problem in the manufacture of cotton yarn is that of laying the fibres parallel to one another and forming them into a continuous rove of predetermined diameter. In modern methods of spinning, this stage is preceded by 5 to 8 operations, completely independent of one another. The next concern is how to apply the twist to the fibres once and for all in such a way as to maximize the strength of the yarn in the case of a given diameter[a/] and a specific quality of raw material. The tensile strength of a particular yarn depends upon various factors, of which those worth mentioning for the purpose of the present explanation are the twist it is given and the length of the fibres composing it. This point merits rather more detailed consideration.

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a/ The "diameter" of the yarn is a manner of speaking; a particular yarn is identified by the "count", which is the ratio between a given length and the corresponding weight. In the so-called "indirect yarn count systems" (English and metrical), which are those most commonly used for cotton, the higher the count the finer is the yarn. The actual diameter of the thread depends not only upon the mass of fibres forming it - i.e., the yarn count - but also on the thickness of the fibres themselves and on the twist received.

/Cotton fibre

Cotton fibre is one of the most variable materials used at any point in the textile industry. The properties of cotton fibres, and above all its staple length, vary according to the area of cultivation and the climatic conditions, and may even be different for two crops from a single area. Moreover, in any given stock of cotton the fibre-length variations in relation to the standard for the stock are not the same. This means that if the fibres in a given sample were sorted and laid side by side with the longest fibres on the left, a typical pattern would be obtained, and this pattern varies from one stock of cotton to another, reflecting the fact that the variations from the norm is not the same. Put more simply, the longer the staple and the more even the distribution of the fibres by length, the higher the count and the greater the relative strength of the yarn obtainable.

Thus, the unevenness of the length of the cotton fibres in their natural state conditions both the counts and the strength of the yarn that can be manufactured. To overcome this difficulty, and widen the range of yarn counts that can be produced, while at the same time improving the other physical characteristics of the yarn (strength, uniformity, appearance, etc.), a mechanical procedure has been introduced whereby a specific proportion of short fibres can be removed, with the result that the average length of the fibre is increased, dispersion among different lengths is reduced and the lot is rendered homogeneous. This procedure is known as "combing" the fibres, and the yarn produced in this way is called "combed yarn"; whereas yarn which has not been subjected to the combing process is described as "carded". The combing of cotton makes yarn production costs very much higher, either because more processing is entailed or because in the removal of the short fibres sometimes as much as 30 per cent of the raw material is eliminated in the form of waste, in addition to the normal waste involved in carding and combing, which represents about 14 per cent.

A study of table ÑÑ will obviate the need for a very detailed description of the various phases of the production process in the cotton textile industry. The table in question shows the production flow chart for one of the cases considered in the present study (C-VII), and provides

/a picture

a picture of all spinning and weaving operations, from the arrival of the baled cotton to the delivery of the grey goods. The flow chart relates to combed yarn; in the manufacture of carded yarn, the pre-combing operations are omitted, and the rest remain unchanged.

Since the various yarn counts and thicknesses may be combined in innumerable different ways in the composition of the fabric, and other concomitant characteristics may vary in their turn, the range of products in the textile industry is so wide as to preclude any sort of generalization with regard to the production capacity of a given machine or plant. Although a fairly accurate estimate can be made, the validity of any comparison of production capacities will depend upon precise specification of the nature of the products manufactured. In this connexion, it will be useful to give a brief explanation of the way in which production is usually measured in the textile industry in the two stages of the manufacturing process - spinning and weaving.

Yarn output is measured by weight, the count produced being also specified. As a spinning mill usually manufactures more than one count at a time, it is necessary to specify the average count, that is, the average for the yarns produced, weighted by the output of each. When comparisons are made, the first problem stems from the fact that operational conditions in a mill producing, for example, four different counts will not be the same as in another producing a single count, even though the average count may be the same for both mills.

The production capacity of a spinning mill is determined by the number of ring spinning frames it possesses, while the output of these frames will in its turn depend upon the following factors:

(a) Yarn count produced, i.e., the mass of fibres comprising one unit of length;

(b) Yarn twist, i.e., the number of turns the thread has been given in one unit of length. The twist is expressed as the ratio between the number of turns performed by the traveller[b/] and the length of the yarn produced in a given unit of time;

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b/ The number of turns the traveller performs round the ring is equivalent to the number of spindle revolutions minus the quotient resulting from division of the length of yarn produced in a given unit of time by the length of the ring perimeter.

(c) Machine speed, generally expressed in terms of spindle revolutions per minute;

(d) Operational efficiency of the machine, i.e., the ratio between operating time and the total time available, due allowance being made for the fact that the whole machine or some of the spindles will undergo occasional stoppages on account of yarn breaks, bobbin changing, emergency repairs or maintenance operations, faulty machine-minding, etc. Machine efficiency can be more precisely defined as the ratio between real and theoretical output.

In weaving mills, output is usually measured in linear metres, which are converted into square metres whenever this is necessary for the comparison it is desired to make. To give an adequate indication of weaving output, the following are the minimum specifications required:

(a) Width of fabric on leaving the loom;

(b) Warp and weft yarn counts;

(c) Closeness of weave, i.e., the ends of warp and picks of filling in one unit of length.

On these bases, the weight per metre of fabric can be calculated, although some estimates still remain to be made, such as those relating to the number of threads in the selvedges and to warp and weft contraction.

The final stage in the weaving section is carried out on the loom, whose output - expressed in terms of length - depends upon the following factors:

(a) The number of picks of filling in the fabric per unit of length;

(b) Loom speed, which is expressed in terms of the number of picks per unit of time.[c/] Each pick corresponds to the insertion of one weft thread and an increase in the length of fabric equivalent to the inverse of the number of insertions;

(c) Machine efficiency, i.e., the ratio between real and theoretical output.

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c/ In view of the mechanical limitations of the machine, especially as regards the driving of the shuttle, the speed of the loom depends upon its working width, the number of shuttles in operation, the automatic weft change system and the warp control system.

/From the

From the foregoing remarks, some idea can be formed of the endless number of variables which play a part in the production process in the textile industry, and of the need to disregard some of them, especially when the aim is to study the sector from the macro-economic standpoint. In the present survey, an attempt has been made to reduce to a minimum the distortions that may be introduced by the above-mentioned factors, and this accounts for the amount of detail that has had to be incorporated in some cases.

The fabric leaves the loom in a grey or untreated state, and therefore has to be subjected to a number of treatments, both physical and chemical, before it can be marketed. These treatments are given the generic name of "finishing", and also offer an almost infinite range of possible variations and combinations. In view of the complete independence of this stage of the manufacturing process, there is a marked tendency to execute it separately from the spinning and weaving processes, in plants engaged solely in finishing operations. Moreover, the technological development of this section of the industry, with the introduction of continuous processes and the consequent increase in the capacity of the production units, has still further conduced to its isolation from the rest.

Table A

MAIN CHARACTERISTICS OF PRODUCTS

Specification	Product A Coarse fabric	Product B Medium fabric	Product C Fine fabric
Yarn (warp and weft)			
Count	8's	18's	40's
Twist constant	4.25	4.00	3.80
Twist per inch	12	17	24
Type of cotton (Brazil)	Sao Paulo, 26 mm	Sertao, 30 mm	Seridó, 34 mm
Carded or combed	Carded	Carded	Combed
Fabric			
Width of cloth (cm)	80	90	100
Warp ends per centimetre	13	20	47
Filling picks per centimetre	10	20	32
Total number of warp ends	1 070	1 880a/	4 800
Contraction of warp (percentage)	1.0	7.3	8.3
Contraction of weft (percentage)	2.0	7.3	16.3
Weight per linear metre (grammes)	140	130	130
Warp	80	66	76
Weft	60	64	54
Weight per square metre (grammes)	175	144	130

a/ With triple selvedges.

/Table B

Table B

COARSE FABRIC: SPIN PLAN AND WEAVING SPECIFICATIONS

Stage of production process	Yarn count produced	Hank feed	Draft	Twist (turns per inch)	Operational speed	Efficiency (percentage)	Output per unit/hour
Scutcher	0.0012	-	-	-	9.4 r.p.m.	90	180 kg
Card	0.12	0.0012	100	-	42 "	90	24 kg
Drawing frame I	0.12	6/0.12	6	-	800 feet per minute	70	50 kg
Drawing frame II	0.12	6/0.12	6	-	800 feet per minute	70	50 kg
Roving frame	0.60	0.12	5	0.90	700 r.p.m.	72	840 g
Ring spinning frame	8	0.60	13.3	12.00	7 600 "	88	62.7 g
Cone winder	8	8	-	-	500 yards per minute	60	1 215 g
Pirn winder	8	8	-	-	400 yards per minute	60	972 g
Warper	8	3 beams, 356 ends			400 yards per minute	40	230 kg
Slasher	8	-	-	-	48 yards per minute	50	104 kg
Loom	-	-	-	-	200 picks per minute	80	9.60 m

a/ On the assumption that evaporation capacity is 320 kilogrammes per hour and that the humidity content of the warp is 150 per cent.

Table C

MEDIUM FABRIC: SPIN PLAN AND WEAVING SPECIFICATIONS

Stage of production process	Yarn count produced	Hank feed	Draft	Twist (turns per inch)	Operational speed	Efficiency (percentage)	Output per unit/hour
Scutcher	0.0012	-	-	-	9.4 rpm	90	180 kg
Card	0.12	0.0012	100	-	35 rpm	90	20 kg
Drawing frame I	0.12	6/0.12	6	-	800 feet per minute	74	53 kg
Drawing frame II	0.12	6/0.12	6	-	800 feet per minute	74	53 kg
Roving frame	0.75	0.12	6.25	1.00	900 rpm	76	820 g
Ring spinning frame	18	0.75	24	17 9	800 rpm	92	26.5 g
Cone winder	18	18	-	-	600 yards per minute	70	756 g
Pirn winder	18	18	-	-	450 yards per minute	70	567 g
Warper	18	4 beams, 470 ends			500 yards per minute	50	221 kg
Slasher	18	-	-	-	48 yards per minute [a/]	50	81 kg
Loom	-	-	-	-	230 picks per minute	90	5.40 m

a/ On the assumption that evaporation capacity is 320 kilogrammes per hour and that the humidity content of the warp is 150 per cent.

Table D

FINE FABRIC: SPIN PLAN AND WEAVING SPECIFICATIONS

Stage of production process	Yarn count produced	Hank feed	Draft	Twist (turns per inch)	Operational speed	Efficiency (percentage)	Output per unit/hour
Scutcher	0.0014	-	-	-	11 rpm	90	180 kg
Card	0.14	0.0014	100	-	28 rpm	90	14 kg
Drawing frame (pre combing)	0.14	6/0.14	6	-	800 feet per minute	80	49 kg
Lap machine	0.0087	16/0.14	1	-	1 550 feet per minute	75	144 kg
Comb	0.14	4/0.0087	64	-	140 nips per nimute	90	24 kg
Drawing frame I	0.14	6/0.14	6	-	400 feet per minute	80	24.5 kg
Drawing frame II	0.14	6/0.14	6	-	400 feet per minute	80	24.5 kg
Roving frame	1.2	0.14	8.6	1.37	1 200 rpm	80	525 g
Ring spinning frame	40	1.2	33.3	24	11 000 rpm	95	9.8 g
Cone winder	40	40	-	-	700 yards per minute	80	453 g
Pirn winder	40	40	-	-	500 yards per minute	80	324 g
Warper	40	8 beams, 600 ends			600 yards per minute	60	175 kg
Slasher	40	-	-	-	50 yards per minute[a/]	50	108 kg
Loom	-	-	-	-	200 picks per minute	92	3.45 m

a/ On the assumption that evaporation capacity is 320 kilogrammes per hour and that the humidity content of the warp is 150 per cent.

Table E

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabric: Size category I: 2 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	3 179	203	6.0	23	0.77	1	23
Card	552	2 988	191	6.0	23	5.40	6	10
Drawing frame I	1 150	2 973	15	0.5	16	2.58	4	36
Drawing frame II	1 150	2 958	15	0.5	16	2.58	4	36
Roving frame	19.320	2 949	15	0.5	23	152	152	-
Ring spinning frame	1.442	2 884	59	2.0	23	2 000	2 000	-
Cone winder	27.945	2 826	58	2.0	23	101	100	-
Pirn winder	22.356	1 204	12	1.0	23	53.8	54	-
Warper	5 290	1 594	16	1.0	8	0.30	1	70
Slasher	2 392	1 578	16	1.0	16	0.66	1	34
Loom	30.912	2 782	-	-	23	90	90	-
	(220.80 m)	(19 871 m)						

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	3 382			
Waste recovered (kilogrammes)	294	Total waste	600	17.7
Daily consumption of cotton (kilogrammes)	3 088	Waste recovered	294	8.7
Annual consumption of cotton (tons)	926	Net waste	306	9.0

Table F

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabric: Size category II: 6 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	9 533	608	6.0	23	2.30	3	24
Card	552	8 961	572	6.0	23	16.20	17	5
Drawing frame I	1 150	8 916	45	0.5	23	7.75	8	-
Drawing frame II	1 150	8 872	44	0.5	23	7.71	8	-
Roving frame	19.230	8 828	44	0.5	23	457	460	-
Ring spinning frame	1.442	8 652	176	2.0	23	6 000	6 000	
Cone winder	27.945	8 479	173	2.0	23	303	300	-
Pirn winder	22.356	3 610	36	1.0	23	161	160	-
Warper	5 290	4 785	48	1.0	23	0.90	1	10
Slasher	2 392	4 737	48	1.0	23	1.98	2	-
Loom	30 912 (220.80 m)	8 347 (59 621 m)	-	-	23	270	270	-

				Kilogrammes	Percentage
Total input of cotton (kilogrammes)	10 141	Total waste		1 794	17.7
Waste recovered (kilogrammes)	882				
Daily consumption of cotton (kilogrammes)	9 259	Waste recovered		882	8.7
Annual consumption of cotton (tons)	2 775	Net waste		912	9.0

Table 6

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabrics: Size category III: 10 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	15 889	1 014	6.0	23	3.8	4	5
Card	552	14 936	959	6.0	23	27.0	27	-
Drawing frame I	1 150	14 862	74	0.5	23	12.9	14	8
Drawing frame II	1 150	14 788	74	0.5	23	12.9	14	8
Roving frame	19.320	14 714	74	0.5	23	761	760	-
Ring spinning frame	1.442	14 420	294	2.0	23	10 000	10 000	-
Cone winder	27.945	14 132	288	2.0	23	506	500	-
Pirn winder	22.356	6 016	61	1.0	23	269	270	-
Warper	5 290	7 975	80	1.0	23	1.50	2	25
Slasher	2 392	7 895	80	1.0	23	3.30	4	18
Loom	30.912 (220.80 m)	13 911 (99 363 m)	-	-	23	450	450	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	16 903			
Waste recovered (kilogrammes)	1 470	Total waste	2 992	17.7
Daily consumption of cotton (kilogrammes)	15 433	Waste recovered	1 470	8.7
Annual consumption of cotton (tons)	4 630	Net waste	1 522	9.0

Table H

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabric: Size category IV: 18 500 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	23 397	1 876	6.0	23	7.1	7	-
Card	552	27 633	1 764	6.0	23	50	50	-
Drawing frame I	1 150	27 495	138	0.5	23	23.9	24	-
Drawing frame II	1 150	27 358	137	0.5	23	23.8	24	-
Roving frame	19.320	27 221	137	0.5	23	1 409	1 400	-
Ring spinning frame	1.442	26 677	544	2.0	23	18 500	18 500	-
Cone winder	27.945	26 144	533	2.0	23	935	940	-
Pirn winder	22.356	11 130	112	1.0	23	498	500	-
Warper	5 290	14 753	149	1.0	23	2.8	3	5
Slasher	2 392	14 606	147	1.0	23	6.1	6	-
Loom	30.912 (220.80 m)	25 736 (183 827 m)	-	-	23	832	830	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	31 273			
Waste recovered (kilogrammes)	2 721	Total waste	5 537	17.7
Daily consumption of cotton (kilogrammes)	28 552	Waste recovered	2 721	8.7
Annual consumption of cotton (tons)	8 565	Net waste	2 816	9.0

/Table I

Table I

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabric: Size category V: 26 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	41 315	2 637	6.0	23	9.9	10	-
Card	552	38 836	2 479	6.0	23	70.3	70	-
Drawing frame I	1 150	38 642	194	0.5	23	33.6	34	-
Drawing frame II	1 150	38 449	193	0.5	23	33.4	34	-
Roving frame	19.320	38 257	192	0.5	23	1 980	1 980	-
Ring spinning frame	1.442	37 492	765	2.0	23	26 000	26 000	-
Cone winder	27.945	36 742	750	2.0	23	1 315	1 320	-
Pirn winder	22.356	15 642	158	1.0	23	699	700	-
Warper	5 290	20 733	209	1.0	23	3.9	4	-
Slasher	2 392	20 526	207	1.0	23	8.6	9	5
Loom	30.912 (220.80 m)	36 168 (258 942 m)	-	-	23	1 170	1 170	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	43 952			
Waste recovered (kilogrammes)	3 824	Total waste	7 784	17.7
Daily consumption of cotton (kilogrammes)	40 128	Waste recovered	3 824	8.7
Annual consumption of cotton (tons)	12 038	Net waste	3 960	9.0

