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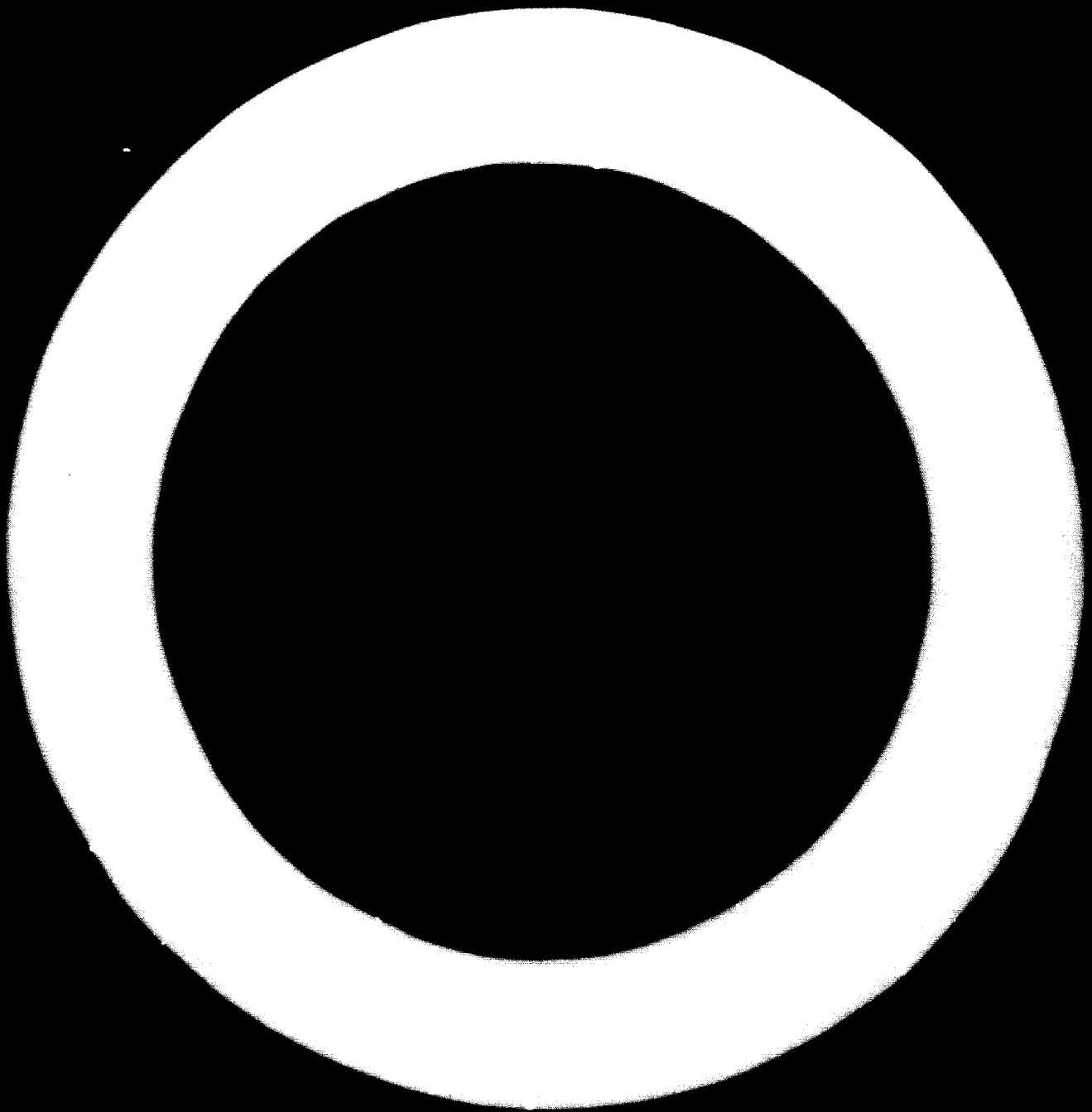
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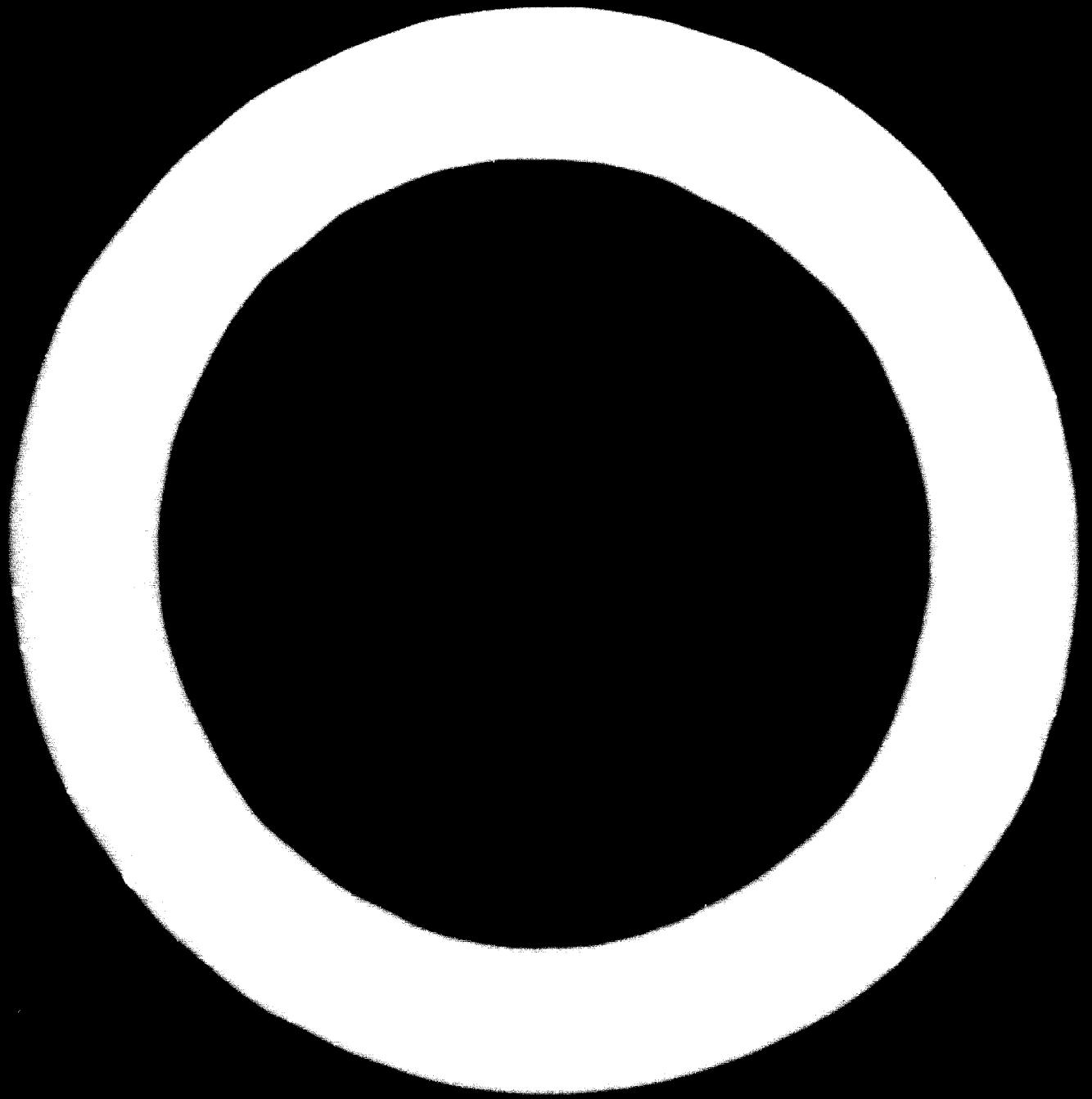
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REPORT OF
THE UNITED NATIONS
INTERNATIONAL CONFERENCE
ON TEXTILE AND APPAREL
IN BANGALORE
INDIA





**REPORT OF
THE UNITED NATIONS
INTERREGIONAL WORKSHOP
ON TEXTILE INDUSTRIES
IN DEVELOPING
COUNTRIES**

**1982, POLAND
6 - 27 September 1982**



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INTRODUCTION

1. The United Nations Interregional Workshop on Textile Industries in Developing Countries was held in Lodz, Poland from 6-27 September 1965.
 2. The Workshop was organized by the Centre for Industrial Development in co-operation with the Bureau of Technical Assistance Operations of the Department of Economic and Social Affairs of the United Nations Secretariat, and the Government of Poland.
 3. The Workshop was attended by:
 - (a) Participants invited from the following developing countries: Argentina, Brazil, Colombia, Hong Kong, India, Iran, Israel, Mexico, Poland and the United Arab Republic;
 - (b) Experts from industry, universities and research institutes from the following countries: Czechoslovakia, France, Japan, Switzerland and the United Kingdom;
 - (c) A representative of the United Nations Economic Commission for Latin America (ECLA);
 - (d) Observers from the International Wool Secretariat; and
 - (e) Observers from textile research institutes and textile mills in Poland.
- A list of participants, experts, officers of the Workshop and observers is included in annex III of this summary report.
4. The Workshop was opened with an address by Dr. I.H. Abdel-Rahman, United Nations Commissioner for Industrial Development, and a message was read from Dr. Victor Hoo, United Nations Commissioner for Technical Assistance.
 5. Welcome addresses were given by Mr. K. Olszewski, Minister, Head of the Committee for Co-operation with Foreign Countries, Government of Poland; Mr. Z. Wojtkowski, Vice Minister of Light Industries; and Mr. E. Kazmierczak, Mayor of the City of Lodz. Addresses were also given by Dr. T. Jedryka, Chairman of the Workshop, and by the Director of the Workshop, Dr. N. Beredjick.
 6. Dr. T. Jedryka (Poland) and Dr. J.L. Juvet (Switzerland) were unanimously elected Chairman and General Rapporteur, respectively. Dr. N. Beredjick and Mr. V. Saxl served as Director and Technical Consultant of the Workshop.
 7. The Workshop had before it a working paper entitled The Textile Industry in Developing Countries by Mr. V. Saxl, and thirty-three background documents in the field of textiles prepared by, or for, the Centre for Industrial Development. A list of the papers is included as annex II and the programme of the Workshop as annex I.

8. The Workshop elaborated a set of recommendations and the report on the textile industries in developing countries which follows hereafter. The recommendations and report were unanimously adopted at the concluding session of the Workshop.

9. As part of the Workshop Programme, the participants took part in field trips to textile mills and textile machinery plants in the vicinity of Lodz, Bialsko-Biala, Cracow, Warsaw and to the East Fibres Research Institute in Poznan.