Table J

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabric: Size category VI: 37 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	58 794	3 753	6.0	23	14.2	14	-
Card	552	55 267	3 527	6.0	23	100	100	-
Drawing frame I	1 150	54 991	276	0.5	23	47.8	48	-
Drawing frame II	1 150	54 716	275	0.5	23	47.5	48	-
Roving frame	19.320	54 443	273	0.5	23	2 818	2 820	-
Ring spinning frame	1.442	53 354	1 089	2.0	23	37 000	37 000	-
Cone winder	27.945	52 287	1 067	2.0	23	1 871	1 880	-
Firn winder	22.356	22 260	224	1.0	23	995	1 000	-
Harper	5 290	29 505	298	1.0	23	5.6	6	7
Slasher	2 392	29 210	295	1.0	23	12.2	12	-
Loom	30.912 (220.80 m)	51 470 (367 640 m)	-	-	23	1 665	1 660	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	62 547			
Waste recovered (kilogrammes)	5 441	Total waste	11 077	17.7
Daily consumption of cotton (kilogrammes)	57 106	Waste recovered	5 441	8.7
Annual consumption of cotton (tons)	17 132	Net waste	5 636	9.0

/Table K

Table K

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabrics: Size category VII: 60 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	95 342	6 085	6.0	23	23.0	23	-
Card	552	89 622	5 720	6.0	23	163	163	-
Drawing frame I	1 150	89 174	448	0.5	23	77.5	78	-
Drawing frame II	1 150	88 728	446	0.5	23	771	78	-
Roving frame	19.320	88 285	443	0.5	23	4 569	4 560	-
Ring spinning frame	1.442	86 520	1 765	2.0	23	60 000	60 000	-
Cone winder	27.945	84 790	1 730	2.0	23	3 034	3 040	-
Firm winder	22.356	36 114	346	1.0	23	1 615	1 620	-
Warper	5 290	47 847	483	1.0	23	9.0	9	-
Slasher	2 392	47 369	478	1.0	23	19.8	20	-
Loom	30.912 (220.80 m)	83 483 (596 302 m)	-	-	23	2 700	2 700	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	101 427			
Waste recovered (kilogrammes)	8 824	Total waste	17 944	17.7
Daily consumption of cotton (kilogrammes)	92 603	Waste recovered	8 824	8.7
Annual consumption of cotton (tons)	27 781	Net waste	9 120	9.0

Table 1

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Coarse fabrics: Size category VIII: 100 000 spindles)

Machine	Production: Daily unit output (kilogrammes)	Production: Total daily output required (kilogrammes)	Waste per day: Kilogrammes	Waste per day: Percentage	Number of working hours per day	Number of production units: Theoretical	Number of production units: Actual	Idle capacity (percentage)
Scutcher	4 140	158 906	10 143	6.0	23	38.3	38	-
Card	552	149 372	9 534	6.0	23	270	270	-
Drawing frame I	1 150	148 625	747	0.5	23	129	130	-
Drawing frame II	1 150	147 882	743	0.5	23	129	130	-
Roving frame	19.320	147 143	739	0.5	23	7 616	7 620	-
Ring spinning frame	1.442	144 200	2 943	2.0	23	100 000	100 000	-
Cone winder	27.945	141 316	2 884	2.0	23	5 056	5 000	-
Pirn winder	22.356	60 159	607	1.0	23	2 690	2 700	-
Warper	5 290	79 745	805	1.0	23	15	15	-
Slasher	2 392	78 948	797	1.0	23	33	33	-
Loom	30.912 (220.80 m)	139 107 (959 619 m)	-	-	23	4 500	4 500	-

				Kilogrammes	Percentage
Total input of cotton (kilogrammes)	169 049				
Waste recovered (kilogrammes)	14 707	Total waste		29 942	17.7
Daily consumption of cotton (kilogrammes)	154 342	Waste recovered		14 707	8.7
Annual consumption of cotton (tons)	46 302	Net waste		15 235	9.0

Table LL

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics: Size category I: 2 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	1 334	70	5.0	8	0.32	1	68
Card	460	1 254	80	6.0	23	2.72	3	10
Drawing frame I	1 219	1 248	6	0.5	23	1.02	1	-
Drawing frame II	1 219	1 242	6	0.5	23	1.02	1	-
Roving frame	18.860	1 236	6	0.5	23	65.5	68	-
Ring spinning frame	0.609	1 218	18	1.5	23	2 000	2 000	-
Cone winder	17.388	1 194	24	2.0	23	68.6	70	-
Firm winder	13.041	579	6	1.0	23	41.4	48	
Warper	4 853	603	6	1.0	8	0.12	1	88
Slasher	1 863	597	6	1.0	8	0.32	1	68
Loom	16.146 (124.20 m)	1 176 (9 046 m)	-	-	23	72.8	73	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	1 440			
Waste recovered (kilogrammes)	74	Total waste	228	16.3
Daily consumption of cotton (Kilogrammes)	1 330	Waste recovered	74	5.3
Annual consumption of cotton (tons)	399	Net waste	154	11.0

Table M

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabric: Size category II: 6 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	4 140	218	5.0	23	3.00	3	0
Card	460	3 892	248	6.0	23	8.46	9	0
Drawing frame I	1 219	3 873	19	0.5	23	3.17	4	20
Drawing frame II	1 219	3 854	19	0.5	23	3.17	4	20
Roving frame	18.860	3 835	19	0.5	23	203	200	0
Ring spining frame	0.609	3 778	57	1.5	23	6 200	6 000	0
Cone winder	17.388	3 703	75	2.0	23	213	220	0
Pirn winder	13.041	1 797	18	1.0	23	138	140	0
Warper	4 853	1 868	20	1.0	8	0.38	1	62
Slasher	1 863	1 850	18	1.0	23	0.99	1	0
Loom	16.146 (124.20 m)	3 647 (28 054 m)	-	-	23	226	226	0

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	4 358			
Waste recovered (kilogrammes)	231	Total waste	711	16.3
Daily consumption of cotton (kilogrammes)	4 127	Waste recovered	232	5.3
Annual consumption of cotton (tons)	1 238	Net waste	480	11.0

Table N

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics: Size category III: 10 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	6 650	332	5.0	23	1.6	2	20
Card	460	5 274	376	6.0	23	13.6	14	-
Drawing frame I	1 219	6 243	31	0.5	23	5.12	6	15
Drawing frame II	1 219	6 212	31	0.5	23	5.12	6	15
Roving frame	18.860	6 181	31	0.5	23	327	324	-
Ring spinning frame	0.609	6 090	91	1.5	23	10 000	10 000	-
Cone winder	17.388	5 968	122	2.0	23	343	344	-
Pirn winder	13.041	2 895	29	1.0	23	222	224	-
Warper	4 853	3 014	30	1.0	16	0.62	1	38
Slasher	1 863	2 984	30	1.0	23	1.6	2	20
Loom	16.146 (124.20 m)	5 879 (45 223 m)	-	-	23	364	364	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	6 982			
Waste recovered (kilogrammes)	370	Total waste	1 103	16.3
Daily consumption of cotton (kilogrammes)	6 612	Waste recovered	370	5.3
Annual consumption of cotton (tons)	1 984	Net waste	733	11.0

Table 5

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics Size category IV: 18 500 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	12 420	659	5.0	23	3	3	0
Card	460	11 675	745	6.0	25	25.3	26	0
Drawing frame I	1 219	11 617	58	0.5	23	9.5	10	0
Drawing frame II	1 219	11 559	58	0.5	23	9.5	10	0
Roving frame	18.860	11 501	58	0.5	23	609	608	0
Ring spinning frame	0.609	11 329	172	1.5	23	18 600	18 500	0
Cone winder	17.388	11 103	226	2.0	23	638	640	0
Pirn winder	13.041	5 387	54	1.0	23	413	416	0
Warper	4 853	5 606	56	1.0	23	1.2	1	0
Slasher	1 863	5 550	56	1.0	23	3	3	0
Loom	16 146 (124.20 m)	10 937 (84 130 m)	-	-	23	678	680	0

				Kilogrammes)	Percentage
Total input of cotton (kilogrammes)	13 073				
Waste recovered (kilogrammes)	692	Total waste		2 136	16.3
Daily consumption of cotton (kilogrammes)	12 381	Waste recovered		692	5.3
Annual consumption of cotton (tons)	3 714	Net waste		1 444	11.0

Table 0

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics: Size category V: 26 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	17 359	913	5.0	23	4.2	5	16
Card	460	16 318	1 041	6.0	23	35.5	36	-
Drawing frame I	1 219	16 237	81	0.5	23	13.3	14	-
Drawing frame II	1 219	16 156	81	0.5	23	13.3	14	-
Roving frame	18 860	16 075	81	0.5	23	852	850	-
Ring spinning frame	0.609	15 834	241	1.5	23	26 000	26 000	-
Cone winder	17.388	15 518	316	2.0	23	892	900	-
Firn winder	13.041	7 528	76	1.0	23	577	580	-
Warper	4 853	7 835	79	1.0	23	1.6	2	20
Slasher	1 863	7 757	78	1.0	23	4.2	5	16
Loom	16.146 (124.20 m)	15 285 (117 577 m)	-	-	23	946	950	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	18 272			
Waste recovered (kilogrammes)	968	Total waste	2 987	16.3
Daily consumption of cotton (kilogrammes)	17 304	Waste recovered	968	5.3
Annual consumption of cotton (tons)	5 191	Net waste	2 019	11.0

Table P

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics; Size category VI: 37 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	24 840	1 307	5.0	23	6	6	-
Card	460	23 350	1 490	6.0	23	50.7	51	-
Drawing frame I	1 219	23 234	116	0.5	23	19.0	20	-
Drawing frame II	1 219	23 118	116	0.5	23	19.0	20	-
Roving frame	18 860	23 002	116	0.5	23	1 219	1 220	-
Ring spinning frame	0.609	22 658	344	1.5	23	37 200	37 000	-
Cone winder	17.388	22 206	452	2.0	23	1 277	1 280	-
Pirn winder	13.041	10 774	108	1.0	23	826	830	-
Warper	4 853	11 212	112	1.0	23	2.3	3	23
Slasher	1 863	11 100	112	1.0	23	5.9	6	-
Loom	16.146 (124.20 m)	21 874 (168 260 m)	-	-	23	1 356	1 360	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	26 147			
Waste recovered (kilogrammes)	1 385	Total waste	4 273	16.3
Daily consumption of cotton (kilogrammes)	24 762	Waste recovered	1 385	5.3
Annual consumption of cotton (tons)	7 428	Net waste	2 888	11.0

Table 8

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabric: Size category VII; 60 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	40 060	2 108	5.0	23	9.7	10	3
Card	460	37 657	2 403	6.0	23	81.8	82	-
Drawing frame I	1 219	37 469	188	0.5	23	30.7	32	-
Drawing frame II	1 219	37 282	187	0.5	23	30.7	32	-
Roving frame	18 860	37 096	186	0.5	23	1 967	1 980	-
Ring spinning frame	0.609	36 540	556	1.5	23	60 000	60 000	-
Cone winder	17.388	35 810	730	2.0	23	2 059	2 060	-
Pirn winder	13.041	17 372	175	1.0	23	1 332	1 340	-
Warper	4 853	18 081	182	1.0	23	3.7	4	8
Slasher	1 863	17 901	180	1.0	23	9.6	10	4
Loom	16.146 (124.20 m)	35 273 (271 330 m)	-	-	23	2 185	2 190	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	42 168			
Waste recovered (kilogrammes)	2 235	Total waste	6 895	16.3
Daily consumption of cotton (kilogrammes)	39 933	Waste recovered	2 235	5.3
Annual consumption of cotton (tons)	11 980	Net waste	4 660	11.0

Table 8

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Medium fabrics: Size category VIII; 100 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	66 769	3 514	5.0	23	16.1	16	-
Card	460	62 763	4 006	6.0	23	13.6	136	-
Drawing frame I	1 219	62 449	314	0.5	23	51.2	52	-
Drawing frame II	1 219	62 137	312	0.5	23	50.9	52	-
Roving frame	18 860	61 827	310	0.5	23	3 278	3 280	-
Ring spinning frame	0.609	60 900	927	1.5	23	100 000	100 000	-
Cone winder	17.388	59 682	1 218	2.0	23	3 432	3 440	-
Pirn winder	13.041	28 952	292	1.0	23	2 220	2 220	-
Warper	4 853	30 134	304	1.0	23	6.2	6	-
Slasher	1 863	29 833	301	1.0	23	16	16	-
Loom	16.146 (124.20 m)	58 785 (452 192 m)	-	-	23	3 640	3 650	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	70 283			
Waste recovered (kilogrammes)	3 725	Total waste	11 498	16.3
Daily consumption of cotton (kilogrammes)	66 558	Waste recovered	3 725	5.3
Annual consumption of cotton (tons)	19 967	Net waste	7 773	11.0

Table S

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category I: 2 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	611	25	4.0	8	0.15	1	85
Card	322	581	30	5.0	23	1.80	2	10
Drawing frame (precombing)	1 127	578	3	0.5	8	0.51	2	75
Lap machine	3 312	575	3	0.5	8	0.17	1	83
Comber	552	460	115	20.0	23	0.83	1	17
Drawing frame I	563	458	2	0.5	16	0.81	2	60
Drawing frame II	563	456	2	0.5	16	0.81	2	60
Roving frame	12.075	454	2	0.5	23	37.6	40	-
Ring spinning frame	0.225	450	4	1.0	23	2 000	2 000	-
Cone winder	10.419	446	4	1.0	23	42.8	44	-
Pirn winder	7.452	186	1	0.5	23	24.9	24	-
Warper	4 025	258	1	0.5	8	0.06	1	94
Slasher	2 484	257	1	0.5	8	0.10	1	90
Loom	10 315 (79.35 m)	443 (3 407 m)	-	-	23	42.9	43	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	636			
Waste recovered (kilogrammes)	17	Total waste	193	30.4
Daily consumption of cotton (kilogrammes)	619	Waste recovered	17	2.7
Annual consumption of cotton (kilogrammes)	186	Net waste	176	28.0

/Table T

Table T

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category II: 6 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	1 838	76	4.0	16	0.44	1	56
Card	322	1 746	92	5.0	23	5.40	6	10
Drawing frame (precombing)	1 127	1 738	8	0.5	23	1.54	2	23
Lap machine	3 312	1 730	8	0.5	16	0.52	1	48
Comber	552	1 384	346	20.0	23	2.50	3	17
Drawing frame I	563	1 377	7	0.5	16	2.44	4	40
Drawing frame II	563	1 370	7	0.5	16	2.43	4	40
Roving frame	12.075	1 363	7	0.5	23	113	112	-
Ring spinning frame	0.225	1 350	13	1.0	23	6 000	6 000	-
Cone winder	10.419	1 337	13	1.0	23	128	130	-
Pirn winder	7.452	560	2	0.5	23	75	72	-
Warper	4 025	772	3	0.5	8	0.19	1	80
Slesher	2 484	769	3	0.5	8	0.30	1	70
Loom	10.315 (79.35 m)	1 329 (10 223 m)	-	-	23	129	130	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	1 914			
Waste recovered (kilogrammes)	32	Total waste	585	30.7
Daily consumption of cotton (kilogrammes)	1 882	Waste recovered	32	2.7
Annual consumption of cotton (kilogrammes)	565	Net waste	553	28.0

/Table U

Table V

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category III: 10 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	3 063	127	4.0	23	0.74	1	26
Card	322	2 910	153	5.0	23	9.03	9	-
Drawing frame (preombing)	1 127	2 896	14	0.5	16	2.57	4	36
Lap machine	3 312	2 882	14	0.5	23	0.87	1	13
Comber	552	2 306	576	20.0	23	4.18	5	17
Drawing frame I	563	2 295	11	0.5	23	4.07	4	-
Drawing frame II	563	2 284	11	0.5	23	4.05	4	-
Roving frame	12.075	2 273	11	0.5	23	188	188	-
Ring spinning frame	0.225	2 250	23	1.0	23	10 000	10 000	-
Cone winder	10.419	2 228	22	1.0	23	214	214	-
Pirn winder	7.452	931	5	0.5	23	125	124	-
Warper	4 025	1 286	6	0.5	8	0.32	1	68
Slasher	2 484	1 280	6	0.5	16	0.51	1	49
Loom	10.315 (79.35 m)	2 211 (17 007 m)	-	-	23	214	214	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	3 190			
Waste recovered (kilogrammes)	86	Total waste	979	30.7
Daily consumption of cotton (kilogrammes)	3 104	Waste recovered	86	2.7
Annual consumption of cotton (kilogrammes)	931	Net waste	903	28.0

/Table V

Table V

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category IV: 18 500-spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	5 671	236	4.0	16	1.36	2	32
Card	322	5 388	283	5.0	23	16.7	17	-
Drawing frame (precombing)	1 127	5 361	27	0.5	23	4.75	6	21
Lap machine	3 312	5 334	27	0.5	23	1.61	2	20
Comber	552	4 267	1 067	20.0	23	7.73	8	-
Drawing frame I	563	4 246	21	0.5	23	7.54	8	6
Drawing frame II	563	4 225	21	0.5	23	7.50	8	6
Roving frame	12.075	4 204	21	0.5	23	348	348	-
Ring spinning frame	0.225	4 162	42	1.0	23	18 500	18 500	-
Cone winder	10.419	4 120	42	1.0	23	395	396	-
Pirn winder	7.452	1 722	8	0.5	23	231	230	-
Warper	4 025	2 378	12	0.5	16	0.59	1	41
Slasher	2 484	2 366	12	0.5	23	0.95	1	5
Loom	10.315 (79.35 m)	4 088 (31 446 m)	-	-	23	396	396	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	5 907			
Waste recovered (kilogrammes)	159	Total waste	1 819	30.7
Daily consumption of cotton (kilogrammes)	5 748	Waste recovered	159	2.7
Annual consumption of cotton (kilogrammes)	1 724	Net waste	1 660	28.0

/Table W

Table W

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category V; 26 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	7 970	332	4.0	23	1.9	2	5
Card	322	7 572	398	5.0	23	23.5	24	-
Drawing frame (precombing)	1 127	7 534	38	0.5	23	6.7	8	17
Lap machine	3 312	7 497	37	0.5	23	2.3	3	24
Comber	552	5 998	1 499	20.0	23	10.8	11	-
Drawing frame I	563	5 968	30	0.5	23	10.6	12	12
Drawing frame II	563	5 938	30	0.5	23	10.5	12	12
Roving frame	12.075	5 909	29	0.5	23	489	490	-
Ring spinning frame	0.225	5 850	59	1.0	23	26 000	26 000	-
Cone winder	10.419	5 792	58	1.0	23	556	560	-
Pirn winder	7.452	2 421	12	0.5	23	325	324	-
Warper	4 025	3 343	16	0.5	23	0.8	1	20
Slasher	2 484	3 327	16	0.5	23	1.3	2	35
Loom	10.315 (79.35 m)	5 748 (44 215 m)	-	-	23	557	560	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	8 302			
Waste recovered (kilogrammes)	224	Total waste	2 554	30.7
Daily consumption of cotton (kilogrammes)	8 078	Waste recovered	224	2.7
Annual consumption of cotton (tons)	2 423	Net waste	2 330	28.0

/Table X

Table X

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabrics. Size category VI: 37 000 spindles)

Machine	Production: Daily unit output (kilogrammes)	Production: Total daily output required (kilogrammes)	Waste per day: Kilogrammes	Waste per day: Percentage	Number of working hours per day	Number of production units: Theoretical	Number of production units: Actual	Idle capacity (percentage)
Scutcher	4 140	11 342	472	4.0	23	2.7	3	10
Card	322	10 775	567	5.0	23	33.4	35	-
Drawing frame (pre-combing)	1 127	10 721	54	0.5	23	9.5	10	-
Lap machine	3 312	10 668	53	0.5	23	3.2	4	20
Comber	552	8 535	2 133	20.0	23	15.4	16	-
Drawing frame I	563	8 493	42	0.5	23	15.0	16	-
Drawing frame II	563	8 451	42	0.5	23	15.0	16	-
Roving frame	12.075	8 409	42	0.5	23	696	700	-
Ring spinning frame	0.225	8 325	84	1.0	23	37 000	37 000	-
Cone winder	10.419	8 242	83	1.0	23	792	800	-
Pirn winder	7.452	3 445	17	0.5	23	462	460	-
Warper	4 025	4 756	24	0.5	16	1.2	2	40
Slasher	2 484	4 732	24	0.5	23	1.9	2	-
Loom	10.315 (79.35 m)	8 177 (62 900 m)	-	-	23	793	800	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	11 814			
Waste recovered (kilogrammes)	319	Total waste	3 637	30.7
Daily consumption of cotton (kilogrammes)	11 495	Waste recovered	319	2.7
Annual consumption of cotton (tons)	3 448	Net waste	3 318	28.0

/Table I

Table Y

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabric: Size category VII: 60 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	18 396	766	4.0	23	4.4	5	12
Card	322	17 476	920	5.0	23	54.2	54	-
Drawing frame (preombing)	1 127	17 389	87	0.5	23	15.4	16	-
Lap machine	3 312	17 302	87	0.5	23	5.2	6	14
Comber	552	13 842	3 460	20.0	23	25	25	-
Drawing frame I	563	13 773	69	0.5	23	24.4	26	7
Drawing frame II	563	13 704	69	0.5	23	24.3	26	7
Roving frame	12.075	13 636	68	0.5	23	1 129	1 130	-
Ring spinning frame	0.225	13 500	136	1.0	23	60 000	60 000	-
Cone winder	10.419	13 365	135	1.0	23	1 282	1 280	-
Pirn winder	7.452	5 585	28	0.5	23	749	750	-
Warper	4 025	7 714	38	0.5	23	1.9	2	-
Slasher	2 484	7 676	38	0.5	23	3.0	3	-
Loom	10.315 (79.35 m)	13 261 (102 007 m)	-	-	23	1 285	1 280	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	19 162			
Waste recovered (kilogrammes)	517	Total waste	5 901	30.7
Daily consumption of cotton (kilogrammes)	18 654	Waste recovered	517	2.7
Annual consumption of cotton (tons)	5 593	Net waste	5 384	28.0

/Table Z

Table 2

DAILY OUTPUT AND MACHINE REQUIREMENTS

(Fine fabrics: Size category VIII: 100 000 spindles)

Machine	Production		Waste per day		Number of working hours per day	Number of production units		Idle capacity (percentage)
	Daily unit output (kilogrammes)	Total daily output required (kilogrammes)	Kilogrammes	Percentage		Theoretical	Actual	
Scutcher	4 140	30 662	1 278	4.0	23	7.4	8	8
Card	322	29 129	1 593	5.0	23	90.4	90	-
Drawing frame (precombing)	1 127	28 984	145	0.5	23	25.7	26	-
Lap machine	3 322	28 839	145	0.5	23	8.7	9	-
Comber	552	23 071	5 768	20.0	23	41.8	42	-
Drawing frame I	563	22 956	115	0.5	23	40.7	42	-
Drawing frame II	563	22 841	115	0.5	23	40.6	42	-
Roving frame	12.079	22 727	114	0.5	23	1 882	1 880	-
Ring spinning frame	0.225	22 500	227	1.0	23	100 000	100 000	-
Cone winder	10.419	22 275	225	1.0	23	2 138	2 140	-
Pirn winder	7.452	9 308	47	0.5	23	1 249	1 250	-
Warper	4 025	12 855	65	0.5	23	3.2	4	20
Slasher	2 484	12 791	64	0.5	23	5.1	6	15
Loom	10.315 (79.35 m)	22 099 (169 992 m)	-	-	23	2 142	2 140	-

			Kilogrammes	Percentage
Total input of cotton (kilogrammes)	31 940			
Waste recovered (kilogrammes)	862	Total waste	9 841	30.7
Daily consumption of cotton (kilogrammes)	31 078	Waste recovered	862	2.7
Annual consumption of cotton (tons)	9 323	Net waste	8 979	28.0

Table

PRODUCT A, COARSE FABRIC: MACHIN

(F.o.b. price

Equipment specification	Unit price	Size I 2 000 spindles		Size II 6 000 spindles		Size III 10 000 spindles	
		Number required	Total cost	Number required	Total cost	Number required	Total cost
I. Main equipment			541 480		1 453 600		2 404 700
A. Spinning			269 620		692 700		1 111 400
1. Feeders	4 000	4	16 000	6	24 000	8	32 000
2. Opening equipment, comprising waste spinner, feed boxes, magnetic separators, dust extractors, etc.	18 000	1	1 800	1	18 000	1	18 000
3. Single process equipment and apparatus, comprising blenders, distributors, dust filters, etc.	12 000	1	12 000	1	12 000	2	24 000
4. Scutchers	16 500	1	16 500	3	49 500	4	66 000
5. Cards	10 000	6	60 000	17	170 000	27	270 000
6. Drawing frames	2 850	8	22 800	16	45 600	28	79 800
7. Roving frames	160	152	24 320	460	73 600	760	121 600
8. Ring spinning frames	41	2 000	82 000	6 000	246 000	10 000	410 000
9. Cone winders	180	100	18 000	300	54 000	500	90 000
B. Weaving			273 860		760 900		1 293 300
1. Pirn winders	340	54	18 360	160	54 400	270	91 800
2. Warping machines	12 000	1	12 000	1	12 000	2	24 000
3. Slasher	30 000	1	30 000	2	60 000	4	120 000
4. Looms	2 350	90	211 500	270	634 500	450	1 057 500
II. Auxiliary equipment			23 000		23 000		23 000
A. Spinning			8 600		8 600		8 600
1. Scales of different kinds	1 000	2	2 000	2	2 000	2	2 000
2. Carts for handling material	200	1	200	1	200	1	200
3. Fork lift	3 000	1	3 000	1	3 000	1	3 000
4. Card maintenance equipment	600	1	600	1	600	1	600
5. Cylinder maintenance equipment	2 800	1	2 800	1	2 800	1	2 800
B. Weaving			14 400		14 400		14 400
1. Knotters	6 000	1	6 000	1	6 000	1	6 000
2. Size preparation equipment	3 200	1	3 200	1	3 200	1	3 200
3. Carts for handling material	200	1	200	1	200	1	200
4. Drill stripper	5 000	1	5 000	1	5 000	1	5 000
III. Accessories			18 908		51 951		87 901
A. Spinning			9 298		29 241		48 631
1. Lap rods (3 per card)	1	18	18	51	51	81	81
2. Card sliver cans (2 per card)	15	12	180	34	510	54	810
3. Drawing frame cans (7 for each delivery plus 2 per intermediate bobbin)	15	360	5 400	1 032	15 480	1 716	25 740
4. Roving bobbins (2.5 per ring spindle) thousands	700	5	3 500	15	10 500	25	17 500
5. Ring frame bobbins (3 per ring spindle) thousands	150	6	900	18	2 700	30	4 500
B. Weaving			8 910		22 710		39 270
1. Pirns (20 per spindle and 30 per loom) thousands	150	4	600	11	1 650	19	2 850
2. Wooden cones (2 per spindle and 2 000 per warper) thousands	300	2	600	3	900	5	1 500
3. Cylinders for warpers (10 per slasher and 4 per warper)	165	14	2 310	24	3 960	48	7 920
4. Harness, reeds, shuttles, etc. (60 dollars per loom)	60	90	5 400	270	16 200	450	27 000
IV. Miscellaneous			115 393		218 257		315 165
A. Machine shop	-	-	30 000	-	40 000	-	40 000
B. Laboratory	-	-	25 000	-	25 000	-	25 000
C. Furniture and equipment	-	-	3 000	-	3 000	-	3 000
D. Spare parts (5 per cent of I and II)	-	-	28 224	-	73 830	-	121 385
E. Contingencies (5 per cent of I, II and III)	-	-	29 169	-	76 427	-	125 780
Total spinning			288 218		730 541		1 168 631
Total weaving			295 170		798 010		1 346 970
Total miscellaneous			115 393		218 257		315 165
Grand total			698 781		1 746 808		2 830 766

AA

KEY INVESTMENT REQUIREMENTS

(in dollars)

Size IV 18 500 spindles		Size V 26 000 spindles		Size VI 37 000 spindles		Size VII 60 000 spindles		Size VIII 100 000 spindles	
Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost
	4 368 500		6 148 700		8 720 200		14 104 700		20 416 200
	2 032 000		2 843 200		4 097 200		6 500 900		10 747 200
14	56 000	20	80 000	28	112 000	34	136 000	52	208 000
2	36 000	2	36 000	3	54 000	5	90 000	8	144 000
3	36 000	4	48 000	5	60 000	7	84 000	9	108 000
7	115 500	10	165 000	14	231 000	23	379 500	38	627 000
50	500 000	70	700 000	100	1 000 000	163	1 630 000	270	2 700 000
48	136 800	68	193 800	96	273 600	156	444 600	260	741 000
1 400	224 000	1 980	316 800	2 820	451 200	4 560	729 600	7 620	1 219 200
18 500	758 500	26 000	1 066 000	37 000	1 517 000	60 000	2 460 000	100 000	4 100 000
940	169 200	1 320	237 600	1 880	338 400	3 040	547 200	5 000	900 000
	2 336 500		3 305 500		4 673 000		7 601 800		12 663 000
500	170 000	700	238 000	1 000	340 000	1 620	550 800	2 700	918 000
3	36 000	4	48 000	6	72 000	9	108 000	15	180 000
6	180 000	9	270 000	12	360 000	20	600 000	33	990 000
830	1 950 500	1 170	2 749 500	1 660	3 901 000	2 720	6 345 000	4 500	10 575 000
	32 600		42 200		59 600		96 200		155 600
	8 800		9 000		12 000		17 200		18 400
2	2 000	2	2 000	2	2 000	3	3 000	3	3 000
2	400	3	600	4	800	6	1 200	10	2 000
1	3 000	1	3 000	1	3 000	2	6 000	2	6 000
1	600	1	600	2	600	2	1 200	3	1 800
1	2 800	1	2 800	2	5 600	2	5 600	2	5 600
	23 800		33 200		47 600		68 200		92 800
2	12 000	3	18 000	4	24 000	7	42 000	11	66 000
2	6 400	3	9 600	4	12 800	5	16 000	6	19 200
2	400	3	600	4	800	6	1 200	10	2 000
1	5 000	1	5 000	2	10 000	2	10 000	2	10 000
	161 170		224 390		317 690		525 650		1 009 310
	91 840		126 050		179 050		290 560		574 840
150	150	210	210	300	300	490	490	810	810
100	1 500	140	2 100	200	3 000	326	4 890	540	8 100
3 316	49 740	4 436	66 540	6 312	94 680	10 212	153 180	27 650	414 750
46	32 200	65	45 500	92	64 400	150	105 000	250	175 000
55	8 250	78	11 700	111	16 650	180	27 000	300	45 000
	69 330		98 340		136 660		225 090		374 700
35	5 250	49	7 350	70	10 500	113	16 950	189	28 350
8	2 400	11	3 300	16	4 800	24	7 200	40	12 000
72	11 880	106	17 490	144	23 760	236	38 940	390	64 350
830	49 800	1 170	70 200	1 660	99 600	2 700	162 000	4 500	270 000
	527 169		710 310		983 865		1 347 875		2 518 056
-	50 000	-	50 000	-	60 000	-	70 000	-	80 000
-	25 000	-	25 000	-	25 000	-	25 000	-	25 000
-	4 000	-	5 000	-	6 000	-	8 000	-	10 000
-	220 055	-	309 545	-	438 490	-	709 545	-	1 176 290
-	228 114	-	320 765	-	454 375	-	735 328	-	1 226 768
	2 132 640		2 978 250		4 228 230		6 808 460		11 409 410
	2 429 630		3 437 040		4 859 250		7 898 890		13 134 900
	527 169		710 310		983 865		1 347 875		2 518 056
	5 089 439		7 125 600		10 071 355		16 254 423		27 062 366

Table

PRODUCT B, MEDIUM FABRIC: MACHINE

(F.o.b. price

Equipment specification	Unit price	Size I 2 000 spindles Number required	Size I 2 000 spindles Total cost	Size II 6 000 spindles Number required	Size II 6 000 spindles Total cost	Size III 10 000 spindles Number required	Size III 10 000 spindles Total cost
I. Main equipment			439 580		1 112 600		1 760 520
A. Spinning			202 680		492 900		776 960
1. Feeders	4 000	4	16 000	4	16 000	4	16 000
2. Opening equipment, comprising waste openers, feed boxes, magnetic separators, dust extractors, etc.	18 000	1	18 000	1	18 000	1	18 000
3. Simple process equipment and apparatus, comprising blenders, distributors, dust filters, etc.	12 000	1	12 000	1	12 000	1	12 000
4. Scutchers	16 500	1	16 500	1	16 500	2	33 000
5. Cards	10 000	3	30 000	2	20 000	14	140 000
6. Drawing frames	2 850	2	5 700	8	22 800	12	34 200
7. Roving frames	150	68	10 200	200	30 000	324	51 840
8. Ring spinning frames	41	2 000	82 000	6 000	246 000	10 000	410 000
9. Cone winders	180	70	12 600	220	39 600	344	61 920
B. Weaving			229 870		620 700		1 003 560
1. Pirn winders	340	48	16 320	140	47 600	224	76 160
2. Warping machines	12 000	1	12 000	1	12 000	1	12 000
3. Slasher	30 000	1	30 000	1	30 000	2	60 000
4. Looms	2 350	73	171 550	226	531 100	361	839 400
II. Auxiliary equipment			29 000		23 000		22 000
A. Spinning			8 600		8 600		8 600
1. Scales of different kinds	1 000	2	2 000	2	2 000	2	2 000
2. Carts for handling material	200	1	200	1	200	1	200
3. Fork lift	3 000	1	3 000	1	3 000	1	3 000
4. Card maintenance equipment	600	1	600	1	600	1	600
5. Cylinder maintenance equipment	2 800	1	2 800	1	2 800	1	2 800
B. Weaving			14 400		14 400		14 400
1. Hauttors	6 000	1	6 000	1	6 000	1	6 000
2. Size preparation equipment	3 200	1	3 200	1	3 200	1	3 200
3. Carts for handling material	200	1	200	1	200	1	200
4. Cull stripper	5 000	1	5 000	1	5 000	1	5 000
III. Accessories			14 489		26 132		42 392
A. Spinning			6 749		20 332		32 762
1. Lap rods (3 per card)	1	9	9	27	27	42	42
2. Card clothe cans (2 per card)	15	6	90	18	270	28	420
3. Drawing frame cans (7 for each delivery plus 2 per intermediate bobbin)	15	150	2 250	456	6 840	722	10 830
4. Roving bobbins (205 per ring spindle) thousand	700	5	3 500	15	10 500	25	17 500
5. Ring frame bobbins (3 per ring spindle) thousand	150	6	900	18	2 700	30	4 500
B. Weaving			7 740		17 820		28 950
1. Pirns (20 per spindle and 30 per loom) thousand	150	3	450	9	1 350	15	2 250
2. Wooden cones (2 per spindle and 2 000 per warper) thousand	300	2	600	2	600	3	900
3. Cylinders for warpers (10 per slasher and 4 per warper)	165	14	2 310	14	2 310	24	3 960
4. Harness, reeds, shuttles, etc. (60 dollars per loom)	60	73	4 380	226	13 560	364	21 840
IV. Miscellaneous			104 380		183 568		251 457
A. Machine shop	-	-	30 000	-	40 000	-	40 000
B. Laboratory	-	-	25 000	-	25 000	-	25 000
C. Furniture and equipment	-	-	3 000	-	3 000	-	3 000
D. Spare parts (5 per cent of I and II)	-	-	22 826	-	56 830	-	90 376
E. Contingencies (5 per cent of I, II and III)	-	-	23 552	-	58 738	-	93 281
Total spinning			219 029		521 837		818 702
Total weaving			252 010		652 920		1 074 910
Total miscellaneous			104 380		183 568		251 457
Grand total			575 419		1 358 325		2 137 069