I. RECOMMENDATIONS

10. The following recommendations were adopted by the Workshop:

(a) The Workshop, taking into consideration the great need for determining appropriate policies in the textile industry of the studies made by United Nations bodies in certain developing regions, recommends that the Governments of developing countries, in co-operation with the national associations of textile manufacturers, request from the Centre for Industrial Development and the regional economic commissions the extension of such studies to their respective countries and regions with a view to assisting them in determining the economic and technological aspects of an optimum policy for their textile industries.

(b) The Workshop, having noted the firm desires of the developing countries to create or expand their textile industry as an essential part of their industrialization process, considered that the high costs of modern machinery may accentuate the difficulties in the balance of payments of these countries and, in such cases where outside financing is necessary, recommends that it be given in such a way so as to be advantageous to the developing country and avoid possible practices in the export of textile goods which are not in conformity with the rules of international trade.

(c) The Workshop, having considered the increasing variety of textile machinery offered by manufacturers to developing countries, and having noted some of the difficulties in making adequate selection of appropriate equipment for the expansion or modernization of the textile industry in developing countries, recommends that the United Nations Centre for Industrial Development meet with a group of textile machinery experts with a view to formulating a set of guidelines on the selection of textile machinery. The Workshop, having noted with satisfaction that the Centre for Industrial Development will, in any case, convene a group of experts to consider the problems of utilizing second-hand machinery in all industrial sectors in developing countries, further recommends that the group of textile experts consider, in collaboration with the above body, the problems of utilizing second-hand textile machinery in the textile industry of developing countries.

(d) The Workshop recommends that Governments of developing countries take full advantage of the assistance which the United Nations may render through its Centre for Industrial Development, regional economic commissions, the Expanded Programme and regular programme of technical assistance and the Special Fund. Such assistance should not be limited to basic surveys of the textile industry in these countries, but should include follow-up assistance for the solution of specific problems in the industry adequately identified and pin-pointed through such or other surveys and studies. The Workshop further recommends that such assistance include both economic and technical aspects of the textile industry, and be designed according to the nature of the problems of the respective countries, ranging from short-term missions of individual experts, to collaboration in the establishment of local institutions which may serve the textile industry to longer-range assistance through missions of groups of experts and in collaboration with local counterpart personnel.

(e) The Workshop recommends that developing countries consider the creation of a body to deal specifically with the problems of production and trade of textiles in these countries, with a view to:

- (i) Rationalizing their production and assisting in determining any possible lines of specialization for individual countries or sub-regions or regions;
- (ii) Liberalizing to a further extent trade in textiles among the developing countries.

To this effect, the Workshop recommends that the Committee for Industrial Development consider the establishment of a special sub-committee to formulate the terms of reference of the above-mentioned body.

(f) The Workshop, having taken into account the valuable experience gained and the fruitful exchange of views among the participants at the United Nations Interregional Workshop on Textile Industries in Developing Countries, recommends that the appropriate organs of the United Nations make all necessary provisions for the convening, at periodic intervals of two or three years, workshops or seminars of similar nature in the field of textiles. Arrangements should be made to hold these meetings in different regions in countries willing to extend invitations and provide host facilities.

(g) The Workshop, having considered the importance of productivity for textile industries in developing countries, recommends that the United Nations and its specialized agencies undertake all necessary steps to assist in the formation of regional or national centres of productivity where such do not exist, with a view to improving the efficiency of textile industry management, disseminating new techniques of organization and management and new or improved methods of training of personnel at all levels and carrying out productivity measurements and inter-firm comparisons. The Workshop further recommends that the United Nations and its specialized agencies call on developing countries with established experience in this field to provide experts, scholarships and training facilities for the implementation of this recommendation.

(h) The Workshop, having considered the background documentation submitted by the Centre for Industrial Development recommends the utilization of this material, together with any additional information to be collected by the United Nations with a view to preparing a general survey of trends and prospects for the textile industry in developing countries, and further recommends that this survey be submitted for consideration to the International Symposium for Industrial Development, to be held in 1967.

(i) The Workshop, having considered the acute shortage of skilled manpower for the efficient operation of the textile industry in developing countries, and having elaborated for this purpose a draft programme for group in-plant training of engineers and technicians from textile plants in developing countries, recommends that the United Nations Centre for Industrial Development take all steps necessary for the early implementation of the group in-plant training programme in textiles and to this purpose initiate, as soon as possible, negotiations with Governments of countries willing and able to provide the necessary training facilities and personnel, and having a viable textile industry.

(j) The Workshop recommends that the regional economic commissions of the United Nations should initiate or continue studies on the basic and general aspects of the textile industry in developing countries. It should formulate general principles of policy on the subject. The Workshop recommends that these studies cover, as far as possible, the following aspects, including spinning, weaving, finishing and other processes. The studies should include as main fundamental aspects: (a) the level of productivity, better say the concept of economies of scale, taking into account both the technical factors, such as equipment and labour requirements, and the other elements as the quality of raw materials and final products, the level of factor costs in the various countries and overhead costs, especially administrative and marketing. The Workshop further recommends that the studies define a policy on textile industry, developing countries should take into account the findings of the above recommended studies and any other relevant information, and the additional modifications and adjustments required by the particular conditions of each developing country.

(k) The Workshop recommends that in order to facilitate the advance and modernization of the textile industry in developing countries, the United Nations bring to the attention of the Governments of respective member States, the necessity of adopting adequate measures to facilitate access by the developing countries to modern technological processes and know-how at reasonable rates of fees and royalties.

(l) The Workshop recommends that the United Nations, through its regional economic commissions and the Centre for Industrial Development, initiate or continue studies in developing countries at the national and regional level, in order to establish adequate standards of productivity for the textile industry for these countries and regions. The studies should include such aspects as labour productivity, technical productivity, work loads and work assignments within the mills of each country, and should, in so far as possible, include comparison with the standards of developed countries.

(m) The Workshop, having considered the problems of transfer of textile technology and know-how to developing countries, recommends that the United Nations Centre for Industrial Development take all appropriate steps to enlist the participation of textile research and development centres or institutes in industrialized countries in co-operative projects with similar institutions in developing countries with a view to improving their technical facilities and the skills of their personnel.

11. The report of the Workshop which follows hereafter deals with the main substantive items which were discussed in detail during the deliberations of the Workshop from 6 to 27 September 1965 in Lodz, Poland.

II. THE INTERNATIONAL SETTING

12. During the nineteenth century, industrial development in Europe was influenced considerably by the evolution of the textile industry, which was the first factory-type industry to appear. After the First World War, difficulties arose in Europe, and especially in the United Kingdom, resulting from changes which occurred in the structure of world production and trade. It should be mentioned that the difficulties faced by the textile industry, particularly the cotton industry, have changed in character during the present century. Between the two wars, they were mainly the result, on the one hand, of the emergence of new producers and, on the other, of the markets which were decreasing in size partly due to the world crisis. The problems were therefore mainly commercial and social. Since the end of the Second World War, however, these difficulties have become increasingly complex, largely owing to political and technological factors, the influence of which has been felt in the development of the textile industry in a number of developing countries.

13. The Workshop took note of the slow increase in world demand for textiles in recent years. On the whole, per capita consumption rose by nearly 30 per cent between 1950 and 1960 (in terms of weight), based on statistics of the Food and Agriculture Organization of the United Nations (FAO). However, there were marked differences between the rates of growth in different regions of the world. In the highly developed countries of North America and Oceania, the level of consumption remained virtually stable, while in Western Europe a substantial increase was registered, particularly considering the already high level of consumption existing in these regions. This increase was even more pronounced in Eastern Europe, including the USSR.

14. On the other hand, in the developing regions where textile consumption may be expected to increase rapidly because of the low level of consumption prevailing so far, per capita growth of consumption showed rather disappointing results. For example, in Latin America it was only 2 per cent higher in 1960 than in 1950; in Africa it increased by about 20 per cent, and in the Far East (not including Japan), by 25 per cent. Among the developing regions, only the Middle East showed a substantial growth, which amounted to over 70 per cent during the decade 1950-1960.

15. Thus, with the exception of the Middle East, the growth of per capita consumption in developing regions was less than that of the world as a whole, and, in consequence, the gap between the developed and developing countries as regards consumption of textiles was apparently widening.

16. This phenomenon is not limited to textiles only, but would seem to reflect the general trend of economic growth in the respective regions. In so far as textiles were concerned, the Workshop agreed that measures should be sought to narrow this gap by means of stimulating textile consumption in developing countries through appropriate policies.

17. It was pointed out that consumption expressed in terms of weight was not necessarily the most accurate indicator of the real trends of textile use, but that due to the lack of statistical material and the difficulty in obtaining other indicators, this measure was still taken as the basic indicator. The trend towards using synthetic fibres and higher counts of yarn in many fabrics tends to make the product lighter with the consequence that expenditure in textiles may, in fact, be rising more rapidly than is indicated by consumption expressed in terms of weight. In fact, this is well borne out in countries where statistical data are available. Nevertheless, it was pointed out that the influence of synthetics in developing countries was still small, although increasing rapidly. As shown in table 1, the consumption of apparel fibre indicates that cotton remains in a leading position, accounting for about two thirds of the total consumption, despite a decline in its relative share. The consumption of wool, about 10 per cent of the total has remained rather stable during the last few years. Among the man-made fibres, rayon has recovered in recent years after some years of stagnation and even decline. The most rapid growth has occurred with synthetic fibres, although on a world-wide basis their share of the market is still less than 10 per cent of the total and an even smaller proportion in developing regions.

18. The most recent information available to the Workshop, although referring to production rather than consumption data, is shown in table 2. The production figures relating to 1964 indicate that the afore-mentioned trends have not changed significantly. It should be noted that tables 1 and 2 do not contain any data on the consumption of bast fibres.

19. According to estimates presented at the Workshop, the total world production of textile fibres, including bast fibres such as jute and flax, in 1960 was 19.4 million tonnes and in 1970 is expected to reach 26.8 million tonnes, with an increase of 38 per cent during the decade. Natural fibres accounted for 16.1 million tonnes in 1960 and could reach 20 million tonnes in 1970, whereas man-made fibres, the production of which was 3.3 million tonnes in 1960, are expected to reach 6.8 million tonnes in 1970. The growth of man-made fibres in the decade is expected to be about 106 per cent, while the growth of natural fibres, only about 24 per cent.

20. Among natural fibres, cotton is expected to show the highest rate of increase (27 per cent in the decade of 1960-1970) with bast fibres next (23 per cent). The production of wool is expected to remain almost constant at about 1.5 million tonnes each year.