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ERY INVESTMENT REQUIREMENTS

in dollars)

Size IV 18 500 spindles		Size V 26 000 spindles		Size VI 37 000 spindles		Size VII 60 000 spindles		Size VIII 100 000 spindles	
Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost
	3 232 920		4 564 000		6 471 800		10 431 100		17 288 700
	1 391 480		1 960 300		2 777 600		4 481 000		7 404 400
6	24 000	8	32 000	10	40 000	16	64 000	24	96 000
1	18 000	1	18 000	2	36 000	3	54 000	4	72 000
1	12 000	2	24 000	3	36 000	4	48 000	6	72 000
3	49 500	5	82 500	6	99 000	10	165 000	16	264 000
26	260 000	36	360 000	51	510 000	82	820 000	136	1 360 000
20	57 000	28	79 800	40	114 000	64	182 400	104	296 400
608	97 280	850	136 000	1 220	195 200	1 980	316 800	3 280	524 800
18 500	758 500	26 000	1 066 000	37 000	1 517 000	60 000	2 460 000	100 000	4 100 000
640	115 200	900	162 000	1 280	230 400	2 060	370 800	3 440	619 200
	1 841 440		2 603 700		3 694 200		5 350 100		8 884 900
416	141 440	580	197 200	830	282 200	1 340	455 600	2 220	754 800
1	12 000	1	24 000	3	36 000	4	48 000	6	72 000
3	90 000	5	150 000	6	180 000	10	300 000	16	480 000
680	1 598 000	950	2 232 500	1 360	3 196 000	2 190	5 146 500	3 650	8 577 500
	29 000		22 400		41 800		61 400		92 200
	8 600		8 800		11 800		16 000		16 400
2	2 000	2	2 000	2	2 000	3	3 000	3	3 000
1	200	2	400	3	600	4	800	6	1 200
1	3 000	1	3 000	1	3 000	2	6 000	3	6 000
1	600	1	600	1	600	1	600	1	600
1	2 800	1	2 800	2	5 600	2	5 600	2	5 600
	20 400		20 600		30 000		45 400		74 800
2	12 000	2	12 000	3	18 000	5	30 000	9	54 000
1	3 200	1	3 200	2	6 400	3	9 600	5	9 600
1	200	2	400	3	600	4	800	6	1 200
1	5 000	1	5 000	1	5 000	1	5 000	2	10 000
	113 308		161 198		228 113		360 766		615 248
	61 648		86 828		123 533		200 826		333 608
78	78	108	108	153	153	246	246	408	408
52	780	72	1 080	102	1 530	164	2 460	272	4 080
1 356	20 340	1 896	28 440	2 720	40 800	4 408	66 120	7 288	109 320
46	32 200	65	45 500	92	64 400	150	105 000	250	175 000
55	8 250	78	11 700	111	16 650	180	27 000	300	45 000
	51 660		74 370		104 580		167 940		281 460
29	4 350	40	6 000	58	8 700	92	13 800	154	23 100
3	900	6	1 800	8	2 400	12	3 600	19	5 700
34	5 610	58	9 570	72	11 880	116	19 140	204	33 660
680	40 800	950	57 000	1 360	81 600	2 190	131 400	3 650	219 000
	400 857		547 400		743 766		1 160 688		1 873 753
-	40 000	-	50 000	-	50 000	-	60 000	-	70 000
-	25 000	-	25 000	-	25 000	-	25 000	-	25 000
-	4 000	-	5 000	-	6 000	-	8 000	-	10 000
-	163 096	-	229 670	-	325 680	-	524 625	-	868 995
-	168 761	-	237 730	-	337 086	-	543 063	-	899 758
	1 461 728		2 055 938		2 912 933		4 697 826		7 754 608
	1 913 500		2 698 670		3 828 780		6 163 440		10 240 560
	400 857		547 400		743 766		1 160 688		1 873 753
	3 776 085		5 301 998		7 485 479		12 021 954		19 868 921

Table

PRODUCT C, FINE FABRIC; MACHIN

(Pounds price

Equipment specification	Unit price	Size I 2 000 spindles Number required	Size I 2 000 spindles Total cost	Size II 6 000 spindles Number required	Size II 6 000 spindles Total cost	Size III 10 000 spindles Number required	Size III 10 000 spindles Total cost
I. Main equipment			267 730		861 130		1 333 960
A. Spinning			216 520		489 120		746 800
1. Feeders	4 000	4	16 000	4	16 000	4	16 000
2. Opening equipment, comprising waste openers, feed boxes, automatic separators, dust extractors, etc.	18 000	1	18 000	1	18 000	1	18 000
3. Single process equipment and apparatus, comprising blenders, distributors, dust filters, etc.	12 000	1	12 000	1	12 000	1	12 000
4. Scutchers	16 500	1	16 500	1	16 500	1	16 500
5. Cards	10 000	2	20 000	6	60 000	9	90 000
6. Drawing frames (pre-combing)	2 850	2	5 700	2	5 700	4	11 400
7. Lap machines	5 800	1	5 800	1	5 800	1	5 800
8. Combers	15 400	1	15 400	3	46 200	5	77 000
9. Drawing frames	2 700	4	10 800	8	21 600	8	21 600
10. Roving frames	160	40	6 400	112	17 920	188	30 080
11. Ring spinning frames	41	2 000	82 000	6 000	246 000	10 000	410 000
12. Cone winders	180	44	7 920	130	23 400	214	38 520
B. Weaving			151 210		37 280		587 040
1. Pirn winders	340	24	8 160	72	24 480	124	42 160
2. Warping machines	12 000	1	12 000	1	12 000	1	12 000
3. Sizehor	30 000	1	30 000	1	30 000	1	30 000
4. Looms	2 350	43	101 050	130	305 500	214	502 900
II. Auxiliary equipment			23 000		23 000		23 000
A. Spinning			8 600		8 600		8 600
1. Scales of different kinds	1 000	2	2 000	2	2 000	2	2 000
2. Carts for handling material	200	1	200	1	200	1	200
3. Fork lift	3 000	1	3 000	1	3 000	1	3 000
4. Card maintenance equipment	600	1	600	1	600	1	600
5. Cylinder maintenance equipment	2 800	1	2 800	1	2 800	1	2 800
B. Weaving			14 400		14 400		14 400
1. Furbers	6 000	1	6 000	1	6 000	1	6 000
2. Size preparation equipment	3 200	1	3 200	1	3 200	1	3 200
3. Carts for handling material	200	1	200	1	200	1	200
4. Cell stripper	5 000	1	5 000	1	5 000	1	5 000
III. Accessories			11 896		27 918		43 922
A. Spinning			6 196		16 458		25 122
1. Lap rods (3 per card)	1	6	6	18	18	27	27
2. Card clover cans (2 per card)	15	4	60	12	180	18	270
3. Drawing frame cans (7 for each delivery plus 2 for intermediate bobbin)	15	120	1 800	300	4 500	450	6 750
4. Lap machine cans (32 per machine)	15	32	480	32	480	32	480
5. Combor clover cans (4 per machine)	15	4	60	12	180	20	300
6. Roving bobbins (2 per ring spindle)	thousands 700	4	2 800	12	8 400	20	14 000
7. Ring frame bobbins (3 per ring spindle)	thousands 150	6	900	18	2 700	30	4 500
B. Weaving			5 700		11 460		17 800
1. Pirns (20 per spindle and 30 per loom)	thousands 150	2	300	5	750	9	1 350
2. Weaver cones (2 per spindle and 2 000 per warper)	thousands 300	2	600	2	600	3	900
3. Cylinders for warpers (10 per sizehor and 4 per warper)	165	14	2 310	14	2 310	14	2 310
4. Harness, reeds, shuttles, etc. (60 dollars per loom)	60	43	2 580	130	7 800	214	12 840
IV. Miscellaneous			27 658		157 806		205 890
A. Machine shop	-	-	30 000	-	40 000	-	40 000
B. Laboratory	-	-	25 000	-	25 000	-	25 000
C. Furniture and equipment	-	-	3 000	-	3 000	-	3 000
D. Spare parts (5 per cent of I and II)	-	-	19 537	-	44 205	-	67 848
E. Contingencies (5 per cent of I, II and III)	-	-	20 131	-	45 601	-	70 042
Total spinning			232 226		514 178		781 977
Total weaving			171 400		397 840		618 840
Total miscellaneous			97 658		157 806		205 890
Grand total			509 284		1 069 824		1 606 727

ERY INVESTMENT REQUIREMENTS

in dollars)

Size IV 18 500 spindles		Size V 25 000 spindles		Size VI 37 000 spindles		Size VII 60 000 spindles		Size VIII 100 000 spindles	
Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost	Number required	Total cost
	2 380 360		3 336 760		4 752 400		7 588 500		12 647 900
	1 329 560		1 838 600		2 629 000		4 213 500		6 965 900
4	16 000	4	16 000	6	24 000	10	40 000	16	64 000
1	18 000	1	18 000	1	18 000	2	36 000	2	36 000
1	12 000	1	12 000	2	24 000	3	36 000	4	48 000
2	33 000	2	33 000	3	49 500	5	82 500	8	132 000
17	170 000	24	240 000	35	350 000	54	540 000	90	900 000
6	17 100	8	22 800	10	28 500	16	45 600	26	74 100
2	11 600	3	17 400	4	23 200	6	34 800	9	52 200
8	123 200	11	169 400	16	246 400	25	385 000	42	646 800
16	43 200	24	64 800	32	86 400	52	140 400	84	226 800
348	55 680	490	78 400	700	112 000	1 130	180 800	1 880	300 800
18 500	758 500	26 000	1 066 000	37 000	1 517 000	60 000	2 460 000	100 000	4 100 000
396	71 280	560	100 800	800	144 000	1 280	230 400	2 140	385 200
	1 050 800		2 498 160		2 120 400		3 377 000		5 682 000
230	78 200	324	110 160	460	156 400	750	255 000	1 250	425 000
1	12 000	1	12 000	2	24 000	2	24 000	4	48 000
1	30 000	2	60 000	2	60 000	3	90 000	6	180 000
396	930 600	560	1 316 000	800	1 880 000	1 280	3 008 000	2 140	5 029 000
	23 000		29 400		32 200		42 600		55 400
	8 600		8 800		11 600		15 800		16 200
2	2 000	2	2 000	2	2 000	3	3 000	3	3 000
1	200	2	400	2	400	3	600	5	1 000
1	3 000	1	3 000	1	3 000	2	6 000	2	6 000
1	600	1	600	1	600	1	600	1	600
1	2 800	1	2 800	2	5 600	2	5 600	2	5 600
	14 400		20 600		20 600		26 000		33 200
1	6 000	2	12 000	2	12 000	3	18 000	5	30 000
1	3 200	1	3 200	1	3 200	1	3 200	1	3 200
1	200	2	400	2	400	3	600	5	1 000
1	5 000	1	5 000	1	5 000	1	5 000	1	5 000
	28 121		110 302		157 055		230 482		422 850
	48 721		68 902		27 285		157 662		252 210
51	51	72	72	105	105	162	162	270	270
510	510	48	720	70	1 050	108	1 620	180	2 700
850	12 750	1 200	18 000	1 700	25 500	2 700	40 500	4 500	67 500
64	960	96	1 440	128	1 920	192	2 880	288	4 320
32	480	44	660	64	960	100	1 500	168	2 520
37	25 900	52	36 400	74	51 800	120	84 000	200	140 000
54	8 100	78	11 700	111	16 650	180	27 000	300	45 000
	29 370		41 910		52 070		92 820		153 540
16	2 400	23	3 450	33	4 950	53	7 950	100	15 000
3	900	3	900	5	1 500	6	1 800	12	3 600
14	2 310	24	3 960	28	4 620	38	6 270	76	12 540
396	23 760	560	33 600	800	48 000	1 280	76 800	2 140	128 400
	213 242		422 161		566 413		868 635		1 396 423
-	40 000	-	50 000	-	50 000	-	60 000	-	70 000
-	25 000	-	25 000	-	25 000	-	25 000	-	25 000
-	4 000	-	5 000	-	6 000	-	8 000	-	10 000
-	120 168	-	168 308	-	238 780	-	381 555	-	635 165
-	124 074	-	173 852	-	246 633	-	394 080	-	656 258
	1 385 911		1 916 392		2 732 585		4 384 962		7 244 410
	1 054 570		1 560 670		2 200 070		3 496 620		5 880 740
	313 242		422 161		566 413		868 635		1 396 423
	2 754 723		3 899 223		5 499 068		8 750 217		14 521 573

Table DD

INVESTMENT REQUIRED FOR BUILDINGS AND ANCILLARY FITTINGS

(Dollars)

Specifications	Cost per square	Size I 2 000 spindles		Size II 6 000 spindles		Size III 10 000 spindles		Size IV 18 500 spindles		Size V 26 000 spindles		Size VI 37 000 spindles		Size VII 60 000 spindles		Size VIII 100 000 spindles	
		Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost	Area needed (m^2)	Total cost
Product A - coarse fabric																	
I. Buildings - total area	-	1 920	150 100	8 970	339 500	13 470	506 500	23 350	875 800	31 200	1 164 800	43 000	1 600 400	54 400	2 385 600	102 500	3 764 400
A. Production area	36	2 800	100 800	6 500	248 400	10 780	388 100	19 170	690 100	26 000	936 000	36 440	1 311 800	56 000	2 016 000	93 200	3 355 200
B. Services area	44	1 120	49 300	2 070	91 100	2 690	118 400	4 220	185 700	5 200	228 800	6 560	288 600	8 400	369 600	9 300	409 200
II. Light and power installations	12	-	47 000	-	107 000	-	161 000	-	280 000	-	374 000	-	516 000	-	773 000	-	1 230 000
III. Air conditioning	15	-	58 800	-	134 000	-	202 000	-	351 000	-	468 000	-	645 000	-	966 000	-	1 537 000
IV. Water and steam supplies (including boilers)	-	-	9 000	-	25 600	-	40 500	-	70 500	-	93 600	-	129 500	-	189 000	-	292 000
Total cost	-	-	264 900	-	606 100	-	910 000	-	1 577 300	-	2 100 400	-	2 885 900	-	4 313 600	-	6 823 400
Product B - medium fabric																	
I. Buildings - total area	-	3 660	140 100	7 340	277 800	11 100	417 400	19 150	717 000	25 870	969 500	35 160	1 308 600	52 200	1 933 600	82 800	3 040 800
A. Production area	36	2 615	94 100	5 645	203 200	8 880	319 700	15 760	565 200	21 640	779 000	29 800	1 072 800	45 400	1 634 400	75 300	2 710 800
B. Services area	44	1 045	46 000	1 695	74 600	2 220	97 700	3 450	151 800	4 330	190 500	5 360	235 800	6 800	299 200	7 500	330 000
II. Light and power installations	12	-	43 900	-	88 000	-	133 000	-	230 000	-	311 000	-	422 000	-	626 000	-	993 000
III. Air conditioning	15	-	55 000	-	110 000	-	166 000	-	287 000	-	389 000	-	527 000	-	783 000	-	1 242 000
IV. Water and steam supplies (including boilers)	-	-	6 600	-	17 200	-	29 100	-	51 000	-	66 500	-	88 400	-	131 400	-	200 000
Total cost	-	-	245 600	-	493 000	-	745 500	-	1 285 000	-	1 736 000	-	2 346 000	-	3 474 000	-	5 475 800
Product C - fine fabric																	
I. Buildings - total area	-	2 760	105 700	5 320	201 300	6 610	248 500	11 580	433 600	15 910	594 000	21 980	816 100	32 080	1 188 300	50 600	1 858 400
A. Production area	36	1 970	70 900	4 090	147 200	5 250	190 400	9 490	341 600	13 260	477 400	18 630	670 700	27 500	1 004 400	46 000	1 656 000
B. Services area	44	790	34 800	1 230	54 100	1 320	58 100	2 090	92 000	2 650	116 600	3 350	147 400	4 180	183 900	4 600	202 400
II. Light and power installations	12	-	33 000	-	63 800	-	79 000	-	139 000	-	191 000	-	264 000	-	385 000	-	607 000
III. Air conditioning	15	-	41 400	-	80 000	-	99 000	-	174 000	-	238 000	-	330 000	-	481 000	-	759 000
IV. Water and steam supplies (including boilers)	-	-	4 500	-	10 700	-	15 000	-	25 700	-	33 600	-	44 000	-	64 000	-	96 300
Total cost	-	-	184 600	-	355 800	-	441 500	-	772 300	-	1 056 600	-	1 456 100	-	2 118 300	-	3 320 700