21. Cellulosic fibres constitute the largest proportion of man-made fibres produced and their production is expected to increase by about 30 per cent during the same decade. On the other hand, the production of synthetics may rise significantly in the decade 1960-1970, reaching about 3.2 million tonnes in 1970, i.e. almost equal to cellulosic fibres.

22. As a result of these different rates, the proportion of natural fibres will tend to drop from 83 per cent of total consumption in 1960 to 75 per cent in 1970. According to some estimates, cotton will drop from 52 per cent to 48 per cent, bast fibres from 24 per cent to 21 per cent, and wool from 7 per cent to 6 per cent. The proportion of cellulose will be more or less constant (about 13 or 14 per cent), but synthetics will rise from 4 per cent in 1960 to about 12 per cent in 1970. These figures portray the definite trend of the increasing importance of synthetic fibres as raw material for the textile industry.

Table 1

World consumption of apparel fibre, 1958-1962

Item	1958	1959	1960	1961	1962
(in thousand metric tons)					
Availability for home use					
Cotton	9,381	10,096	10,280	10,285	10,116
Wool	1,279	1,435	1,461	1,476	1,488
Rayon	2,280	2,501	2,616	2,725	2,871
Synthetics	418	581	716	837	1,065
Total fibres	13,358	14,613	15,073	15,323	15,540
(in per cent)					
Cotton	70	69	68	67	65
Wool	10	10	10	10	10
Total natural fibres	80	79	78	77	75
Rayon	17	17	17	18	18
Synthetics	3	4	5	5	7
Total man-made fibres	20	21	22	23	25
Total fibres	100	100	100	100	100
(in kilogrammes)					
Consumption per capita ^{a/}					
Cotton	3.39	3.42	3.46	3.39	-
Wool	0.47	0.48	0.49	0.49	-
Rayon	0.85	0.85	0.88	0.91	-
Synthetics	0.17	0.20	0.24	0.29	-
Total fibres	4.88	4.95	5.07	5.08	-

a. Three-year moving averages.

Table 1

World production of certain fibres, 1964

	Millions of pounds	Percent of total
Raw cotton	24,507	63
Raw wool	5,540	14
Raw silk	64	-
Rayon and acetate	7,250	18
Non-cellulosic (synthetic)	3,778	10
	38,979	100

Source: Textile Organon, June 1965.

23. There will also be modifications in the geographical distribution of textile products. For instance, the main producers of cotton will tend to decrease their proportions, even though production will increase because of higher yield per unit area. The smaller producers are also extending the cultivated area, and their production will increase even more rapidly than that of the big producers.

24. Wool will continue to be a product of extensive international trade as the principal producers (Argentina, Australia, New Zealand, South Africa, Union of Soviet Socialist Republics, Uruguay) are not the major consumers (France, Japan, United Kingdom, United States).

25. At present, the textile industry, catering to basic human needs, is one of the first to take root in developing countries, which are often the producers of the necessary raw materials. Accordingly, the distribution of textile equipment installed in the world has changed, as seen in table 3, which deals with cotton and allied industries, the most important branch of the textile industry.

26. Many participants declared that when authorities in a developing country attempted to establish a mill, they were often faced with difficulties, owing to the wide selection of machinery available. For these reasons, it was recommended by the Workshop that a panel of experts of international stature be established under the auspices of the United Nations to advise new producers in developing areas. In this connexion, the assistance activities already undertaken by some developed countries were considered commendable by some participants.

27. It was pointed out that due to the present nature of the industry and its present capital intensity, some reassessment of plans for the more rapid establishment and expansion of the textile industry in some developing countries was necessary. There often exists a fairly dependable domestic demand as an outlet for mills that could be installed, but it was also noted that at present, the return on capital invested in the textile industry was rather low in the world in general.

Table 3

Distribution of textile equipment(In per cent of total)Cotton system: World distribution of active spindles

	<u>1958</u>	<u>1963</u>
Africa	1	2
North America	18	18
South America	4	5
Asia and Oceania	21	26
Japan	7	9
Europe	49	40
	<u>100</u>	<u>100</u>

Cotton system: world distribution of active looms

	<u>1958</u>	<u>1963</u>
Africa	1	2
North America	16	14
South America	7	6
Asia	16	26
Japan	12	14
Europe	48	38
	<u>100</u>	<u>100</u>

Source: International Federation of Cotton and Allied Textile Industries (IFCATI).

28. Along with the more recent problem of the capital intensity of the textile industry, some participants emphasized the fact that problems of industrialization in other basic fields have also cropped up in developing countries. The result has been that Governments in many developing countries have undertaken a planned development based on certain priorities and national objectives. Consequently, the question arises as to how to go about installing or expanding the textile industries in these regions and to what extent this should be undertaken. It was recognized that countries having the benefit of an established industry, as for instance, India, could expand on the existing structure, especially if they have a very large home market. The problem, however, appears more complex for most developing countries because the extremely rapid technical progress has progressively altered the traditional structure of the sector. As already stated, the textile industry is changing from a labour intensive to a capital intensive industry. Consequently, the transition from a single to a double or triple shift system, rendered necessary by the demand to set aside reserves for depreciation, has resulted in the appearance of surplus production capacity in some countries of Europe.

29. With the introduction of new industries in developing countries, it was thought necessary and very advisable by some participants to explore possible export markets, after meeting domestic requirements. The export markets could be found on a regional basis within the framework of an integrated regional industry or, in some cases, in overseas markets. Such measures were considered in line with the efforts of the developing countries to ameliorate their balance of payment difficulties.

30. As regards the regional integration of industries, it was felt that developing countries in a particular region should strive, wherever possible, to set up industries complementary to each other.

31. Some participants stated that it would be advisable for such countries to establish economical industries without the protective barriers of high tariff walls and without attempting to manufacture a wide range of products, especially in plants below the minimum economic size. It was considered likely that some countries, after attaining a degree of industrial development, could venture into the field of specialized fabrics and products and enter the world market for such goods. In such instances, it would not be impossible for them to export by taking advantage of their traditional skills and existing equipment. However, for goods in general demand, it may be necessary for such countries to acquire certain advanced types of equipment or highly developed machinery with which to face the competition in the world export markets. In these instances, some participants stated, governmental authorities in such developing countries could fix some positive export obligations for any interested parties, in order to avoid the burden of their foreign exchange reserves. It was pointed out, however, that such exports should be made, as far as possible, in accordance with general rules applied in international trade. In this context, it was considered necessary for developed countries supplying machinery to accept a part of such export obligations and find ways and means to supply the machines needed, thereby eliminating any further burden on the balance of payments of developing countries. The channels of multilateral aid were considered one desirable solution to such problems.

32. It was strongly emphasized that the developed countries with a superior knowledge of manufacture and with a capacity to supply plants and machinery might be of immense assistance to the developing countries. Reference was made to bilateral agreements between certain industrialized countries and some developing countries, dealing not only with the supply of plants and machinery, but also with technical assistance. These were considered to be steps in the right direction as long as the advice given was impartial and in the best interests of the developing countries.

III. ASSESSMENT OF NEEDS

33. The Workshop recognized that the slow growth of textile consumption, particularly in the developing countries or regions, was hardly occasioned by insufficiency of supply. On the contrary, on a global basis there exists sufficient, if not excessive, productive capacity which could satisfy the present demand. However, one of the major obstacles to be overcome by developing countries wishing to avail themselves of this supply is the shortage of foreign exchange for the import of these goods. In some developing countries where the domestic industry already supplies the home market to a greater or lesser degree, the low level of income does not yet permit the acquisition of larger quantities of textiles from the limited total disposable family income available.

34. In this connexion, the Workshop discussed the interrelationship between absolute levels of income and the level of textile consumption, the growth of incomes and the growth of textile consumption, as well as the level of prices of textiles and the consequent effect upon demand. It was agreed that this question should be carefully analysed in assessing the needs of the textile industry and that while some general principles regarding these interrelationships might be derived from the historical experience of other countries, it would be necessary to make a separate evaluation for each particular country.

35. The consumption of textiles is influenced by a number of factors, some of which are related to general economic policy at the government level, particularly as regards the growth of per capita income, whereas others are centred around the mill level where industrialists through a policy of prices, quality and type of product may influence and stimulate the demand for textiles.

36. It becomes evident, therefore, that the assessment of needs and the formulation of policies regarding the textile industry requires a joint effort at the national level and at the mill level. At the national level, governmental agencies which have over-all responsibility for industrial development policies in general and those relating to the textile industry in particular, should work together in assessing the needs on which a policy and an eventual programme or plan could be based. International agencies, such as the United Nations, could also assist Governments and industrialists in certain stages of this task.

37. The participants agreed that a special study should be made on the relationship between prices and demand, as it was pointed out that in some cases the demand did not follow the same trends as the income. Special reference was made to the monetary policies and inflation which in some Latin American countries distort the price structure and tend towards an artificial demand by increased accumulation of stocks by wholesalers.

38. The Workshop noted with interest the report on the work undertaken by the United Nations Economic Commission for Latin America (ECLA), with respect to the textile industry in the countries of that region. These surveys comprise a first-hand collection of basic data regarding production, installed capacity and its utilization, degree of obsolescence of equipment, output per machine and labour productivity, together with some tentative cost calculations. If such data are normally not available in developing countries efforts should be made to collect,

analyse and maintain them on a permanent basis, since they constitute an essential element for the formulation of adequate development policies for this industry. The ECLA surveys referred to above also include an assessment of the probable evolution of a market in these countries and a confrontation of the supply and demand situation for a given future date. These surveys are undertaken without disclosing the identity of individual firms, in order to ensure an ample participation of the enterprises. They provide a stimulus for action to correct the problems identified and permit the formulation of a co-ordinated programme for the development and rationalization of that industry.

39. Market studies and forecasts for various countries are also undertaken by the International Cotton Advisory Committee and surveys concerning installed capacity and its utilization are undertaken by the International Federation of Cotton and Allied Textile Industries (IFCATI).

40. The general conclusions to be drawn, at least from the Latin American experience, shows that under the umbrella of high tariff protection and limited internal competition, the textile industry has grown over the years with operating conditions which, except for very few instances, are far below accepted standards. This situation may account for the relatively high price of textiles and, in turn for the slow growth in consumption.

41. It was noted by the participants that Colombia and Paraguay were exceptional in that their industry operates at high efficiency, and their relatively low level of textile prices has contributed to a very fast increase in consumption.

IV. FORMULATION OF POLICIES

42. The Workshop agreed to differentiate between the situations prevailing in developing countries by classifying the latter in two broad categories,

(a) Countries which already have developed a significant textile industry;

(b) Countries which are in the beginning of their industrialization process and have plans to set up a textile industry.