ESTIMATED MINIMUM WORKING CAPITAL NEEDED FOR MILL OPERATION, ACCORDING TO EACH HYPOTHESIS CONSIDERED

(Dollars)

Concept	Size I 2 000 spindles	Size II 6 000 spindles	Size III 10 000 spindles	Size IV 18 500 spindles	Size V 26 000 spindles	Size VI 37 000 spindles	Size VII 60 000 spindles	Size VIII 100 000 spindles
Product A - coarse fabric								
1. Minimum stock raw cotton	93 800	281 000	469 100	867 900	1 219 800	1 736 000	2 815 000	4 691 800
2. Material in course of processing	25 600	68 200	111 600	204 400	286 200	405 800	655 300	1 087 200
3. Stock of finished products	12 800	34 100	55 800	102 200	143 100	202 900	327 600	543 600
4. Stock of spare parts and ancillary materials	10 800	29 100	48 100	87 400	123 000	174 200	282 100	468 200
5. Minimum cash supply	7 700	20 500	33 500	61 900	85 800	121 700	196 600	326 200
Total working capital	150 700	452 900	718 100	1 325 000	1 857 900	2 640 600	4 276 600	7 117 000
Product B - medium fabric								
1. Minimum stock of raw cotton	44 200	137 000	219 600	411 000	574 500	822 000	1 325 800	2 209 700
2. Material in course of processing	14 600	36 400	56 800	103 100	143 700	203 300	327 700	563 800
3. Stock of finished products	7 300	18 200	28 400	51 600	71 800	101 700	162 800	268 400
4. Stock of spare parts and ancillary materials	88 700	22 300	35 600	64 600	91 300	129 400	208 600	345 600
5. Minimum cash supply	4 400	10 900	17 000	30 900	43 100	61 000	98 300	169 100
Total working capital	79 200	224 800	357 400	661 200	924 400	1 317 400	2 123 200	3 574 800
Product C - fine fabric								
1. Minimum stock of raw cotton	27 500	83 500	137 600	254 800	358 100	509 600	826 600	1 377 900
2. Material in course of processing	10 700	23 400	37 000	65 400	91 500	127 800	205 800	333 100
3. Stock of finished products	5 400	11 700	18 500	32 700	45 700	63 900	101 900	166 500
4. Stock of spare parts and ancillary materials	7 400	17 200	26 700	47 600	66 700	94 800	151 800	252 900
5. Minimum cash supply	3 200	7 000	11 100	19 600	27 400	38 900	61 700	99 900
Total working capital	54 200	142 800	230 900	420 100	589 400	839 400	1 347 800	2 230 300

Note: Estimate worked out on the following basis: Item 1. 2 months' production supply.
2. 10 day's production supply at cost of raw material and labour (including social security charges).
3. 5 day's production supply at cost of raw material and labour (including social security charges).
4. 2 per cent of value of equipment.
5. 1 per cent of annual cost of raw materials and labour (including social security charges).

Table FF

TIME TABLE FOR MILL INSTALLATION (MONTHS), ACCORDING TO EACH HYPOTHESIS CONSIDERED

Number of looms	Mill size (number of spindles)							
	2 000	6 000	10 000	18 500	26 000	37 000	60 000	100 000
Coarse fabric								
90	12							
270		14						
450			16					
830				18				
1 170					20			
1 660						22		
2 700							26	
4 500								30
Medium fabric								
73	8							
226		10						
364			12					
680				14				
950					16			
1 360						18		
2 190							22	
3 650								26
Fine fabric								
44	6							
130		8						
214			10					
396				12				
560					14			
800						16		
1 280							20	
2 140								24

able GG

TOTAL INVESTMENT REQUIREMENTS FOR EACH HYPOTHESIS CONSIDERED

(Dollars)

Specification	Size I 2 000 spindles	Size II 6 000 spindles	Size III 10 000 spindles	Size IV 18 500 spindles	Size V 26 000 spindles	Size VI 37 000 spindles	Size VII 60 000 spindles	Size VIII 100 000 spindles
Product A - coarse fabric								
I. Fixed investment	1 235 500	3 068 100	4 917 200	8 806 700	12 247 500	17 188 300	27 637 500	46 046 000
A. Buildings and ancillary fittings	284 900	606 100	910 000	1 577 300	2 100 400	2 885 900	4 913 600	6 823 400
B. Machinery and ancillary equipment	638 800	1 746 800	2 840 800	5 089 400	7 125 600	10 071 400	16 254 400	27 053 400
C. Freight and insurance a/	69 200	174 700	283 100	508 200	712 600	1 007 100	1 625 400	2 705 300
D. Construction costs b/	27 100	72 700	120 200	216 400	297 400	435 500	705 200	1 170 500
E. Running-in costs c/	42 400	91 000	124 300	184 900	204 900	216 000	229 000	302 000
F. Interest payments during construction period d/	132 400	376 800	648 800	1 227 800	1 776 600	2 572 400	4 509 900	7 991 400
II. Working capital	150 700	432 900	718 100	1 325 000	1 857 900	2 640 600	4 276 600	7 117 000
A. Permanent stock of working capital	150 700	432 900	718 100	1 325 000	1 857 900	2 640 600	4 276 600	7 117 000
III. Total investment	1 386 200	3 501 000	5 635 300	10 131 700	14 085 400	19 828 900	32 914 100	53 163 000
Product B - padding fabric								
I. Fixed investment	1 011 100	2 325 700	3 629 600	6 495 400	9 032 800	12 663 000	20 261 700	33 534 300
A. Buildings and ancillary fittings	249 600	498 000	745 500	1 295 000	1 736 000	2 346 000	3 474 000	5 475 500
B. Machinery and ancillary equipment	575 400	1 359 300	2 117 100	3 776 100	5 302 000	7 485 500	12 022 000	19 863 900
C. Freight and insurance a/	57 500	135 800	211 700	377 600	530 200	748 600	1 202 200	1 986 900
D. Construction costs b/	21 700	55 700	89 900	161 600	226 200	322 600	521 600	864 400
E. Running-in costs c/	36 000	71 500	94 900	135 000	155 900	169 600	172 200	225 600
F. Interest payments during construction period d/	74 900	221 400	371 400	720 100	1 081 500	1 593 700	2 869 700	5 172 700
II. Working capital	79 200	224 800	387 400	661 200	924 400	1 317 400	2 123 200	3 574 800
A. Permanent stock of working capital	79 200	224 800	373 400	661 200	924 400	1 317 400	2 123 200	3 574 800
III. Total investment	1 090 300	2 550 500	3 987 000	7 156 600	9 957 200	13 978 400	22 384 900	37 109 100
Product C - fine fabric								
I. Fixed investment	530 400	1 761 200	2 966 600	4 509 600	6 292 800	8 864 200	14 080 700	22 460 800
A. Buildings and ancillary fittings	184 800	395 800	641 500	772 900	1 056 600	1 456 100	2 118 300	3 320 700
B. Machinery and ancillary equipment	300 300	1 059 800	1 623 700	2 774 700	3 899 200	5 422 100	8 750 200	14 521 600
C. Freight and insurance a/	30 000	107 200	160 700	278 500	388 200	548 300	879 900	1 432 200
D. Construction costs b/	11 400	43 100	66 700	119 000	165 600	237 200	379 400	632 400
E. Running-in costs c/	20 100	55 100	60 300	99 100	114 200	126 100	124 200	153 400
F. Interest payments during construction period d/	47 000	130 500	222 700	439 000	669 100	1 005 900	1 836 600	3 374 500
II. Working capital	54 200	142 800	230 900	420 100	589 400	834 400	1 347 800	2 230 300
A. Permanent stock of working capital	54 200	142 800	230 900	420 100	589 400	834 400	1 347 800	2 230 300
III. Total investment	684 600	1 904 100	2 737 500	4 929 700	6 881 200	9 698 700	15 428 500	25 691 100

a/ 10 per cent of total value of machinery (according to tables AA, BB and CC); b/ 5 per cent of the value of the main machines and equipment (again according to tables AA, BB and CC); c/ 4 to 0.6 per cent in increasing order of size of the value of the fixed assets; d/ 12 per cent a year of the value of items A to E, in accordance with the construction periods indicated in table FF, and on the assumption that sizes III to VIII will achieve an average output of 10, 20, 30, 40, 50 and 60 per cent respectively during the second half of the installation period.

Table HH

Table

MODELS A, COARSE FABRICS: LABOUR

(Cot

Occupation	Classification a/	Hourly wage a/	Size I-2 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size II-6 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size III-10 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost
I. Spinning						57	52 440				107	97 480				192	192 024
A. Opening through roving						27	25 140				49	44 436				92	92 192
Opener tender	T	0.25	1	1	1	3	1 920	2	2	2	6	3 840	2	2	2	6	3 840
Picker tender	T	0.25	1	1	1	3	2 880	2	2	2	6	5 376	2	2	2	6	5 376
Card tender	T	0.25	1	1	1	3	2 880	1	1	1	3	2 688	1	1	1	3	2 688
Card helper	T	0.25	1	1	1	3	1 920	1	1	1	3	1 920	1	1	1	3	1 920
Card fixer	T	0.50	1	1	1	3	1 200	1	1	1	3	1 200	1	1	1	3	1 200
Drawing tender	T	0.25	1	1	1	3	2 880	2	2	2	6	5 376	2	2	2	6	5 376
Roving tender	T	0.25	1	1	1	3	2 880	2	2	2	6	5 376	2	2	2	6	5 376
Roving helper	T	0.25	1	1	1	3	1 920	1	1	1	3	1 920	1	1	1	3	1 920
Oiler	T	0.25	1	1	1	3	600	1	1	1	3	600	1	1	1	3	1 200
Sweeper	T	0.25	1	1	1	3	600	1	1	1	3	1 200	1	1	1	3	1 920
Maintenance foreman	F	0.75	1	1	1	3	1 800	1	1	1	3	1 760	1	1	1	3	1 760
Production foreman	F	0.75	1	1	1	3	1 760	1	1	1	3	1 760	1	1	1	3	1 760
B. Spinning and winding						30	27 300				61	55 422				100	97 200
Spinner	T	0.35	2	2	2	6	5 376	4	4	4	12	10 752	6	6	6	18	16 128
Winder	T	0.35	3	3	3	9	8 064	10	10	10	30	26 880	17	17	17	51	45 696
Roll piecer	T	0.25	1	1	1	3	1 920	2	1	1	4	1 920	2	2	2	6	3 840
Spool loader	T	0.25	1	1	1	3	600	1	1	1	3	1 200	1	1	1	3	2 400
Doffer	T	0.25	1	1	1	3	1 920	2	2	2	6	3 840	3	3	3	9	5 760
Spool roll cleaner	D	0.25	1	1	1	3		2	2	2	6	600	3	3	3	9	600
Yarn handler	T	0.25	1	1	1	3	1 920	1	1	1	3	1 920	1	1	1	3	1 920
Traveller changer	T	0.25	1	1	1	3		1	1	1	3	600	1	1	1	3	600
Sweeper	T	0.25	1	1	1	3	600	1	1	1	3	1 200	1	1	1	3	1 920
Maintenance foreman	F	0.75	1	1	1	3	1 800	1	1	1	3	1 800	1	1	1	3	1 800
Production foreman	F	0.75	1	1	1	3	1 760	1	1	1	3	1 760	1	1	1	3	1 760
II. Weaving						33	32 856				36	38 232				102	102 240
A. Warping through tying-in						23	22 245				36	38 232				56	51 648
Warper tender	T	0.35	1			1	840	1	1	1	3	2 688	1	1	1	3	3 528
Assistant warper tender	T	0.25	1			1	600	1	1	1	3	1 920	1	1	1	3	2 520
Yarn handler	T	0.25	2			2	600	2	2	2	6	600	2	2	2	6	1 200
Slasher tender	T	0.35	1			2	1 680	2	2	2	6	5 376	4	4	4	12	10 752
Assistant slasher tender	T	0.25	1			2	1 200	2	2	2	6	3 840	4	4	4	12	7 680
Size man	T	0.35	1			1	840	1	1	1	3	840	2	2	2	6	1 680
Tying-in hand	T	0.35	1			3	2 688	1	1	1	3	2 688	2	2	2	6	2 688
Drawing-in hand	T	0.35	2			2	1 680	2	2	2	6	3 360	2	2	2	6	3 360
Oiler	T	0.25	1			1	600	1	1	1	3	600	1	1	1	3	1 200
Sweeper	T	0.25	1			1	600	1	1	1	3	1 200	1	1	1	3	1 920
Maintenance foreman	F	0.75	1			1	960	1	1	1	3	2 880	2	2	2	6	3 960
Production foreman	F	0.75	1			1	760	1	1	1	3	5 760	1	1	1	3	5 760
B. Loom section						22	21 008				72	70 656				125	121 344
Weaver	T	0.35	6	6	6	18	16 128	17	17	17	51	45 696	28	28	28	84	75 264
Battery hand	T	0.25	1	1	1	3	1 920	3	3	3	9	5 760	6	6	6	18	11 520
Pirn loader	T	0.25	2	2	2	6	2 880	3	3	3	9	2 520	2	2	2	6	3 840
Cloth doffer	T	0.25	1	1	1	3	1 200	2	2	2	6	2 520	2	2	2	6	3 840
Oiler	T	0.25	1			1	600	1	1	1	3	600	1	1	1	3	600
Sweeper	T	0.25	1			1	600	1	1	1	3	600	1	1	1	3	600
Maintenance foreman	F	0.75	1			1	960	1	1	1	3	2 280	2	2	2	6	3 520
Production foreman	F	0.75	1			1	760	1	1	1	3	5 760	1	1	1	3	5 760
III. Auxiliary services						12	15 480				22	27 520				28	30 480
A. Maintenance						8	8 640				12	12 840				16	18 240
Mechanic	T	0.50	1			1	1 200	2			2	2 880	3			3	3 840
Electrician	T	0.50						1			1	1 200	1			1	1 200
Welder	T	0.50	1			1	960	1			1	1 200	1			1	1 200
Carpenter	T	0.50						1			1	1 200	1			1	1 200
Workshop hand	T	0.25	1			1	480	1			1	960	1			1	1 200
Boilerman	T	0.35	1			1	840	1			1	840	1			1	840
Air conditioning mechanic	T	0.50	1			1	960	1			1	1 200	1			1	1 200
Foreman	F	0.75	1			1	800	1			1	960	1			1	1 200
B. Laboratory						2	840				2	1 440				2	2 400
Sample collector	T	0.35											1			1	840
Technician	T	0.35	1			1	840	1			1	840	1			1	840
Assistant	T	0.25						1			1	600	1			1	720
C. Miscellaneous						10	6 600				18	2 280				26	22 680
Cotton storage hand	T	0.25	2	2	2	6	3 960	1			1	1 920	1	1	1	3	1 920
Harness and shuttle adjustor	T	0.35	1			1	840	2			2	1 680	2	2	2	6	3 360
Roller adjuster	T	0.35	1			1	840	2			2	840	2	2	2	6	3 360
Unspecified	T	0.25	3			3	1 000	8			8	1 800	12			12	7 200
IV. Administration						10	25 680				12	27 480				17	34 260
Manager	A	M.Sc.c/	US$ 500			1	6 000				1	6 000				2	12 000
Engineer	A	M.Sc.c/	500			1	6 000				1	6 000				1	6 000
Technician	A	M.Sc.c/	350			1	4 200				1	4 200				2	8 400
Supervisor	A	M.Sc.c/	220			2	5 280				2	5 280				2	10 560
Office staff	A	0.50				2	2 400				3	3 600				4	4 800
Stenographer and typewriter	A	0.25				3	1 800				4	2 400				6	3 600
Total mill labour force						129	146 940				262	257 926				393	401 010
Total fixed labour						35	49 080				51	68 040				65	85 260
Total variable labour						58	73 680				203	161 856				313	293 148
Total administrative staff						16	23 880				12	27 480				17	34 260

a/ F = fixed; V = variable; A = administrative. b/ The third shift is increased 20 per cent. c/ M.Sc. = monthly salary.