43. The economic systems of the countries, whether free market economy or centrally planned, are also to be taken into consideration, mainly as regards the methods of elaborating policies for the development and the operation of the textile industry in developing countries.

A. Classifications

44. It has been recognized that the problems of the textile industry in developing countries might be pragmatically classified as follows:

1. Oldest among developing countries

45. In this category, typically represented by Latin America, some countries of the Far East such as India, and some countries of Central Africa, a textile industry has been in existence for a long time. The industry has frequently undergone considerable expansion during and immediately after the Second World War. In many instances, the industry was established by merchants who began by importing clothing materials and later went into industrial production.

46. After the Second World War, because of the existence of a seller's market, adequate industrial policy was not pursued. As a consequence, profits were in many cases reinvested outside the mill. The main problems in many of these countries appear to be surplus of equipment, obsolescence of machinery and often, lack of administrative and technical personnel. Broadly, these problems are seen to arise from the trend towards switching from a labour-intensive to a capital-intensive industry.

47. Exceptions to the above situation are countries where the textile industry has developed rationally, with constant modernization and sound expansion. The industry, in these few exceptions, can be considered at present as competing with that of the most advanced countries, and as a possible competitor to the textile industry of countries exporting textiles. The problem in these instances is the necessity of expanding production to provide exportable surpluses, as development has proceeded rationally only with respect to the internal market.

2. Newly developing countries with incipient industries

48. These are countries most of which have become independent since the Second World War. They are essentially producers of primary and agricultural products,

without any significant industrial activities, since their consumer goods were supplied by the metropolis. Such countries are mostly those of the Near East, Asia and Africa. Their main problem is to start a co-ordinated well-equipped industry, each unit being of an economic size and the technical level being in accordance with the conditions prevailing locally. The main aspects of the policies to be adopted might be summed up as follows:

- (a) Promoting the textile industry;
- (b) Finding sources of financing;
- (c) Planning the structure of the industry;
- (d) Formulating general policies to promote the most efficient operation;
- (e) Initiating measures and institutions designed to ensure higher levels of productivity;
- (f) Training of manpower at all levels;
- (g) Formulating price and marketing policies.

B. Promotion of the textile industry in developing countries

49. Any decision to promote a textile industry should be based on the three following considerations:

- (a) Satisfaction of the country's domestic market;
- (b) When the domestic market is not sufficient, the satisfaction of a regional market should be the principal goal, provided that political and economic conditions of several neighbouring countries suggest the feasibility of regional economic integration;
- (c) If manufacturing conditions are favourable for competitive production, policies might be established with a view to exporting on the international market, after the domestic demand has been fully satisfied.

In this connexion, the unique position of Hong Kong was noted, where a fully successful textile industry has been set up principally to supply the world market. Exports from some countries producing raw materials such as extra long cotton fibres, special animal hair such as alpaca, vicuna, etc., can also be the object of development policies, if adequate manufacturing conditions can be obtained, in order to keep in these countries a substantial added value, and to counteract the effects of fluctuations in the international prices of raw materials. Such is the case of the United Arab Republic and might also apply to Peru, Bolivia, and north-eastern Brazil.

50. Special mention was also made of the interest in developing the export of sophisticated handicraft products made in certain developing countries. This has been the experience of some countries such as India, Guatemala and Mexico, where the traditional ability of the population to produce elaborate and highly artistic fabrics have met with success in developed countries. Special

international trade conditions should be contemplated in order to ease the exports of such products.

51. The participants considered that the textile industry should develop by improving the quality of the goods produced, and by observing the best balance between quantity, quality and price.

52. All the factors involved in the establishment of production have to be considered very carefully, such as machines, organization and labour. Since the productivity of the mill will depend more on the ability of the people to run the industry, than on the quality and degree of the mechanization of their machinery, there should be good management and trained workers. The vocational training of personnel at all levels should be provided at a national level and the cost of necessary training in the enterprise should be included in the budget.

53. In this respect, the participants recommended following the precedents created in some countries where technical assistance has been given to the management of the new industries, through agreements between certain industrialized and developing countries.

54. Some participants also pointed out the advantage of decentralizing industry by installing production units in various less industrialized locations, but within the over-all plan for the industry.

55. In the case of some countries, reorganization and re-equipment of the textile industry is being realized through a system of programming which gives incentives to the mills participating in the programme. Such a programme must be as integrated as possible, and must fit into the scope of the general development of the country's economy so that the reorganization of the textile industry will develop along with the rest of the industry, as well as with other sectors, such as agriculture and stock-breeding.

56. In some other countries, the establishment or the development of the textile industry is promoted through an over-all programme embracing all activities related to it within the framework of the general development of the country's economy. Where a textile industry already exists but has to change or modify its structure, the programme should provide adequate measures for solving the problems created by such a change or modification.

C. Sources of financing

57. Regarding the means of financing such programmes, the Workshop recognized that difficulties might arise in some countries, in particular with regard to three main adverse factors which are often interrelated:

- (a) Decapitalization of the mills due to the lack of an industrial policy;
- (b) Devaluation of national currencies observed in many developing countries;
- (c) The high rates of capital interest.

58. Measures, such as fiscal incentives, should be taken by the Governments to encourage reinvestment in the mills. Exchange insurance schemes in developing countries importing machinery would facilitate the use of credits offered by machinery makers or by Governments of industrialized countries. Credits at low

interest rates, could be sought from international financial institutions for financing a programme of re-equipment, reorganization, or expansion of the textile industry.

59. In certain countries the over-all financing of the development programme is often included in the development plans. In general, financing is made easier by the fact that long-term credit is often available from machine manufacturers, Governments, or international banking institutions through bilateral or multilateral schemes.

D. The structure of the textile industry in developing countries

60. The participants agreed that it was impossible to recommend a single structure for the industry which could be adopted in every developing country. Many factors pertaining to each country must be taken into consideration, as they may have a direct influence on the optimum structure to be adopted for a particular mill. However, a generalized adequate structure should realize the quickest possible rotation of working capital to avoid paying heavy interest on capital borrowed, and should incorporate the most integrated possible production line, which may be several mills of an economical size placed under a common administrative organization.

61. Apart from these general principles, the participants felt that a number of technical, administrative, and commercial rules should govern the choice of a structure. These rules should include the following:

- (a) A sound market study to define a programme of production;
- (b) The best technical balance of production;
- (c) An investigation of the minimum economical size;
- (d) The optimum use of personnel;
- (e) The elaboration of a layout which would allow future extension of mills without undue alteration of the production flow or extensive movement of machinery;
- (f) The maximum use of the equipment production capacity, especially finishing equipment;
- (g) The adequate employment of available raw materials;
- (h) The establishment of complementary industries, such as chemicals and man-made fibres;
- (i) The application of modern methods of production controls;
- (j) The choice of capable mill management;
- (k) The regrouping and consolidation of several mills under one administration, wherever feasible and advisable, in order to improve the efficiency of the operation;

(l) The investigation of the most economical method of obtaining the largest possible distribution of the product, possibly through adequate sales organizations placed under the same administration as the production activity, or closely co-operating with the latter;

(m) The development of markets for the best use of products;

(n) The co-operation with the garment and clothing industry in order to improve the quality of their products.

E. General policies for promoting the most efficient operations

62. Regarding general policies, the Workshop agreed that two different cases should be considered:

1. Developing countries with an existing textile industry

63. This was considered the most difficult case as it is more difficult to change routine practices than to promote efficient measures from the beginning. In general, it has been observed that operational deficiencies observed in some developing countries are due to the insufficient skill of management.

64. Under these circumstances, promotion is basically a matter of educating the administrators of the mills in order to adopt modern methods, to investigate the best use of raw materials they desire to process, to improve the qualifications of the workers and to proceed with sound modernization of the equipment when necessary. Emphasis should be placed on the adequate assessment of the re-equipment plan and industrialists should supply proof that their administrative organization is adequate enough to ensure the realization of the maximum efficiency from new equipment.

2. Developing countries with a newly established textile industry

65. In such countries, promotion is normally included in the national economic development programme and is connected with the development of all activities related to the textile industry. Due preparation of the future staff of the mill must also be included in the general programme so that, after possible temporary help from external management, the mill can be operated entirely by nationals. Preparation and training of labour may be arranged through special schools or technological institutes if the size of the industry justifies their establishment. The United Nations and the International Labour Organisation or the specialized agencies can in such cases contribute to such programmes. In addition, in-plant training should supplement this broader vocational training.

F. Measures and institutions to ensure higher levels of productivity

66. Although it is definitely established that programming should be the basis for obtaining higher levels of productivity, participants were of the opinion that a distinction should be made between countries with free market economies and those with centrally planned economies, as the programming methods differ.

67. In some countries, a programme should be established through official or semi-official planning boards in which the state, the industrialists, the labour unions and responsible representatives of the economic sectors related to the textile industry should participate.

68. The programming may be undertaken in such a way that all activities related to the textile industry could develop, together with the industry itself. Incentives should be given to induce manufacturers to accept the programme. Such incentives could include credit policy, e.g. loans for re-equipment, fiscal policy encouraging consolidation of the industry, and possibly, customs tariffs protection to help newly created mills make the adequate depreciation of their investments. However, it was the opinion of participants that such an incentive should be handled carefully in order not to stifle competition. The purpose of these measures should be directed so as to encourage the new industry to make the necessary efforts to produce at the lowest costs and keep sales prices at the lowest possible level. Complementary to programming, institutions for the promotion of productivity should be created when these do not already exist. The purpose would be to disseminate information and provide training courses, seminars and conferences with a view to improving operational conditions. These institutions should also engage in periodic productivity measurements within enterprises and, from time to time, sectoral studies to examine the development of the industry and to assess whether such development conforms with the established programme.

69. It was strongly emphasized that quality control laboratories should form part of every textile mill. Research laboratories and pilot plants should be established whenever the size of the industry justifies such installations. Such establishments may help to show ways of promoting higher productivity.

70. In other countries, planning should be provided in a similar manner; however, it is customarily included in the general programme of economic development.

71. All actions taken to increase the productivity and the efficiency of the industry are directed towards two main objectives: the reduction of the production costs and the improvement of quality.

6. Price policies and markets

72. The participants agreed that the first and main objective for the textile industry in any developing country was to satisfy the basic need for clothing for the mass consumer, followed by exports. Since standards of living are usually low, it is imperative that clothing be produced at the lowest possible prices, but with consistently adequate quality. Potential markets are generally considerable, and are limited only by buying power. It is therefore in the interest of, as well as the duty of, manufacturers to sell at low cost and in large quantities in order to ensure quick returns. High-class and fancy goods may also be produced when markets are important enough to justify an economic size of production. Sales of such goods are influenced by consumer taste, fashion and price. Adequate margins of profits can be included in the sales prices since the volume of sales will be lower than mass consumption sales. Slower returns, which mean heavier interest charges, are to be expected, and cost price or even below cost price sales of after-season remnants may considerably reduce profits. In addition, the complexity of designing and manufacturing such products may also discourage many producers.

V. RELATIVE IMPORTANCE OF DOMESTIC MANUFACTURES VERSUS IMPORTS

73. The Workshop endorsed the need for general industrial development in the developing countries as a basic requirement for their progress. It was recalled that in response to the interest expressed by developing countries, the United Nations established the Centre for Industrial Development, which, as part of its activities and in addition to this Workshop on textiles, also organizes seminars on other aspects of industrialization and assists Governments in the solution of problems in this field.

74. The reasons for supporting accelerated industrialization as a normal objective of the developing countries were specified as follows:

(a) The transfer of economic activity from the primary to the secondary sectors increases the value added to production and permits a better utilization of the natural resources of the developing countries, thus raising the standard of living of the population;

(b) The need to create new employment opportunities required by the rapid growth of the population and aggravated by the increasing displacement of agricultural labour due to the progressive mechanization of agriculture may be solved expeditiously by rapid industrialization;

(c) There is need in developing countries to remedy the chronic disequilibrium of the balance of payments. In general, developing countries do not earn sufficient foreign exchange for their requirements, sometimes not even sufficient for the raw materials required to keep their industries operating. This is due to the fact that the exports of their traditional products - mainly raw materials and basic commodities - are not sufficient to compensate for the imports needed.

75. It was recognized that the demand for primary products grew slowly on the world market and that their prices were subject to frequent oscillations. Increasing the production and export of such primary products in order to compensate for diminishing foreign exchange receipts would only aggravate this situation, since prices on the world market would tend to fall with the additional supply.

76. On the other hand, the developing countries' demand for manufactured products increases very rapidly, with the result that the need for foreign exchange is substantially higher than the earnings from exports, which are also needed to service amortizations and interest on the financial obligations assumed by the developing countries.

77. Consequently, the Governments of developing countries are faced with the urgency of promoting industrialization to substitute for imports. To achieve this objective, some measures are being taken to protect the industry. Evidently, under the circumstances prevailing, the industry does not necessarily operate under the most competitive conditions. Nevertheless, the social aspects are of

an overriding importance, given the desire to create employment and the promotion of other industries and trade relationships. The latter phenomenon, in fact, includes the general in the developing country.

78. The Workshop noted that a substantial proportion of exports on textiles and that most regions of the world were closely related, as shown in table 4. The two major exceptions are Africa and Oceania, the latter being a special case because of its close relationship with the United Kingdom.

79. The trend towards the substitution of imports of textiles by local production was bound to occur for the reasons pointed out above. It would be impossible for the developing countries to supply the needs of their basic consumer requirements by means of imports. To illustrate the magnitude of the values involved, it was pointed out that, according to estimates by the Economic Commission for Latin America, the production of textiles in that region had reached a value of \$3,700 million.

80. The Workshop pointed out that international organizations such as the United Nations assisted Governments in the establishment of industry in countries without any as yet, having taken as a starting point the size of the internal market with a view to providing an economic basis to this new activity.

81. It was pointed out that the establishment of a new textile industry could be carried out by stages, followed by a gradual process of vertical integration. For example, looms could be installed first, then basic finishing equipment, to be followed eventually by the installation of a spinning mill.

82. The question was also raised concerning the ability to pay for imported equipment when establishing the textile industry in developing countries. It was considered that this problem could be approached either through multilateral international financial assistance or through the export of part of the new production.

83. The Workshop also examined the question of the high prices of textile products in an industry protected by high tariffs. The gradual reduction of tariffs after a period of adjustment for the industry could be an efficient instrument for promoting production at progressively lower, and therefore more competitive prices. The possible alternative of installing other industries which may be more profitable than the textile industry was examined. It was considered that there was no alternative choice available, due to the very nature of the textile activity linked as it is to a basic human necessity. The existence of this industry in developing countries therefore becomes imperative. The discussions led to a general consensus that it would not be viable to prevent the developing countries from setting up their own textile industry for purely economical reasons. However, it was pointed out that international agencies could play a useful role in orienting the establishment of this industry on the most rational basis possible. The Workshop stressed the need for complete and general surveys in every country on the subjects of production, raw materials, and marketing, prior to the establishment of new textile industries. These surveys should be carried out in order to approach the basic problems likely to be encountered and to establish priority criteria for development.

Table 4

Consumption, production, and net import of textiles by regions

Item	1956	1957	1958	1959	1960
<u>NORTH AMERICA</u>					
	<u>(in kilogrammes)</u>				
<u>Per capita consumption</u>	16.0	15.1	15.1	15.1	-
	<u>(in thousand metric tons)</u>				
Available for home use	3,032	2,889	2,741	3,187	3,034
Manufactured	2,987	2,872	2,705	3,091	2,966
Net imports	45	16	36	96	68
	<u>(in per cent)</u>				
Net imports as percentage of availabilities for home use	1.5	0.5	1.3	3.0	2.2

<u>WESTERN EUROPE</u>					
	<u>(in kilogrammes)</u>				
<u>Per capita consumption</u>	8.5	8.7	8.8	8.9	-
	<u>(in thousand metric tons)</u>				
Available for home use	2,661	2,930	2,674	2,846	3,089
Manufactured	3,170	3,377	3,109	3,308	3,567
Net imports	509	447	435	462	478
	<u>(in per cent)</u>				
Net exports as a percentage of manufactured	16.4	13.2	14.0	13.5	12.6

<u>OCEANIA</u>					
	<u>(in kilogrammes)</u>				
<u>Per capita consumption</u>	8.3	8.0	8.1	8.8	-
	<u>(in thousand metric tons)</u>				
Available for home use	119	111	125	131	148
Manufactured	57	61	61	66	69
Net imports	62	50	64	65	79
	<u>(in per cent)</u>				
Net imports as percentage of availabilities for home use	51.8	44.7	57.5	49.9	53.2

Table 3 (continued)

Item	1960	1961	1962	1963	1964
LATIN AMERICA (in kilograms)					
<u>Per capita consumption</u>	4.4	4.4	4.5	4.7	-
(in thousand metric tons)					
Available for home use	804	843	809	81	-
Manufactured	732	732	734	77	0
Net imports	72	111	75	70	0
(in per cent)					
Net imports as percentage of availabilities for home use	8.9	13.1	9.3	8.5	0.0

NEAR EAST (in kilograms)					
<u>Per capita consumption</u>	3.0	3.0	3.2	3.5	-
(in thousand metric tons)					
Available for home use	353	387	409	431	429
Manufactured	273	284	337	340	364
Net imports	80	93	72	82	61
(in per cent)					
Net imports as percentage of availabilities for home use	20.5	24.0	17.8	19.0	14.3

FAR EAST (in kilograms)					
<u>Per capita consumption</u>	2.6	2.7	2.7	2.7	-
(in thousand metric tons)					
Available for home use	2,373	2,385	2,079	2,334	2,588
Manufactured	2,392	2,561	2,163	2,333	2,700
Net exports	19	176	184	199	200
(in per cent)					
Net exports as percentage of manufactured	0.8	6.9	8.5	7.1	7.2

Table 4 (continued)

Year	1956	1957	1958	1959	1960
PAKISTAN (excluding Japan)					
	<u>(in kilogrammes)</u>				
<u>Per capita consumption</u>			2.0	2.0	2.0
	<u>(in thousand metric tons)</u>				
Available for home use			1,480	1,542	1,647
Manufactured			1,217	1,397	1,442
Net imports			263	145	205
	<u>(in per cent)</u>				
Net imports as percentage of manufactured			22.0	10.0	14.0

AFRICA					
	<u>(in kilogrammes)</u>				
<u>Per capita consumption</u>	1.9	1.9	1.8	1.7	-
	<u>(in thousand metric tons)</u>				
Available for home use	345	404	372	357	383
Manufactured	55	59	70	78	76
Net imports	290	344	302	279	307
	<u>(in per cent)</u>				
Net imports as percentage of availabilities for home use	84.2	85.0	80.5	78.2	80.2

Source: Based on FAO statistics.

VI. RAW MATERIALS, CRITERIA FOR SELECTION AND AVAILABILITY

84. The correct use of textile fibres depends on many factors, the most important of which are:

- (a) Wearing conditions of the final products;
- (b) Fibre properties;
- (c) Economic factors of the end uses;
- (d) Availability of fibres;
- (e) Availability of necessary processing equipment;
- (f) Standard of living of the prospective consumers.

85. There are no rules or principles regarding the interrelationship of the above-mentioned factors. There are also no criteria for the assessment of the degree of their economic importance. They can be investigated for any given country with regard to social conditions, tradition and technical possibilities. An accurate analysis based on scientific and technical aspects should have a decisive effect on the proportions of particular varieties of fibres selected for use.

86. For the application and blending of particular fibres, economic factors must be taken into consideration. The appreciable differences in the prices of various fibres and in the cost of their processing, along with the end uses, are the considerations governing selection.

87. Many countries producing substantial quantities of natural fibres avoid the use of man-made fibres in spite of the fact that they often prove to be more economic or more likely to improve the quality of the final material. In countries with a large consumption of natural fibres, attention should be given to the use of man-made fibres, which make possible a highly economic blending.

88. Cotton consumption, it was stated, increased rapidly in Asia (Pakistan), Africa (United Arab Republic) and Latin America (Colombia).

89. Bast fibres are an important part of the world textile market, with a production of 3,230,000 tons in 1964. The most important is jute, followed by sisal and other hard fibres. Flax and hemp form the third group of this family.

90. After considering the general situation of the world market of fibres, the Workshop noted that some countries were using the available raw materials incorrectly. For example, some natural fibres of high quality are used to manufacture low-grade plain goods. Cotton in South America and Africa, and fine hairs (e.g. alpaca) in South America were mentioned as examples of such situations. There are two alternatives for dealing with this problem. One is to adopt a

...of such methods in order to export the high-quality raw material and import other qualities more economically adapted to the kind of products which are locally demanded. In this way the country could save substantial sums of foreign currency. The other possibility is to establish plants which will produce the high-quality goods which could be manufactured with this raw material. The adoption of either of these methods or of an optimum combination of both depends, of course, on the particular situation and needs of each country. The Workshop recommends that every country make a careful study of fibres produced locally and try to use them in the best possible manner, including also their export.