REMENTS AND ANNUAL LABOUR COSTS
ues)

Size IV-18 500 spindles					Size V-26 000 spindles					Size VI-37 000 spindles					Size VII-60 000 spindles					Size VIII-100 000 spindles				
Labour working per shift				Total annual cost	Labour working per shift				Total annual cost	Labour working per shift				Total annual cost	Labour working per shift				Total annual cost	Labour working per shift				Total annual cost
1	2	3	Total		1	2	3	Total		1	2	3	Total		1	2	3	Total		1	2	3	Total	
			282	251 712				397	350 904				549	482 408				890	784 200				1 445	1 268 256
			106	99 696				145	133 824				198	182 256				324	299 424				521	480 048
4	4	4	12	7 680	5	5	5	15	9 600	7	7	7	21	13 440	12	12	12	36	23 040	19	19	19	57	36 480
4	4	4	12	10 752	5	5	5	15	13 440	7	7	7	21	18 816	12	12	12	36	32 256	19	19	19	57	51 072
2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752	7	7	7	21	18 816	11	11	11	33	29 568
3	3	3	9	5 760	4	4	4	12	7 680	5	5	5	15	9 600	8	8	8	24	15 360	13	13	13	39	24 960
2	–	–	2	2 400	2	–	–	2	2 400	3	–	–	3	3 600	5	–	–	5	6 000	9	–	–	9	10 800
5	5	5	15	13 440	7	7	7	21	18 816	10	10	10	30	26 880	16	16	16	48	43 008	26	26	26	78	69 888
6	6	6	18	16 128	8	8	8	24	21 504	11	11	11	33	29 568	18	18	18	54	48 384	30	30	30	90	80 640
3	3	3	9	5 760	5	5	5	15	9 600	7	7	7	21	13 440	11	11	11	33	21 120	19	19	19	57	36 480
1	1	1	3	1 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
3	2	2	7	13 920	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
3	2	2	7	13 920	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
			176	152 016				252	217 080				351	301 152				566	484 776				924	788 208
11	11	11	33	29 568	16	16	16	48	43 008	22	22	22	66	59 136	37	37	37	111	99 456	60	60	60	180	161 280
31	31	31	93	83 328	44	44	44	132	118 272	62	62	62	186	166 656	100	100	100	300	268 800	166	166	166	498	446 208
3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	9	9	9	27	17 280	15	15	15	45	28 800
2	2	1	5	3 120	3	3	2	8	5 040	4	4	3	11	6 960	6	6	6	18	11 520	10	10	10	30	19 200
6	6	6	18	11 520	9	9	9	27	17 280	12	12	12	36	23 040	20	20	20	60	38 400	33	33	33	99	63 360
2	–	–	2	1 200	3	–	–	3	1 800	4	–	–	4	2 400	6	–	–	6	3 600	10	–	–	10	6 000
1	1	1	3	1 920	2	1	1	4	2 520	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
1	–	–	1	600	1	–	–	1	600	2	–	–	2	1 200	3	–	–	3	1 800	4	–	–	4	2 400
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
2	1	–	3	5 400	3	1	1	5	9 360	3	2	1	6	11 160	4	2	2	8	15 120	5	3	2	10	18 720
1	1	1	3	5 760	1	1	1	3	5 760	2	1	1	4	7 560	2	2	2	6	11 520	3	3	3	9	17 280
			327	301 368				454	414 936				650	598 272				1 045	960 072				1 726	1 594 064
			96	90 672				137	129 312				185	174 960				295	278 448				474	451 544
3	3	3	9	8 064	4	4	4	12	10 752	6	6	6	18	16 128	9	9	9	27	24 192	15	15	15	45	40 320
3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	9	9	9	27	17 280	15	15	15	45	28 800
1	1	1	3	1 920	2	1	1	4	2 520	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680
6	6	6	18	16 128	9	9	9	27	24 192	12	12	12	36	32 256	20	20	20	60	53 760	33	33	33	99	88 704
6	6	6	18	11 520	9	9	9	27	17 280	12	12	12	36	23 040	20	20	20	60	38 400	33	33	33	99	63 360
1	1	1	3	2 688	2	1	1	4	3 528	2	2	1	5	4 368	3	3	2	8	7 056	5	5	1	11	9 800
2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752	7	7	7	21	18 816	11	11	11	33	29 568
2	2	2	6	5 376	2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752
1	1	1	3	1 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
4	4	2	10	18 720	6	6	3	15	28 080	8	8	4	20	37 440	13	13	6	32	59 760	22	22	10	54	100 800
2	2	1	5	9 360	3	3	1	7	12 960	4	4	2	10	18 720	6	6	3	15	28 080	10	10	5	25	46 800
			231	210 696				317	285 624				465	423 312				750	681 624				1 252	1 142 520
52	52	52	156	139 776	73	73	73	219	196 224	104	104	104	312	279 552	168	168	168	504	451 584	280	280	280	840	752 640
10	10	10	30	19 200	14	14	14	42	26 880	21	21	21	63	40 320	34	34	34	102	65 280	56	56	56	168	107 520
4	4	4	12	7 680	5	5	5	15	9 600	8	8	8	24	15 360	13	13	13	39	24 960	22	22	22	66	42 240
4	4	4	12	7 680	5	5	5	15	9 600	8	8	8	24	15 360	13	13	13	39	24 960	22	22	22	66	42 240
1	–	–	1	600	2	–	–	2	1 200	2	–	–	2	1 200	3	–	–	3	1 800	5	–	–	5	3 000
2	–	–	2	1 200	3	–	–	3	1 800	4	–	–	4	2 400	6	–	–	6	3 600	8	–	–	8	4 800
4	4	4	12	23 040	5	5	5	15	28 800	8	8	8	24	46 080	13	13	13	39	74 880	22	22	22	66	126 720
2	2	2	6	11 520	2	2	2	6	11 520	4	4	4	12	23 040	6	6	6	18	34 560	11	11	11	33	63 360
			51	39 360				68	52 800				82	63 240				99	78 720				116	93 960
			20	18 840				27	25 680				31	29 280				40	39 120				49	48 960
4	–	–	4	4 800	5	–	–	5	6 000	6	–	–	6	7 200	7	–	–	7	8 400	8	–	–	8	9 600
1	–	–	1	1 200	2	–	–	2	2 400	2	–	–	2	2 400	3	–	–	3	3 600	4	–	–	4	4 800
2	–	–	2	2 400	2	–	–	2	2 400	3	–	–	3	3 600	4	–	–	4	4 800	5	–	–	5	6 000
1	–	–	1	1 200	2	–	–	2	2 400	2	–	–	2	2 400	3	–	–	3	3 600	4	–	–	4	4 800
9	–	–	9	5 400	11	–	–	11	6 600	13	–	–	13	7 800	15	–	–	15	9 000	17	–	–	17	10 200
1	–	–	1	840	2	–	–	2	1 680	2	–	–	2	1 680	3	–	–	3	2 520	4	–	–	4	3 360
1	–	–	1	1 200	2	–	–	2	2 400	2	–	–	2	2 400	3	–	–	3	3 600	4	–	–	4	4 800
1	–	–	1	1 800	1	–	–	1	1 800	1	–	–	1	1 800	2	–	–	2	3 600	3	–	–	3	5 400
			4	2 880				5	3 480				6	4 320				7	5 160				8	5 760
1	–	–	1	840	1	–	–	1	840	2	–	–	2	1 680	2	–	–	2	1 680	2	–	–	2	1 680
1	–	–	1	840	1	–	–	1	840	1	–	–	1	840	2	–	–	2	1 680	2	–	–	2	1 680
2	–	–	2	1 200	3	–	–	3	1 800	3	–	–	3	1 800	3	–	–	3	1 800	4	–	–	4	2 400
			27	17 640				36	23 640				45	29 640				52	34 440				59	39 240
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	5	5	5	15	9 600	6	6	6	18	11 520
3	–	–	3	2 520	4	–	–	4	3 360	5	–	–	5	4 200	6	–	–	6	5 040	7	–	–	7	5 880
2	–	–	2	1 680	3	–	–	3	2 520	4	–	–	4	3 360	5	–	–	5	4 200	6	–	–	6	5 040
16	–	–	16	9 600	20	–	–	20	12 000	24	–	–	24	14 400	26	–	–	26	15 600	28	–	–	28	16 800
			26	67 440				35	87 360				43	112 080				57	155 040				70	192 000
			2	12 000				2	12 000				3	18 000				3	18 000				4	24 000
			2	12 000				2	12 000				2	12 000				4	24 000				4	24 000
			4	16 800				6	25 200				8	33 600				12	50 400				16	67 200
			6	15 840				9	23 760				12	31 680				16	42 240				20	52 800
			6	7 200				8	9 600				10	12 000				12	14 400				14	16 800
			6	3 600				8	4 800				8	4 800				10	6 000				12	7 200
			686	659 880				954	906 000				1 324	1 257 000				2 091	1 978 032				3 357	3 148 280
			106	140 520				146	127 800				195	258 960				292	397 440				471	626 736
			554	451 920				773	690 840				1 086	885 960				1 742	1 425 552				2 816	2 329 544
			26	67 440				35	87 360				43	112 080				57	155 040				70	192 000

Occupation	Class-ification a/	Hourly rate b/	Size I - 2 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size II - 6 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size III - 10 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost
I. Spinning						32	22 360				71	67 536				102	95 664
A. Spinning through roving						19	16 776				29	29 112				25	26 720
Spinner tender	V	0.25	1			1	600	1	1	1	3	1 920	1	1	1	3	1 920
Piecer tender	V	0.35	1			1	840	2	1	1	3	2 688	1	1	1	3	2 688
Card tender	V	0.35	1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688
Card helper	V	0.25															
Card fixer	V	0.50	1			1	1 200	1			1	1 200	1			1	1 200
Drawing tender	V	0.35						1	1	1	3	2 688	1	1	1	3	2 688
Roving tender	V	0.35	1	1	1	3	2 688	1	1	1	3	2 688	2	2	2	6	5 376
Roving helper	V	0.25						1	1	1	3	1 920	1	1	1	3	1 920
Oiler	P	0.25	1			1	600	1			1	600	1	1		2	1 200
Sweeper	P	0.25	1			1	600	1	1		2	1 200	1	1	1	3	1 920
Maintenance foreman	F	0.75	1			1	1 800	1	1	1	3	5 760	2	1	1	4	7 560
Production foreman	F	0.75	1	1	1	3	5 760	1	1	1	3	5 760	2	1	1	4	7 560
B. Spinning and winding						24	22 584				43	38 424				67	58 944
Spinner	V	0.35	1	1	1	3	2 688	3	3	3	9	8 064	5	5	5	15	13 440
Piecer	V	0.35	2	2	2	6	5 376	5	5	5	15	13 440	8	8	8	24	21 504
Reel piecer	V	0.25	1	1	1	3	1 920	1	1	1	3	1 920	2	2	2	6	3 840
Creel tender	V	0.25	1			1	600	1	1		2	1 200	1	1	1	3	1 920
Doffer	V	0.25	1	1	1	3	1 920	1	1	1	3	1 920	2	2	2	6	3 840
Stock reel cleaner	P	0.25						1			1	600	1			1	600
Yarn inspector	V	0.25	1	1	1	3	1 920	1	1	1	3	1 920	1	1	1	3	1 920
Reroller changer	V	0.25						1			1	600	1			1	600
Sweeper	P	0.25	1			1	600	1	1		2	1 200	1	1	1	3	1 920
Maintenance foreman	F	0.75	1			1	1 800	1			1	1 800	1	1		2	3 600
Production foreman	F	0.75	1	1	1	3	5 760	1	1	1	3	5 760	1	1	1	3	5 760
II. Weaving						42	41 352				77	75 576				112	107 904
A. Weaving through type-in						17	19 956				27	28 656				27	27 104
Warper tender	V	0.35	1			1	840	1			1	840	1	1		2	1 680
Assistant warper tender	V	0.25	1			1	600	1			1	600	1	1		2	1 200
Yarn inspector	V	0.25						1			1	600	1			1	600
Slasher tender	V	0.35	1			1	840	1	1	1	3	2 688	2	2	2	6	5 376
Assistant slasher tender	V	0.25	1			1	600	1	1	1	3	1 920	2	2	2	6	3 840
Size man	V	0.35						1			1	840	1			1	840
Type-in hand	V	0.35	1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688
Drawing-in hand	V	0.35	2			2	1 680	2	2		4	3 360	2	2		4	3 360
Oiler	P	0.25	1			1	600	1			1	600	1	1		2	1 200
Sweeper	P	0.25	1			1	600	1	1		2	1 200	1	1		2	1 200
Maintenance foreman	F	0.75	1	1	1	3	5 760	2	1	1	4	7 560	2	2	1	5	9 360
Production foreman	F	0.75	1	1	1	3	5 760	1	1	1	3	5 760	1	1	1	3	5 760
B. Loom section						25	24 384				50	46 920				75	70 800
Weaver	V	0.35	3	3	3	9	8 064	10	10	10	30	26 880	15	15	15	45	40 320
Battery hand	V	0.25	1	1	1	3	1 920	2	2	2	6	3 840	3	3	3	9	5 760
Warp tender	V	0.25	1	1	1	3	1 920	1	1	1	3	1 920	2	2	1	5	3 120
Cloth doffer	V	0.25	1	1	1	3	1 920	1	1	1	3	1 920	2	2	1	5	3 120
Oiler	P	0.25	1			1	600	1			1	600	1			1	600
Sweeper	P	0.25	1			1	600	1			1	600	1			1	600
Maintenance foreman	F	0.75	1	1		2	3 600	1	1	1	3	5 400	2	2	2	6	11 520
Production foreman	F	0.75	1	1	1	3	5 760	1	1	1	3	5 760	1	1	1	3	5 760
III. Auxiliary services						12	14 160				26	23 600				36	28 800
A. Maintenance						8	8 040				15	12 840				16	15 240
Mechanic	F	0.50	1			1	1 200	2			2	2 400	3			3	3 600
Electrician	F	0.50						1			1	1 200	1			1	1 200
Welder	F	0.50	1			1	1 200	1			1	1 200	1			1	1 200
Carpenter	F	0.50						1			1	1 200	1			1	1 200
Workshop hand	F	0.25	3			3	1 800	5			5	3 000	7			7	4 200
Boilerman	F	0.35	1			1	840	1			1	840	1			1	840
Air conditioning mechanic	F	0.50	1			1	1 200	1			1	1 200	1			1	1 200
Foreman	F	0.75	1			1	1 800	1			1	1 800	1			1	1 800
B. Laboratory						1	840				2	1 440				2	2 280
Sample collector	F	0.35											1			1	840
Technician	F	0.35	1			1	840	1			1	840	1			1	840
Assistant	F	0.25						1			1	600	1			1	600
C. Miscellaneous						3	3 280				11	7 320				17	11 280
Cotton storage hand	V	0.25	1			1	1 200	1	1		2	1 200	1	1	1	3	1 920
Furnace and shuttle adjustor	V	0.35	1			1	840	2			2	1 680	2			2	1 680
Roller adjustor	V	0.35	1			1	840	1			1	840	2			2	1 680
Unspecified	V	0.25	4			4	2 400	5			6	3 600	10			10	6 000
IV. Administration						10	25 680				12	27 480				17	44 160
Manager	A	[illegible]	500			1	6 000				1	6 000				2	12 000
Engineer	A	[illegible]	500			1	6 000				1	6 000				1	6 000
Technician	A	[illegible]	350			1	4 200				1	4 200				2	8 400
Supervisor	A	[illegible]	220			2	5 280				2	5 280				4	10 560
Office staff	A	0.50				2	2 400				3	3 600				4	4 800
Sweeper and watchman	A	0.25				3	1 800				4	2 400				4	2 400
Total direct labour force						208	123 552				186	192 192				267	276 528
Total fixed labour						35	49 080				49	64 440				64	83 640
Total variable labour						55	48 792				125	100 272				186	248 728
Total of administrative staff						10	25 680				12	27 480				17	44 160

a/ V = variable; F = semi-fixed; A = semi-executive.

b/ The basic unit is increased 20 per cent.