91. It was also noted that one wool-growing country was producing only particular types of wool suitable for specific end uses. The same country may lack other wools with the qualities needed for the production of certain fabrics used domestically or required for export. In such instances it is important to study such situations carefully and recommend which qualities are really needed for the end product which would be imported without endangering the domestic wool market. Thus, it may be advisable to import some fibres to improve the wool blends, or import coarser fibres for less expensive fabrics, leaving the finer ones for export.

92. The Workshop took note of the activities of the International Wool Secretariat, whose aim is to promote the use and usefulness of wool by carrying out fundamental and applied scientific research and by promoting woollen fabrics and products. It was further stated that the International Wool Secretariat assists manufacturers in producing more and better wool products at lower prices by advising on such items as the best technological methods for a specific product, labour deployment, machinery and fashion trends in womens' wear.

93. The Workshop took notice of the rapid development of new industries producing synthetic fibres in developing countries. Several participants explained the way in which these industries were developing in their countries (e.g. Brazil, Argentina, Mexico, Colombia), proceeding from the manufacture of yarn, to the polymer, to the monomer, and even in some cases to the raw materials for the monomers in petrochemical plants. In this respect it was observed that the line of development of such industries not only depends on economical and technical considerations, but also on the institutional conditions prevailing in each country.

94. One of the reasons for the increasing consumption of synthetics is that they are more suitable for a large number of products. The rate of growth of the staple variety of man-made fibres is now higher than that of filaments. From 1960 to 1964, the production of cellulose staple fibres grew by 33 per cent and that of filaments, grew by 16 per cent, whereas production of synthetic, staple fibres grew by 147 per cent and for filaments by 130 per cent. This situation will change in the coming years, and it has been calculated that in 1970 more than 70 per cent of the production will be in filament form, mainly because of improvements in techniques of texturized yarns (200,000 tonnes in 1964). The biggest producers of man-made fibres are the United States, Japan, the United Kingdom, the Union of Soviet Socialist Republics, Italy and France, and there is a definite tendency towards the concentration of production in these countries. In 1950, almost all man-made fibres were cellulosic (nearly 96 per cent of the total), but in 1964 they represented only two thirds of the total. Also, the importance of different synthetic fibres has changed: polyesters and polyacrylics have come into use more rapidly than polyamides and others. Nevertheless, polyamide, polyacrylic and polypropylene fibres are likely to maintain an important position in the future

because of the progress made in texturized yarns, and the development of new end-products (e.g. tire cord, carpets). Following the lead of elastomerics offer interesting possibilities and will probably be applied also to glass fibres.

95. The principal problems concerning man-made fibres are the over-capacity and excess installed capacity in the world, mainly in the industrially advanced countries, the large amounts of capital needed for production, and the large number of developing countries which are beginning to operate small uneconomical plants to produce cellulosic and synthetic fibres at home.

96. Considering all the problems involved, if such plants are to be established in developing countries, the advanced countries should be requested to give technical assistance. However, it was stressed repeatedly at the Workshop that there was a danger of over-production of man-made fibres on a world-wide basis. In any event, the satisfactory introduction of this industry should be considered only in large markets.

97. The Workshop noted with interest the recent development of new kinds of man-made fibres, such as polyvinyls and polyacryls, which are gaining in importance because their properties improve the quality of the products. Moreover, they can sometimes be used as economical substitutes for cotton or other fibres. Such is the case in some developing countries where there is a scarcity of land, or where the land could be diverted to more adequate crops, or in countries where it is necessary but difficult to import cotton.

98. With regard to the substitution of natural fibres by man-made fibres, it was observed that there is a trend all over the world to produce mixed fabrics to suit particular end uses. The developing countries could benefit from this experience and plan their production on the basis of consumption of some man-made fibres right from the beginning. It is quite evident that taste, consumers preferences and the establishment of man-made fibre industries could stimulate the demand for these fibres in developing countries.

99. The Workshop took note of the importance of blends in the wool industry. Wool has some excellent properties unequalled by any other fibres; for instance, it is warm and capable of absorbing moisture without feeling damp to the touch. However, the wool fibre is relatively weak and has other less desirable qualities. Therefore, blends are increasingly used to improve the strength of the wool products and add dimensional stability to fabrics. In the past years, many different types of blends have been tested and at present, two principal types of blends are being used: wool with polyester fibres for worsted fabrics and wool with acrylic fibres for goods incorporating woollen yarns. The wool-polyester blends have captured an important part of the worsted goods market, especially for the light-weight fabrics. It was stated that the production and consumption of wool has increased by about 50 per cent over the past fifteen years, and although wool-growers endeavour to produce a great quantity of this material from year to year, there would be a shortage of wool, if synthetic fibres were not employed in the woollen industry.

100. Some participants stated that the prices of textile goods, which are greatly influenced by the prices of raw materials, depend largely on national policies for raw material prices. These policies differ greatly from one country to another. Consequently, in spite of relatively small differences in costs as regards the added value by the modern textile industries, it was pointed out that the prices

of finished goods could differ widely. Therefore, it was recommended that appropriate bodies take measures to liberalize as far as possible access to raw material markets, within the framework of an adequate price policy. Such steps could be taken gradually, for instance, on a regional basis, attempting to integrate production of raw materials (natural and man-made) to the best advantage of the consuming industries. Under present circumstances, it was pointed out that the above-mentioned excess capacity of production, as foreseen in the man-made fibre sector in developed countries, may have undesirable future effects on the prices of natural fibres.

101. In conclusion, it was recommended that the consuming countries study carefully the situation of markets of natural and synthetic fibres which could be mutually substituted in order to avoid serious disturbances that might otherwise be brought about in prices or availability.

VII. THE MILL LEVEL, METHODS OF ASSESSMENT OF NEEDS AND FORMULATION OF OPTIMUM POLICIES

102. It is clear that in developing countries the aspirations and policies of the Government greatly influence actions and policies at the mill level. The Government may be programming the development, expansion or modernization of industry and facilitating financing, special exchange rates for equipment, and raw materials. The Government may grant tax exemptions for development textile industries, in general or to induce manufacturers to establish mills in particular regions.

103. The Workshop dealt with the specific policies at the mill level after having considered regional as well as national aspects of policy. Policies at the mill level start with planning mills through the proper utilization of raw materials and equipment, to finished products. This subject deals with modern methods of administration and other points enumerated hereafter. In this context the Workshop considered the establishment of new plants, the modernization and expansion of plants and the improvement of operations at the mill level.

A. Investment decisions regarding new textile mills in developing countries

104. The first important step in investigating the feasibility of establishing a primary textile plant (spinning, weaving and finishing) in a developing country is to ascertain whether the following factors are available:

(a) Sufficient capital for the advantageous purchase of basic machinery and other fixed assets without undue borrowing at high interest rate;

(b) Working capital in amounts sufficient to cover needs with limited use of credit, the understanding in advance being that profits normally come only after an extended period, sometimes as long as four years, especially in areas where extensive labour training is needed;

(c) Ample labour supply, unskilled and some skilled;

(d) Raw materials available locally or imported at reasonable prices;

(e) Duty protection against competition from foreign industries which may be well developed and whose equipment may be already amortized;

(f) A distinct need for a basic product now being imported or which is now absent from the market;

(g) Preliminary cost analysis showing a possibility for manufacturing products within the range of mass consumption;

(h) Management with technical knowledge and expert in marketing and finance.

105. Once the availability of these factors is established, a detailed survey of the market should be made. This can proceed along the following lines:

(b) Extent of the market. Data are required on population figures, per capita income available for textile products, local customs and living standards and the existence of other industries (modern or traditional). All these factors determine the market for the new industry.

(c) Type of plant. Once the requirements of the market are determined, as to type of goods, price range and volume, a decision must be made as to whether an integrated plant (spinning, weaving, and finishing) is desirable, or, if required by the size of market, it would be preferable to separate spinning and weaving from finishing. Each has its advantages and disadvantages. At this stage, it is desirable to ascertain whether costs will permit production for export and what types of products can be exported to other markets.

(d) Type of product. Based on studies of the market, climate and seasons, it will become evident that certain basic fabrics should be produced. These will fall into the following broad categories:

- (i) Stable fabrics such as sheeting, poplins, batistes, drills, etc.;
- (ii) Fancy woven fabrics usually yarn-dyed and requiring dobbies and/or jacquard type looms;
- (iii) Prints on a variety of basic fabrics of three or four colours and on high-class fancy fabrics using eight and ten colours;
- (iv) Industrial fabrics such as canvas, tyre cord, beltings, plush fabrics, etc.;
- (v) Floor coverings and tapestries requiring special weaving and finishing equipment such as tufting, jacquard, etc.;
- (vi) Marginal products such as bedspreads, towellings, etc.

(e) Type of machinery. The type of spinning and weaving machinery to be purchased will depend on the articles to be produced and the basic fibres to be used. Finishing plants should be very flexible and able to handle all fibres, especially blends which will continue to grow in importance. The most modern machinery should be investigated, even if it initially seems unnecessary to bring in such machinery to developing countries. With the great advances in textile technology in recent years, the possibility of economically transferring old equipment to new markets has to be considered and evaluated very carefully. Today, countries tend to develop rapidly and inefficient machinery may quickly require replacement.

(f) Location of plants. This will depend on the following factors:

- (i) Labour availability and skills;
- (ii) Climate and altitude determine the type of building required. The effect on machinery of climate, humidity, chemical reactions, etc. should also be considered;
- (iii) Water availability and type;

- (iv) Availability of electricity and cost of power is vital. It may be necessary to install power-generating equipment;
- (v) Accessibility to market and home office are vital for efficient customer service. Available transport and means of communication must be carefully studied;
- (vi) Local tax assessments can influence the cost of operations, but are often waived for new mills;
- (vii) Market conditions including detailed and careful research into sales channels, types of customers (cutters, wholesalers, retailers), customer's likes and dislikes, regional preferences, colour trends.

B. Plant modernization

106. In addition to the question of establishing a new plant, very often the task is to modernize and expand a mill, reorganize a factory in order to be able to produce more fabrics and more diversified products, or improve mill operations in general. It was generally agreed that modernizing a plant and streamlining operations should precede any expansion programme. The modernization programme itself may enable the manufacturer to produce more goods of better quality, or more diversified fabrics which may render an expansion unnecessary.

107. Modernizing a plant may involve replacing individual machines within a group of machines or within a department, replacing a complete production line or modernizing one or more departments. When replacing individual machines, one has to consider the purpose of the replacement and see to it that the machine ties in with the preceding and subsequent operations. Careful calculations must be made before deciding on modernizing a factory by purchasing individual machines, especially when only small investments can be afforded and it is essential to ensure the selection of only the most profitable equipment.

108. Very often, whole groups of machines are replaced by more efficient equipment. An example of such a case is the replacement of obsolete gill-boxes in worsted spinning with high-speed gills, perhaps equipped with auto-levelling devices. This reduces the number of processes and substantially increases production per man-hour, while achieving an improvement in the quality of the product.

109. It is sometimes necessary to modernize an entire department; for instance, in old "French-type" worsted spinning, eight to ten drawing steps can be replaced by four to five; the installation of new spinning frames with high drafts and large packages is mandatory in order to enable the mill to compete with other establishments. On a visit to a mill in Poland, the Workshop noted that such a modernization programme was achieved in this mill by replacing the finishing department, having first determined that such an investment was of the greatest over-all benefit. Winding is one of the departments where modernization is often necessary, but which does not always have the attention it deserves although it can contribute substantially to improving yarn quality and facilitating subsequent operations. Substantial savings can be obtained by a smoothly operating winding department.

110. The Workshop agreed that the benefits of plant modernization should be utilized to their fullest extent without improving operations in general, e.g. improvements in supervision, introduction of mill quality control and proper labor

training. It was pointed out in this connexion that in a study prepared by the Economic Commission for Latin America analysing twenty-five cotton-spinning mills of the oldest type with 550,000 spindles, it was concluded that one-third of the total over-all operational deficiency was due to obsolete equipment and two-thirds were due to the fact that the unit output of operating machinery was not equal to the recognized standards. Thus, modernization of the equipment of the twenty-five selected mills would reduce the over-all operational deficiency by one-third, whereas it could be reduced by two-thirds through administrative reforms, improved production flows, better layouts, better manpower training and use of better-quality cotton. In other words, better management and production methods could improve operations significantly without substantial investments.

111. During the discussions, participants agreed that a serious problem of efficient management existed in developing countries. It was stressed that modern machinery alone was not the solution; it is imperative that the men operating these machines are efficient. Participants suggested that the importance of adopting management training programmes be brought to the attention of the United Nations and the specialized agencies as the basis for improving operations in developing countries.

C. Expansion of plants

112. The expansion of plants is generally a simpler task, as management usually has a clear idea as to whether to manufacture more of the same type of goods or diversify. Machinery is then acquired accordingly.

113. One of the more modern planning trends today is the construction of unit plants to facilitate expansion. For instance, a completely balanced spinning plant with a particular number of spindles may be constructed. Adjacent to the plant, sufficient space is left in order to put up additional buildings and install an additional unit. Separation walls can be removed and the factory can then operate as one larger and more efficient plant with lower unit costs.

114. In more old-fashioned mills, expansion is feasible, but care should be taken to ensure that sufficient space is available so that the additional installations do not become cramped. Otherwise, the firm might find itself fighting against shortage of space, especially of storage space for intermediate products, and thereby make material handling more difficult.

D. Improving operations at mill level

115. It may happen that due to circumstances and conditions - sometimes beyond the control of management - a mill can no longer operate successfully and profitably. Reorganization of such a factory, purchase of new equipment, production modernization, change in sales policy, etc., may help to solve a large part of the problems.

116. To illustrate these points, it might be interesting to mention some of the basic problems which were encountered during the reorganization of a spinning mill in a Latin American country. The problems were deciding on the types of yarns to be produced most economically, the redistribution of the labour force and problems in the technological field.

117. A psychological problem encountered was the need to convince the management, the workers and plant technicians of the need for a change. This was done, besides conducting lectures and visits to other plants, the establishment of a study group, the assistance of consulting engineers responsible for preparing and co-ordinating the studies on the proposed changes.

118. Another problem was to determine which products could be most economically produced in the light of existing conditions within the plant, such as the possibilities of improving blends, reduction of yarn counts and/or changes in craft organization.

119. The third problem was to create conditions which would result in improved production factors, such as the installation of new air-conditioning units and overhead cleaners.

120. Another aspect was the reduction of the number of "ends down by" better selection of raw materials and spinning controls. A mill control laboratory with strict quality controls was installed, and material handling and positioning were simplified. The size of cans in the drawing process was increased and new roving frames with larger bobbins were installed. Waste was reduced by strict waste control procedures.

121. The problems relating to redistribution of labour were reduced by a better selection of production staff and the retraining of workers.

122. One important point raised during the discussion dealt with the proper planning of the type of mill to suit the end product, e.g. a mill for standard goods or one for fancy products. These require different types of equipment and different kinds of organization. Between the time of planning the mill and the time of starting operations, a period which can extend to two years, changes may have occurred in the market which, in turn, could force the mill to produce different types of fabrics than those originally planned. This could seriously unbalance operations and cause the mill to operate uneconomically.

123. The consensus at the Workshop was that mills in developing countries with small markets, which are not planning the production of goods predominately for export, should provide for a certain degree of flexibility so as to be less vulnerable to market changes, or should add equipment at a later date which might increase their versatility.

124. One of the participants mentioned the importance of plant location and pointed out that in the special case of woollen mills the scouring, combing, dyeing, spinning and finishing operations should be located in one place where water is available, whereas winding, twisting and weaving operations could be at another location. The yarn would be transported to the weaving mill and the woven pieces back to the finishing mill. This would only be justified where there is a shortage of water and where the location of the complete plant at one site would be difficult.

125. One of the participants commented on his country's experience in establishing new mills. He stressed the importance of a market study to determine the products to be manufactured as a prerequisite to all further actions. A long-range view should be taken and it should be established whether the supply to the home market alone is foreseen or whether there are export plans and to what extent. For larger

single mill; of perhaps 5,000 spindles and 1,000 looms, production can be diversified to ensure continuous operation.

126. It was also pointed out that top management should be qualified and should have sufficient background experience. Management should exercise over-all control over the project and direct a sound economic labour policy. The purchase, sales and technical operations should be under the supervision of top management; the sections of personnel training and quality control should operate under the over-all management. The sales department may secure orders in advance and set the production programme, in consultation with the other departments. A special costing department should guide the programme of production from the economic point of view.

127. The technical department should be free to give advice regarding the quality and quantity of raw materials in terms of production and output. It should have the responsibility of keeping machinery in good condition, planning modernization and, in time, indicating the necessities for implementation. The flow of technical personnel and skilled labour should be ensured by consultation with the personnel training department.

128. The quality control section should be introduced with great caution and should be considered as complementary to the technical section rather than as a "fault finding" department. If introduced in a thoughtless manner, such a section could very well be a hindrance to technical operations. The technical personnel should co-operate with the quality control department.

129. Fortunately, some developing countries have an industry already in operation and have obtained enough experience so that management can be considered from national sources. For countries where such personnel does not exist, it may be necessary to depend on experts from an industrialized country to initiate the project and train personnel for a limited time to ensure successful operation.

130. Another participant explained operations under centralized planning, where the general management is in the hands of an organization which directs several independent economical units forming an integrated whole. The individual units usually specialize in certain types of fabrics and are composed of one or more mills, each one producing its optimum products. The technical part of programming for expansion or modernization is prepared by the units themselves. The evaluation of the projects and their financing is done by general management. Central research institutes, financed by the Ministry for Consumer Goods, are widely used. These institutes also have the final decision, in so far as the technical aspects are concerned, on centrally planned investments of national importance.

VIII. TEXTILE PROCESSES

A. Cotton spinning system

131. Approximately two-thirds of the spindles installed fall within this system. There have been significant advances in this process; for example, high drafts, large packages, high-speed spinning, as well as the use of ancillary equipment, such as suction devices and overhead cleaners, all of which have contributed to the improvement.

B. Worsted spinning system

132. Considerable improvement was also noted in this system. Worsted starts with very much higher production and better burr-removing devices have been introduced. High-speed gills, some equipped with auto-levellers, have replaced the old gill boxes. A type of ring frame drafting is available, capable of a wide range of drafts, including very high drafts, and capable of processing both oiled and dry combed materials, twisted or untwisted. The number of steps in top production has been reduced, still making possible the production of a better and more even top which, in turn, permits a reduction in the subsequent drawing steps.

133. The Bradford system has been modernized so that yarn can be produced in five steps instead of eight or nine. The Ambler super draft system (ring-spinning frames) permits the use of a hundred or more drafts.

134. The American spinning system with its pin-drafter operations and high draft roving frames is being used in practically all the worsted spinning markets in the United States and Canada.

135. The French worsted system has regained a great part of its loss by the introduction of high draft finishers instead of the porcupine system. Ten drawing steps have been reduced to four or five, and this system is now competitive with the other two spinning systems. Production per man-hour has increased substantially in all systems.

C. Woollen system

136. The Workshop reviewed the significant developments which have taken place in woollen processing. Progress has taken place not only in the use of raw materials and blends, but also in production technology and in the products themselves as, for instance, the present trend towards lighter goods. Often the new processing techniques - higher speeds and higher drafts - require wools of a better and more uniform quality and wool-growers have been taking the necessary steps to improve their products. Better physical and chemical testing methods have been developed which help to predict the yield in scouring and combing, and to determine the staple lengths of the top. New scouring methods are being introduced. The Workshop found that great progress has been made in combing, as better and more productive combers are being used.

137. The woollen card system has improved with the introduction of wider and faster cards and more efficient ring spinning with anti-balloon devices. Mules are gradually being replaced by ring frames, whose spindles may carry very large packages and, by means of special attachments, production per spindle has increased by about 30 per cent.

138. Looms employing the traditional techniques, including the new fully automatic "pick-and-pick" types, are prevailing, but looms without shuttles are growing in importance, especially in the production of plain fabrics.

139. Considerable improvement in the finishing processes of woollen goods has been achieved during the past ten years. Some of the new finishing methods are minimizing the less desirable properties of woollen material, e.g. susceptibility to attack by moths and carpet beetles and low resistance to mildew. Furthermore, there are finishes which impart to woollen fabrics desirable properties otherwise achieved only through blends with synthetic fibres. Some of these new finishing processes are methods for mothproofing and for producing permanent creases, pleats and flat setting, and a new process which gives to clothes the ability to retain a smooth appearance after washing.

140. Processes designed to overcome felting and shrinkage have advanced greatly. Machine washable wool fabrics requiring little care are being produced. Vast research programmes are under way in industrialized countries to develop better and more continuous processes for various finishing operations. Because of all these improvements, large new markets for a variety of additional uses are coming into existence.

141. Another development reported to the Workshop was felt mongering by a new Australian digestion technique, whereby the bacteria normally present on sheep-skins digest the skin without damaging the wool and without requiring the addition of any bacterial culture. No loss of colour in the wool results from the treatment and there is seldom damage to the fibre. This technique might be of interest for those countries where mutton is consumed in great quantities.