II

REQUIREMENTS AND ANNUAL LABOUR COSTS

Dollars)

Size IV 18 500 spindles					Size V 26 000 spindles					Size VI 37 000 spindles					Size VII 60 000 spindles					Size VIII-200 000 spindles				
Labour working per shift			Total	Total annual cost	Labour working per shift			Total	Total annual cost	Labour working per shift			Total	Total annual cost	Labour working per shift			Total	Total annual cost	Labour working per shift			Total	Total annual cost
1	2	3	Total		1	2	3	Total		1	2	3	Total		1	2	3	Total		1	2	3	Total	
			175	161 976				245	224 400				331	302 544				510	493 692				843	797 040
			63	64 704				92	85 440				207	198 864				173	178 368				264	251 328
2	2	2	6	3 840	3	3	3	9	5 760	3	3	3	9	5 760	5	5	5	15	9 600	6	6	6	18	15 360
2	2	2	6	5 376	3	3	3	9	8 064	3	3	3	9	8 064	5	5	5	15	13 440	8	8	8	24	21 504
1	1	1	3	2 688	1	1	1	3	2 688	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440
1	1	1	3	1 920	2	2	2	6	3 840	2	2	2	6	3 840	4	4	4	12	7 680	7	7	7	21	13 440
1	-	-	1	1 200	2	-	-	2	2 400	2	-	-	2	2 400	3	1	1	5	3 600	4	4	4	12	15 360
2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440	8	8	8	24	21 504
3	3	3	9	8 064	4	4	4	12	10 752	5	5	5	15	13 440	8	8	8	24	21 504	13	13	13	39	34 944
2	2	2	6	3 840	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600	8	8	8	24	15 360
1	1	1	3	1 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
3	2	2	7	13 920	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
3	2	2	7	13 920	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
			112	97 272				160	138 960				234	193 680				366	325 264				552	495 360
9	9	9	27	24 192	13	13	13	39	34 944	18	18	18	54	48 384	30	30	30	90	80 640	50	50	50	150	134 400
15	15	15	45	40 320	22	22	22	66	59 136	32	32	32	96	86 016	53	53	53	159	142 464	86	86	86	258	231 168
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	7	7	7	21	13 440	12	12	12	36	23 040
2	1	1	4	2 520	2	2	1	6	3 720	3	3	2	8	5 040	4	4	4	12	7 680	7	7	7	21	13 440
4	4	4	12	7 680	5	5	5	15	9 600	7	7	7	21	13 440	12	12	12	36	23 040	20	20	20	60	38 400
2	-	-	2	1 200	3	-	-	3	1 800	4	-	-	4	2 400	6	-	-	6	3 600	10	-	-	10	6 000
1	1	1	3	1 920	2	1	1	4	2 520	2	2	1	5	3 120	3	2	2	7	4 440	3	3	3	9	5 760
1	-	-	1	600	2	-	-	2	1 200	2	0	0	2	1 200	3	0	0	3	1 800	4	-	-	4	2 400
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
2	1	-	3	5 400	3	1	1	5	9 360	3	2	2	6	11 160	4	2	2	8	15 120	5	3	2	10	19 320
1	1	1	3	5 760	1	1	1	3	5 760	3	1	1	5	9 360	2	2	2	6	11 520	3	3	3	9	17 280
			120	108 312				269	257 952				224	362 688				523	577 272				284	457 632
			57	56 808				85	84 520				119	121 840				272	125 456				265	264 168
1	1	1	3	2 688	2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752	6	6	6	18	16 128
1	1	1	3	1 920	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520
1	1	-	2	1 200	1	1	1	3	1 920	1	1	1	3	1 920	2	1	1	4	2 520	2	2	2	6	3 840
3	3	3	9	8 064	5	5	5	15	13 440	6	6	6	18	16 128	10	10	10	30	26 880	16	16	16	48	43 008
3	3	3	9	5 760	5	5	5	15	9 600	6	6	6	18	11 520	10	10	10	30	19 200	16	16	16	48	30 720
1	1	-	2	1 680	1	1	1	3	2 688	1	1	1	3	2 688	2	2	2	6	5 376	3	3	3	9	8 064
2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440	9	9	9	27	24 192
2	2	1	4	3 360	2	2	1	4	3 360	2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064
1	1	1	3	1 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	1	1	4	2 520	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680
4	3	1	8	14 760	5	5	2	12	22 320	7	7	3	17	31 680	11	11	5	27	50 400	18	18	9	45	84 240
2	2	1	4	7 560	2	2	1	5	9 360	3	3	1	7	12 960	5	5	2	12	22 320	8	8	4	20	37 440
			133	126 504				184	174 432				265	250 848				423	401 808				708	672 192
28	28	28	84	75 264	39	39	39	117	104 832	56	56	56	168	150 528	91	91	91	273	244 608	152	152	152	456	408 576
6	6	6	18	11 520	8	8	8	24	15 360	11	11	11	33	21 120	18	18	18	54	34 560	30	30	30	90	57 600
2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600	7	7	7	21	13 440	12	12	12	36	23 040
2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600	7	7	7	21	13 440	12	12	12	36	23 040
1	-	-	1	600	2	-	-	2	1 200	2	0	0	2	1 200	3	0	0	3	1 800	5	-	-	5	3 000
2	-	-	2	1 200	2	-	-	2	1 200	2	0	0	2	1 200	3	0	0	3	1 800	0	-	-	0	2 400
4	4	3	11	20 880	5	5	5	15	28 800	7	7	7	21	40 320	11	11	11	33	63 360	18	18	18	54	103 680
2	2	1	5	9 360	2	2	2	6	11 520	3	3	3	9	17 280	5	5	5	15	28 800	9	9	9	27	51 840
			45	35 640				59	47 280				78	56 520				98	22 000				105	87 240
			20	18 840				27	25 680				31	29 280				40	39 120				48	48 960
4	-	-	4	4 800	5	-	-	5	6 000	6	-	-	6	7 200	7	-	-	7	8 400	8	-	-	8	9 600
1	-	-	1	1 200	2	-	-	2	2 400	2	0	0	2	2 400	3	0	0	3	3 600	4	-	-	4	4 800
2	-	-	2	2 400	2	-	-	2	2 400	3	0	0	3	3 600	4	0	0	4	4 800	5	-	-	5	6 000
1	-	-	1	1 200	2	-	-	2	2 400	2	0	0	2	2 400	3	0	0	3	3 600	4	-	-	4	4 800
9	-	-	9	5 400	11	-	-	11	6 600	23	-	-	13	7 800	25	-	-	25	9 000	17	-	-	17	10 200
1	-	-	1	840	2	-	-	2	1 680	2	0	0	2	1 680	3	0	0	3	2 520	4	-	-	4	3 360
1	-	-	1	1 200	2	-	-	2	2 400	2	0	0	2	2 400	3	0	0	3	3 600	4	-	-	4	4 800
1	-	-	1	1 800	1	-	-	1	1 800	2	0	0	2	2 400	2	0	0	2	2 400	3	-	-	3	3 600
			4	2 880				5	3 480				6	4 320				7	5 160				8	5 760
1	-	-	1	840	1	-	-	1	840	2	0	0	2	1 680	2	0	0	2	1 680	2	0	0	2	1 680
1	-	-	1	840	1	-	-	1	840	1	0	0	1	840	2	0	0	2	1 680	2	0	0	2	1 680
2	-	-	2	1 200	3	-	-	3	1 800	3	0	0	3	1 800	3	0	0	3	1 800	4	0	0	4	2 400
			21	13 920				27	18 120				34	22 920				41	27 720				48	32 520
2	1	1	4	2 520	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	5	5	5	15	9 600
3	-	-	3	2 520	4	-	-	4	3 360	5	0	0	5	4 200	6	0	0	6	5 040	7	0	0	7	5 880
2	-	-	2	1 680	3	-	-	3	2 520	4	0	0	4	3 360	5	0	0	5	4 200	6	0	0	6	5 040
2	-	-	12	7 200	14	-	-	14	8 400	26	0	0	26	9 600	18	0	0	18	10 800	20	0	0	20	12 000
			26	67 440				35	87 360				48	132 480				57	155 040				70	192 080
			2	12 000				2	12 000				3	18 000				3	18 000				4	24 000
			2	12 000				2	12 000				2	12 000				4	24 000				4	24 000
			4	16 800				6	25 200				8	33 600				12	50 400				16	67 200
			6	15 840				9	23 760				12	31 680				16	42 240				20	52 800
			6	7 200				8	9 600				10	12 000				12	14 400				15	18 000
			6	3 600				8	4 800				8	4 800				10	6 000				12	7 200
			436	448 368				608	616 992				821	833 832				1 265	1 297 944				2 022	2 039 328
			99	129 120				136	175 200				175	230 880				263	357 480				393	532 320
			311	251 808				437	354 432				603	490 872				961	785 424				1570	1269 432
			26	67 440				35	87 360				43	112 080				57	155 040				78	192 000

thly salary.

Description	Classification	Hourly wage rate	Size I-2 000 spindles				Size II-6 000 spindles				Size III-30 000 spindles			
			Labour variable per shift			Total annual cost	Labour variable per shift			Total annual cost	Labour variable per shift			Total annual cost
			1	2	3		1	2	3		1	2	3	
I. Spinning														
A. Preparation (combing through reels)														
Spinner tender	V	0.35												
Piecer tender	V	0.35												
Card tender	V	0.35												
Card helper	V	0.25												
Card fixer	V	0.50												
Drawing (pre-combing)	V	0.35												
Lap tender	V	0.35												
Comber tender	V	0.35												
Drawing tender	V	0.35												
Roving tender	V	0.35												
Roving helper	V	0.25												
Oiler	V	0.25												
Sweeper	L	0.25												
Maintenance foreman	F	0.75												
Production foreman	F	0.75												
B. Spinning and winding														
Batcher	V	0.35												
Winder	V	0.35												
Doff piecer	V	0.25												
Prod. tender	V	0.25												
Doffer	V	0.25												
Steel roll cleaner	L	0.25												
Yarn tender	V	0.25												
Traveller changer	V	0.25												
Sweeper	L	0.25												
Maintenance foreman	F	0.75												
Production foreman	F	0.75												
II. Weaving														
A. Weaving through twister-in														
Weaver	V	0.35												
Additional weaver tender	V	0.25												
Yarn tender	V	0.25												
Slasher tender	V	0.35												
Additional slasher tender	V	0.25												
Size man	V	0.35												
Twister-in head	V	0.35												
Drawing-in head	V	0.35												
Oiler	V	0.25												
Sweeper	L	0.25												
Maintenance foreman	F	0.75												
Production foreman	F	0.75												
B. Loom section														
Weaver	V	0.35												
Battery hand	V	0.35												
Warp tender	V	0.25												
Cloth doffer	V	0.25												
Oiler	V	0.25												
Sweeper	L	0.25												
Maintenance foreman	F	0.75												
Production foreman	F	0.75												
III. Auxiliary services														
A. Maintenance														
Mechanic	F	0.50												
Electrician	F	0.50												
Welder	F	0.50												
Carpenter	F	0.50												
Workshop hand	L	0.25												
Boilerman	F	0.25												
Air conditioning mechanic	F	0.50												
Foreman	F	0.75												
B. Laboratory														
Sample collector	F	0.35												
Technician	F	0.35												
Assistant	F	0.25												
C. Miscellaneous														
Cotton storage hand	V	0.25												
Machine and tackle adjuster	V	0.35												
Roller coverer	V	0.35												
Unspecified	V	0.25												
IV. Administration														
Manager	A	0.50												
Engineer	A	0.50												
Technician	A	0.50												
Supervisor	A	0.50												
Office staff	A	0.50												
Sweeper and watchman	A	0.25												
Total fixed labour														
Total fixed labour														
Total variable labour														
Total administrative staff														

F = fixed; V = variable; A = administrative.

The total must be increased 20 per cent.

... REQUIREMENTS AND ANNUAL LABOUR COSTS

19..)

Size IV-18 500 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size V-26 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size VI-37 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size VII-60 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost	Size VIII-100 000 spindles: Labour working per shift 1	2	3	Total	Total annual cost
			127	132 360				179	170 160				236	224 712				371	352 624				576	545 880
			55	59 232				75	72 240				101	105 792				156	165 416				232	250 826
1	1	-	2	1 220	1	1	1	3	1 920	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680
1	1	-	2	1 680	1	1	1	3	2 688	2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752
1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688	2	2	2	6	5 376	2	2	2	6	5 376
-	-	-	-	-	1	1	1	3	1 920	1	1	1	3	1 920	2	2	2	6	3 840	4	4	4	12	7 680
1	-	-	1	1 200	-	-	-	1	1 200	2	-	-	2	2 400	2	-	-	2	2 400	3	-	-	3	3 600
1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688	2	2	2	6	5 376	2	2	2	6	5 376
1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688	1	1	1	3	2 688
2	2	2	6	5 376	3	3	3	9	8 064	4	4	4	12	10 752	6	6	6	18	16 128	10	10	10	30	26 880
1	1	1	3	2 688	2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440
2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440	8	8	8	24	21 504
1	1	1	3	1 920	1	1	1	3	1 920	2	2	2	6	3 840	2	2	2	6	3 840	3	3	3	9	5 760
2	2	1	5	2 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
3	2	2	7	13 320	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
3	2	2	7	13 320	4	3	2	9	16 920	6	4	2	12	22 320	10	7	3	20	37 080	16	10	5	31	57 600
			72	63 264				104	90 912				137	118 928				215	186 408				243	294 961
6	6	6	18	16 128	9	9	9	27	24 192	12	12	12	36	32 256	20	20	20	60	53 760	33	33	33	99	88 704
7	7	7	21	18 816	10	10	10	30	26 880	13	13	13	39	34 944	21	21	21	63	56 448	35	35	35	105	94 080
2	2	2	6	3 840	3	3	3	9	5 760	3	3	3	9	5 760	5	5	5	15	9 600	8	8	8	24	15 360
1	1	1	3	1 920	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600
2	2	2	6	3 840	3	3	3	9	5 760	5	5	5	15	9 600	7	7	7	21	13 440	12	12	12	36	23 040
2	-	-	2	1 200	3	-	-	3	1 800	4	-	-	4	2 400	6	-	-	6	3 600	10	-	-	10	6 000
1	1	1	3	1 920	1	1	1	3	1 920	2	1	1	4	2 520	2	2	2	6	3 840	3	2	2	7	4 440
1	-	-	1	600	1	-	-	1	600	2	-	-	2	1 200	3	-	-	3	1 800	4	-	-	4	2 400
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	8	8	8	24	15 360
2	1	-	3	5 400	3	1	1	5	9 360	3	2	1	6	11 160	4	2	2	8	15 120	5	3	2	10	18 720
1	1	1	3	5 760	1	1	1	3	5 760	2	1	1	4	7 560	2	2	2	6	11 520	3	3	3	9	17 280
			84	85 656				129	124 032				162	164 952				242	249 024				402	419 520
			31	32 626				48	48 960				56	60 912				83	88 368				139	147 696
1	1	-	2	1 680	1	1	1	3	2 688	2	2	-	4	3 360	2	2	2	6	5 376	4	4	3	11	9 744
1	1	-	2	1 200	1	1	1	3	1 920	2	2	-	4	2 400	2	2	2	6	3 840	4	4	3	11	6 960
-	-	-	-	-	1	-	-	1	600	1	1	-	2	1 200	1	1	-	2	1 200	1	3	1	5	3 120
1	1	1	3	2 688	2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	6	6	6	18	16 128
1	1	1	3	1 920	2	2	2	6	3 840	2	2	2	6	3 840	3	3	3	9	5 760	6	6	6	18	11 520
1	-	-	1	840	1	-	-	1	840	1	1	-	2	1 680	1	1	1	3	2 688	1	1	1	3	2 688
1	1	1	3	2 688	2	2	2	6	5 376	2	2	2	6	5 376	3	3	3	9	8 064	5	5	5	15	13 440
2	2	-	4	3 360	2	2	-	4	3 360	2	2	-	4	3 360	2	2	2	6	5 376	2	2	2	6	5 376
1	1	-	2	1 200	1	1	1	3	1 920	2	1	1	4	2 520	2	2	1	5	3 120	2	2	2	6	3 840
1	1	1	3	1 920	2	1	1	4	2 520	2	2	1	5	3 120	2	2	2	6	3 840	3	3	3	9	5 760
2	2	1	5	9 360	3	3	1	7	12 960	4	4	2	10	18 720	6	6	3	15	26 080	10	10	5	25	46 800
1	1	1	3	5 760	2	1	1	4	7 560	2	2	1	5	9 360	3	3	1	7	12 960	5	5	2	12	22 320
			55	55 440				73	75 472				104	104 640				159	160 656				263	262 624
10	10	10	30	26 880	14	14	14	42	37 632	20	20	20	60	53 760	32	32	32	96	86 016	53	53	53	159	142 464
2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680	6	6	6	18	11 520	10	10	10	30	19 200
1	1	1	3	1 920	2	1	1	4	2 520	2	2	1	5	3 120	3	2	2	7	4 440	4	4	4	12	7 680
1	1	1	3	1 920	2	1	1	4	2 520	2	2	1	5	3 120	3	2	2	7	4 440	4	4	4	12	7 680
1	-	-	1	600	1	-	-	1	600	2	-	-	2	1 200	2	-	-	2	1 200	2	-	-	2	1 200
1	-	-	1	600	2	-	-	2	1 200	2	-	-	2	1 200	2	-	-	2	1 200	3	-	-	3	1 200
2	2	2	6	11 520	3	3	3	9	17 280	4	4	4	12	23 040	6	6	6	18	34 560	10	10	10	30	57 600
1	1	1	3	5 760	2	1	1	4	7 560	2	2	2	6	11 520	3	3	3	9	17 280	5	5	5	15	28 800
			40	22 640				59	43 560				69	52 200				69	66 480				95	79 920
			20	18 640				27	25 680				31	29 280				29	37 920				37	45 360
4	-	-	4	4 800	5	-	-	5	6 000	6	-	-	6	7 200	7	-	-	7	8 400	8	-	-	8	9 600
1	-	-	1	1 200	2	-	-	2	2 400	2	-	-	2	2 400	3	-	-	3	3 600	4	-	-	4	4 800
2	-	-	2	2 400	2	-	-	2	2 400	3	-	-	3	3 600	4	-	-	4	4 800	5	-	-	5	6 000
1	-	-	1	1 200	2	-	-	2	2 400	2	-	-	2	2 400	3	-	-	3	3 600	4	-	-	4	4 800
9	-	-	9	5 400	11	-	-	11	6 600	13	-	-	13	7 800	15	-	-	15	9 000	17	-	-	17	10 200
1	-	-	1	840	2	-	-	2	1 680	2	-	-	2	1 680	3	-	-	3	2 520	4	-	-	4	3 360
1	-	-	1	1 200	2	-	-	2	2 400	2	-	-	2	2 400	2	-	-	2	2 400	3	-	-	3	3 600
1	-	-	1	1 800	1	-	-	1	1 800	1	-	-	1	1 800	2	-	-	2	3 600	2	-	-	2	3 600
			4	2 880				5	3 480				6	4 320				7	5 160				8	5 760
1	-	-	1	840	1	-	-	1	840	2	-	-	2	1 680	2	-	-	2	1 680	2	-	-	2	1 680
1	-	-	1	840	1	-	-	1	840	1	-	-	1	840	2	-	-	2	1 680	2	-	-	2	1 680
2	-	-	2	1 200	3	-	-	3	1 800	3	-	-	3	1 800	3	-	-	3	1 800	4	-	-	4	2 400
			16	10 920				21	14 400				27	18 600				34	23 400				41	28 200
1	1	1	3	1 920	2	1	1	4	2 520	2	2	2	6	3 840	3	3	3	9	5 760	4	4	4	12	7 680
3	-	-	3	2 520	4	-	-	4	3 360	5	-	-	5	4 200	6	-	-	6	5 040	7	-	-	7	5 880
2	-	-	2	1 680	3	-	-	3	2 520	4	-	-	4	3 360	5	-	-	5	4 200	6	-	-	6	5 040
8	-	-	8	4 800	10	-	-	10	6 000	12	-	-	12	7 200	14	-	-	14	8 400	16	-	-	16	9 600
			26	67 440				35	87 360				43	112 080				57	155 040				70	192 000
			2	12 000				2	12 000				3	18 000				3	18 000				4	24 000
			2	12 000				2	12 000				2	12 000				4	24 000				4	24 000
			4	16 800				6	25 200				8	33 600				12	50 400				16	67 200
			5	13 200				9	23 760				12	31 680				16	42 240				20	52 800
			6	7 200				8	9 600				10	12 000				12	14 400				14	16 800
			6	3 600				8	4 800				8	4 800				10	6 000				12	7 200
			277	308 904				320	425 112				507	553 944				750	823 368				1 144	1 238 320
			65	107 040				116	146 160				151	189 240				215	276 520				312	416 760
			186	134 424				207	191 592				313	252 624				478	389 808				763	622 560
			26	67 440				35	87 360				43	112 080				57	155 040				70	192 000

... monthly salary.

/Table XX

Table XX

WORKLOAD PER OPERATIVE (IN TERMS OF PRODUCTION UNITS) ON WHICH MANNING-TABLE IS BASED

Machine	Production units per worker		
	Coarse fabric	Medium fabric	Fine fabric
Opening room			
Picker tender	2	2	2
Opener tender	2	2	2
Card			
Card tender	25	30	40
Card helper	20	20	20
Card fixer (one shift)	30	30	30
Drawing frame			
Drawing tender	10	12	16
Lap machine			
Lap tender	4	4	4
Comber			
Comber tender	4	4	4
Roving frame			
Roving tender	250	250	250
Roving helper	400	500	600
Ring spinning frame			
Spinner	1 600	2 000	3 000
Doffer	3 000	5 000	8 000
Cone winder (non-automatic)			
Winder	30	40	60
Pirn winder (automatic)			
Winder	60	80	120
Warper			
Warper tender	1	1	1
Assistant warper tender	1	1	1
Slasher			
Slasher tender	1	1	1
Assistant slasher tender	1	1	1
Loom			
Weaver	16	24	40
Battery hand	80	120	200
Maintenance foreman	200	200	200
Production foreman	400	400	400
Warp leader	200	300	500
Cloth doffer	200	300	500

Table LL

PRODUCT A (COARSE FABRIC): ANNUAL PRODUCTION COSTS

(Dollars)

Specification	Size I 2 000 spindles	Size II 6 000 spindles	Size III 10 000 spindles	Size IV 18 500 spindles	Size V 26 000 spindles	Size VI 37 000 spindles	Size VII 60 000 spindles	Size VIII 100 000 spindles
I. Fixed costs	353 437	758 023	1 185 675	2 098 988	2 901 524	4 062 929	6 487 630	10 669 455
Fixed labour costs a/	74 760	95 520	128 520	207 960	275 160	371 040	552 480	814 680
Social security payments b/	29 904	38 208	51 408	83 184	110 064	148 416	220 992	325 872
Depreciation c/	71 322	179 269	289 870	521 334	727 582	1 025 545	1 662 611	2 785 163
Maintenance d/	5 415	14 536	24 047	43 685	61 487	87 102	141 047	234 102
Interest e/	166 344	420 120	676 236	1 215 804	1 690 248	2 379 468	3 829 692	6 379 560
Overheads f/	2 242	2 865	3 855	6 239	8 255	11 131	16 574	24 440
Miscellaneous g/	3 450	7 505	11 739	20 782	28 728	40 227	64 234	105 638
II. Variable costs	725 394	2 075 904	3 438 452	6 331 918	8 892 706	12 636 215	20 472 384	34 057 007
Raw material h/	563 008	1 687 200	2 815 040	5 207 520	7 319 104	10 416 256	16 890 848	28 151 616
Ancillary materials i/	11 260	33 744	56 301	104 150	146 382	208 325	337 817	563 032
Variable labour costs j/	73 680	161 856	253 128	451 920	630 840	885 960	1 425 552	2 333 544
Social security payments k/	29 472	64 742	101 251	180 768	252 336	354 384	570 221	933 418
Steam l/	1 065	3 197	5 329	9 859	13 855	19 717	31 974	53 290
Maintenance m/	10 830	28 072	48 094	87 370	122 974	174 204	282 094	468 204
Electric power n/	17 475	43 675	70 775	127 225	178 125	251 775	406 350	676 325
Sales expenditure o/	11 024	31 648	52 464	96 656	135 760	192 944	312 608	520 048
Miscellaneous p/	7 580	21 770	36 070	66 450	93 330	132 650	214 920	357 530
III. Total costs	1 078 831	2 833 927	4 624 127	8 430 906	11 794 230	16 699 144	26 960 014	44 726 462

a/ See tables HH, II, and JJ. Including administrative staff.
b/ 40 per cent of fixed labour costs.
c/ Linear depreciation over 40 years for buildings, and over 15 years for machinery at cost installed and ready to operate.
d/ Fixed maintenance cost, estimated at 1 per cent of the cost of the basic equipment.
e/ 12 per cent of total investment per annum; equivalent to the rate of interest normally paid on long-term loans.
f/ 3 per cent of fixed labour costs; including office supplies, communications, etc., but excluding publicity.
g/ Approximately 1 per cent of total fixed costs.
h/ See tables E to Z.
i/ 2 per cent of raw material costs.
j/ See tables E, I and J.
k/ 40 per cent of variable labour costs.
l/ Estimates based on a steam production cost of 1.5 dollars per ton and a consumption coefficient of 1.5 kilogrammes of steam per kilogramme of product in the slasher.
m/ Variable maintenance costs, estimated at 2 per cent of the cost of the basic equipment.
n/ Approximately 2.5 per cent of variable production costs.
o/ Approximately 1.5 per cent of variable production costs.
p/ Approximately 1 per cent of variable production costs.

Table VII

PRODUCT B (MEDIUM FABRIC): ANNUAL PRODUCTION COSTS

(Dollars)

Specification	Size I 2 000 spindles	Size II 6 000 spindles	Size III 10 000 spindles	Size IV 18 500 spindles	Size V 26 000 spindles	Size VI 37 000 spindles	Size VII 60 000 spindles	Size VIII 100 000 spindles
I. Fixed costs	302 248	588 266	898 782	1 555 858	2 167 416	3 008 595	4 776 614	7 785 630
Fixed labour costs a/	74 760	91 920	127 800	196 560	265 560	342 960	512 520	744 120
Social security payments b/	29 304	36 768	51 120	78 624	105 024	137 184	205 008	297 648
Depreciation c/	57 168	134 493	210 891	375 451	529 671	746 248	1 205 918	2 011 274
Maintenance d/	4 335	11 136	17 805	32 329	45 810	64 718	104 311	172 887
Interest e/	130 896	306 060	478 440	851 592	1 194 984	1 677 408	2 686 188	4 460 292
Overheads f/	2 243	2 758	3 834	5 897	7 877	10 269	15 376	22 324
Miscellaneous g/	2 992	5 831	8 899	15 405	21 460	29 788	47 293	77 085
II. Variable costs	247 976	991 072	1 569 921	2 822 153	4 047 443	5 764 458	9 286 616	15 444 100
Raw material h/	242 592	752 704	1 206 272	2 258 112	3 156 128	4 526 224	7 283 640	12 139 936
Ancillary materials i/	4 852	15 054	24 125	45 162	63 122	90 924	145 677	242 799
Variable labour costs j/	48 792	100 272	148 728	251 808	354 432	490 872	785 424	1 289 832
Social security payments k/	19 517	40 109	59 491	100 723	141 773	196 349	314 170	515 933
Steam l/	403	1 249	2 014	3 746	5 236	7 492	12 083	20 137
Maintenance m/	8 670	22 272	35 610	61 658	91 289	129 436	208 622	345 774
Electric power n/	14 373	33 950	52 925	94 402	132 550	187 125	300 550	496 723
Sales expenditure o/	5 200	14 912	23 616	43 584	60 992	86 696	140 000	232 664
Miscellaneous p/	9 575	10 550	16 240	29 960	41 930	59 740	96 250	160 100
III. Total costs	650 224	1 580 038	2 467 810	4 480 011	6 214 859	8 773 052	14 063 230	23 229 736

a/ See tables III, IV, and V. Including administrative staff.
b/ 40 per cent of fixed labour costs.
c/ Linear depreciation over 40 years for buildings, and over 15 years for machinery at cost installed and ready to operate.
d/ Fixed maintenance costs, estimated at 1 per cent of the cost of the basic equipment.
e/ 11 per cent of fixed investment per annum; equivalent to the rate of interest normally paid on long-term loans.
f/ 3 per cent of fixed labour costs; including office supplies, communications, etc., but excluding publicity.
g/ Approximately 2 per cent of total fixed costs.
h/ See tables I to 4.
i/ 2 per cent of raw material costs.
j/ See tables I, 2 and 3.
k/ 40 per cent of variable labour costs.
l/ Estimated based on a steam production cost of 1.5 dollars per ton and a consumption coefficient of 1.5 kilograms of steam per kilogramme of product in the finisher.
m/ Variable maintenance costs, estimated at 2 per cent of the cost of the basic equipment.
n/ Approximately 1.5 per cent of variable production costs.
o/ Approximately 1.5 per cent of variable production costs.
p/ Approximately 1 per cent of variable production costs.

Table NN

PRODUCT C (FINE FABRIC): ANNUAL PRODUCTION COSTS

(Dollars)

Specification	Size I 2 000 spindles	Size II 6 000 spindles	Size III 10 000 spindles	Size IV 18 500 spindles	Size V 26 000 spindles	Size VI 37 000 spindles	Size VII 60 000 spindles	Size VIII 100 000 spindles
I. Fixed costs	264 444	469 779	676 977	1 143 511	1 584 123	2 194 122	3 431 643	5 560 549
Fixed labour costs a/	72 960	87 720	117 840	174 480	233 520	301 320	433 560	608 760
Social security payments b/	29 184	35 088	47 136	69 792	93 408	120 528	173 424	243 504
Depreciation c/	47 664	102 585	152 696	268 035	375 393	530 232	850 370	1 425 556
Maintenance d/	3 677	8 611	13 340	23 804	33 368	47 434	75 885	126 479
Interest e/	106 152	228 492	335 700	590 844	825 744	1 163 844	1 851 420	3 082 932
Overheads f/	2 189	2 632	3 535	5 234	7 006	9 040	13 007	18 263
Miscellaneous g/	2 618	4 651	6 703	11 322	15 684	21 724	33 977	55 055
II. Variable costs	195 255	483 526	785 215	1 410 260	1 987 014	2 797 453	4 502 603	7 464 678
Raw material h/	113 088	343 520	566 048	1 048 192	1 473 184	2 096 384	3 400 544	5 668 384
Ancillary materials	2 262	6 870	11 321	20 964	29 464	41 928	68 011	113 368
Variable labour costs j/	39 336	54 768	86 112	133 424	191 592	252 624	389 808	622 560
Social security payments k/	15 734	21 907	34 445	53 370	76 637	101 050	155 923	249 024
Steam l/	173	519	864	1 597	2 246	3 194	5 181	8 634
Maintenance m/	7 354	17 222	26 680	47 608	66 736	94 868	151 770	252 958
Electric power n/	12 500	26 750	40 175	69 875	97 475	137 475	218 750	363 050
Sales expenditure o/	2 848	7 120	11 600	20 880	29 440	41 440	66 736	110 640
Miscellaneous p/	1 960	4 850	7 970	14 350	20 240	28 490	45 830	76 060
III. Total costs	459 669	953 305	1 462 192	2 553 771	3 571 137	4 991 575	7 934 246	13 025 227

a/ See tables HH, II, and JJ. Including administrative staff.
b/ 40 per cent of fixed labour costs.
c/ Linear depreciation over 40 years for building, and over 15 years for machinery at cost installed and ready to operate.
d/ Fixed maintenance costs, estimated at 1 per cent of the cost of the basic equipment.
e/ 12 per cent of total investment per annum; equivalent to the rate of interest normally paid on long-term loans.
f/ 3 per cent of fixed labour costs; including office supplies, communications, etc., but excluding publicity.
g/ Approximately 1 per cent of total fixed costs.
h/ See tables E to Z.
i/ 2 per cent of raw material costs.
j/ See tables H, I and J.
k/ 40 per cent of variable labour costs.
l/ Estimates based on a steam production cost of 1.5 dollars per ton and a consumption coefficient of 1.5 kilogrammes of steam per kilogramme of production in the slasher.
m/ Variable maintenance costs, estimated at 2 per cent of the cost of the basic equipment.
n/ Approximately 2.5 per cent of variable production costs.
o/ Approximately 1.5 per cent of variable production costs.
p/ Approximately 1 per cent of variable production costs.

Table 15

PRODUCTION FLOW CHART

(Product C: Size category VII)

Cotton warehouse
Daily consumption (kilogrammes) 18 645

Scutchers

Number of production units	5
Number of working hours per day	23
Daily output (kilogrammes)	18 396
Total waste (kilogrammes)	766
Waste recovered (kilogrammes)	-

Cards

Number of production units	54
Number of working hours per day	23
Daily output (kilogrammes)	17 476
Total waste (kilogrammes)	920
Waste recovered (kilogrammes)	50

Drawing frames (pre-combing)

Number of production units	16
Number of working hours per day	23
Daily output (kilogrammes)	17 389
Total waste (kilogrammes)	87
Waste recovered (kilogrammes)	80

Lap machines

Number of production units	6
Number of working hours per day	23
Daily output (kilogrammes)	17 302
Total waste (kilogrammes)	87
Waste recovered (kilogrammes)	80

Combers

Number of production units	25
Number of working hours per day	23
Daily output (kilogrammes)	13 842
Total waste (kilogrammes)	3 460
Waste recovered (kilogrammes)	-

Drawing frames I

Number of production units	26
Number of working hours per day	23
Daily output (kilogrammes)	13 773
Total waste (kilogrammes)	69
Waste recovered (kilogrammes)	60

Drawing frames II

Number of production units	26
Number of working hours per day	23
Daily output (kilogrammes)	13 704
Total waste (kilogrammes)	69
Waste recovered (kilogrammes)	60

Roving frames

Number of production units	1 130
Number of working hours per day	23
Daily output (kilogrammes)	13 636
Total waste (kilogrammes)	68
Waste recovered (kilogrammes)	60

Ring spinning frames

Number of production units	60 000
Number of working hours per day	23
Daily output (kilogrammes)	13 500
Total waste (kilogrammes)	136
Waste recovered (kilogrammes)	127

Cone winders

Number of production units	1 260
Number of working hours per day	23
Daily output (kilogrammes)	13 365
Total waste (kilogrammes)	135
Waste recovered (kilogrammes)	-

Pirn winders

Number of production units	750
Number of working hours per day	23
Daily output (kilogrammes)	5 585
Total waste (kilogrammes)	28
Waste recovered (kilogrammes)	-

Warpers

Number of production units	2
Number of working hours per day	23
Daily output (kilogrammes)	7 714
Total waste (kilogrammes)	38
Waste recovered (kilogrammes)	-

Slashers

Number of production units	3
Number of working hours per day	23
Daily output (kilogrammes)	7 676
Total waste (kilogrammes)	38
Waste recovered (kilogrammes)	-

Looms

Number of production units	1 280
Number of working hours per day	23
Daily output (kilogrammes)	13 261
Total waste (kilogrammes)	-
	-

Fabric warehouse
Total daily output (metres) 102 007