D. Semi-worsted system

142. A new and improved semi-worsted spinning system is again being used, producing yarn which has an appearance similar to worsted yarn, but is spun without the combing process. It has grown in importance due to improved equipment for the production of such yarns. The preliminary processes consist of carding and gilling. The card sliver is gilled, usually in two operations, one of the gills being equipped with an auto-levelling device. A special type of spinning frame produces a yarn which is quite even and suitable for carpets, hand-knitting yarn, woven felts, and other end uses.

E. Tow to top system

143. Converters are in use which convert continuous tow into staple form, either by breaking or cutting. This process, followed by gilling and spinning, produces a product of good quality, even without the combing operation. Mention should also be made of the use of stretch break converters to produce tow suitable for high-bulk yarns.

F. Texturized yarns system

144. Processes have been developed whereby a change in appearance and texture, as well as increase in the bulk or stretch characteristics of continuous filament yarns, can be obtained by putting a permanent crimp, loop, curl or curl into small continuous filaments. Textured yarns offer one of the most promising areas for the future of filaments of the cellulosic type, such as acetate and tri-acetate. Synthetic filaments are most suitable for texturizing, as they can be heat-set.

145. These processes have provided for a great number of new end-uses in fields where spun yarns had previously been used, such as knitted goods, including underwear, swimwear, men's and women's hosiery, as well as rugs, carpets and woven fabrics, upholstery, etc. There are many types of machinery available for texturizing, most of which are highly specialized.

G. Core-spun yarns system

146. These yarns are used mainly for foundation garments. They may be produced on any conventional spinning frame, including the cotton, worsted and woollen systems. The procedure involves the spinning of a staple sheath around a core of elastic thread under tension.

H. Cotton stretch yarn systems

147. There are two principal methods now being developed for modifying the texture of cotton yarns. The first uses conventional machinery to produce a highly twisted yarn which is treated with a cross-linking agent and then partly untwisted. In the second method, conventionally produced plied yarns are treated and then passed through a false-twisting machine.

148. A third method being developed uses chemicals to modify the cotton so as to give plastic flow properties which permit heat-forming.

I. Dyeing and finishing methods

149. The present textile market requires fabrics which are well-dyed and appropriately finished. Recently, many new techniques have been developed. For example, a new group of dye-stuffs, namely, reactive dyes, have been widely accepted throughout the industry. These reactive dyes do not act by absorption, but by chemical union between cellulose and the dyeing chemicals.

IX. TEXTILE PRODUCTS

150. There are several main categories of fabrics, which are listed in the following paragraphs.

A. Woven fabrics

151. Woven fabrics include all the traditional products made of wool, cotton, synthetic spun yarns and filament yarns. These well-known fabrics have preserved their market importance and have achieved a greater variety by incorporating different blends and applying new finishes. Both blending and new finishing techniques will be discussed in the subsequent pages.

152. There are a number of new types of woven fabrics, such as stretch wovens, produced of texturized filament yarns, or elastomeric yarns in their core-spun form. A new field has emerged with this development and is growing in importance. Another significant development is the use of wider looms, many of the shuttleless type, for the weaving of fabrics which are cut into one-half or one-third width during finishing. This development permits more metres of filling yarn to be inserted at each pick, resulting in reduced weaving costs.

B. Knitted fabrics

153. Woven fabrics are still the most expensive fabrics being produced. Capital turnover is very slow due to the length of time required for production, from spinning to the emergence of finished fabrics. For this reason, considerable inroads into the woven piece goods market are being made by knitted fabrics. The knitting industry is becoming increasingly important to the leisure and sportswear market, because it gives elasticity, easy-wear and easy-care properties to garments. The following knitting techniques were reviewed by the Workshop.

(i) Straight bar and flat knitting

154. The straight bar and flat bed knitting methods are the most closely linked with the original knitting technique. The straight bar machine, known as the full-fashioned frame, produces full-fashioned outer wear of which the most common type is the sweater. Flat bed machines give greater patterning scope, and Jacquard constructions are more easily produced by flat bed knitting than by straight bar knitting.

(ii) Circular knitting

155. A large proportion of men's underwear is produced by circular knitting. In ladies' underwear, circular and warp knitted fabrics hold, by far, the largest share.

156. Perhaps the greatest and most spectacular growth rate within the knitting trade, which has had a marked influence on weaving, has been the development of double jersey, which is a generic term covering a multitude of constructions

produced on two sets of needles which form the basis of all ribbed structures. Double jersey fabrics are used for many end uses, such as ladies' dresses and suits, children's clothes, curtains, sport coats and slacks. The latest developments indicate the possibility that these fabrics will even encroach on the men's suiting field. A continuing expansion in the double jersey industry occurred when textured filaments were put on the market for swimwear, slacks, etc. The introduction of elastomeric yarns may further enhance development in the stretch field.

(iii) Warp knitting

157. The development of the warp knitting industry has been closely linked with the development and increasing use of man-made filaments. The knitting industry has achieved higher production figures by establishing outlets for fabrics of acetate, tri-acetate, nylon and polyester yarns, and its most recent influence on the weaving industry is the sudden increase in the use of warp knitted shirts.

C. Knit-stretch and knit-bonded fabrics

158. These newly developed techniques represent only a small part of the industry. Warp and weft threads are employed, sometimes with a filler, and the fabric is secured by stitching.

D. Stretch fabrics

159. A little more than a decade ago, stretch fabrics were used only for ladies' foundation garments, swimwear and some other limited uses. The stretch property was imparted by natural rubber yarns. At present, synthetic fibre firms are producing elastomeric polyurethane fibres which are used as a direct substitute for the natural rubber yarns.

160. In the field of stretch fabrics produced from cotton, the emphasis at present is being placed upon three basic developments: (a) slack necerization; (b) the use of crosslinking agents to set crimp; and (c) crimping and heat setting thermoplastic cottons.

E. Non-woven fabrics

161. The term "non-woven fabrics" is used to describe materials made primarily of textile fibres which are not processed on conventional spindles, looms or knitting machines, and which are held together by an applied bonding agent or by the use of self-contained thermoplastic fibres. Needled felts are generally excluded from this definition, since they do not contain any bonding material. Essentially a thick mat or batt of fibres is formed, using conventional card webs or special machinery. The fibres in the mat are usually dispersed at random, and are held together by a bonding agent, often a latex. The bonding together of the fibres may be achieved by causing barbed needles to penetrate the mat, or by a third method whereby the fibres are suspended in water and are blended with small fibrous elements. The mat so produced is tear-resistant and may replace both textiles and paper for certain technical uses.

F. Flocked fabrics

162. Another process which falls in the category of unconventional fabric-manufacturing is flocking. As mechanical flocking had many limitations, present emphasis and interest in flocking is based on a development whereby an over-all fabric can be flocked by means of an electrostatic process. The basic principle involved is that the flocked fibre is projected into the base adhesive by means of electrostatic attraction.

163. The end use of the fabric determines the flock to be used and the speed of production. Carpets require fibres of longer length, denser pile and longer drying time, while fabrics similar to velveteen or suede fabrics use short fibres and require less time to dry.

G. Tufted fabrics

164. Tufted fabrics are essentially a pile fabric in which the tuft of pile fibres are inserted into a base fabric in a manner which is essentially a stitching action. Tufting is a more efficient process than weaving and, therefore, cheaper fabrics can be produced. However, better quality is in demand today. In the United States, tufted carpeting dominates the floor-covering field and only about 20 per cent of carpets sold today are of the woven type. New, finer-gauge and more sophisticated machines are broadening still further the range of fabrics produced by tufting techniques.

H. Multi-component textile structures

165. All multi-component fabrics have, as a common feature, an adhesive which is rarely visible in the finished product. The adhesive bonds fibres, flock, foam, sheet, and fabric into numerous combinations of different weight and style. While many of these novel structures are replacing traditional fabrics, others are opening new markets and opportunities for firms which pioneered textile structures.

166. In a number of countries fabric laminates are being used in the shoe industry. It was not until polyurethane foam was developed as a thermal insulating material that designers started to engineer multi-component fabrics.

X. TEXTILE PLANT SIZE AND ECONOMIES OF SCALE

167. The Workshop stressed the necessity for mills to be technically balanced, both within and between departments. The best utilization of labour should also be taken into account when designing new mills. However, technical and labour balance will not necessarily ensure maximum productivity because of the considerable investments involved. Since capital is difficult to obtain in developing countries, it is important to determine the minimum investment required to establish a balanced mill with the aim of producing at the lowest possible cost.

168. In order to investigate the above problem, the Economic Commission for Latin America submitted an outline of a methodology used to assess the minimum economical size of a spinning mill. This methodology has been established for the carded cotton spinning industry, but it can also be applied to other sectors of the textile industry in developing countries. In this methodology, the capital raw material costs and labour costs are assessed for alternative balanced production units. These units consist of a scutcher operating with the appropriate conventional but modern machinery, so as to produce a standard count of, perhaps $Ne = 20$. If the total cost and financial cost are plotted in a graph, it is seen that optimum operating conditions are obtained for a mill size of around 10,000 spindles. An increase in the number of spindles may not justify the substantial increase in investment; below this number, for a given optimum production of machines, some machinery, such as the ring frames, would have to operate three shifts, while other machines would only be working one or two shifts, which would result in idle capacity and, thus, increased costs.

169. As the rates of change in yarn count are greater for the finer counts, the economies of scale for such yarns are more important. However, the actual magnitude of the optimum number of spindles is not greatly affected. This can be seen from further studies made by the Economic Commission for Latin America, which are summarized in tables 5 and 6 for yarn counts and $Ne = 8$ and 40.

170. It was noted that the aspects of economic size were studied in detail for cotton spinning only. Other stages of the cotton process, and other complete processes, such as worsted spinning and weaving, will also require investigation.

171. During the deliberations of the Workshop, it became clear that an economically-sized spinning plant for a mill not integrated with weaving was about 10,000 spindles, whereas for an integrated mill it was about 30,000 spindles. It was also found that there was an upper economic size limit determined by operational, commercial and administrative, rather than technical, considerations. At a certain level, management becomes complicated, capital requirements increase, and skilled labour may be difficult to obtain. Today, a unit of 25,000 spindles, which will cost about \$2.5 million for machinery only, may be regarded as the optimum size which is economical from the point of view of capital investment and working capital required, management ability, requirements of skilled workers, welfare and housing, economic production and return on capital.

Table 5

Comparison of indices of production, investment and costs
with calculations of idle capacity of machinery

Yarn count Ne 8

Spindles	Size looms	Index of investment per unit	Index of cost per unit
2,000	90	100	100
6,000	270	84	83
10,000	450	81	81
18,500	830	79	80
26,000	1,170	78	79
37,000	1,660	77	79
60,000	2,700	76	79
100,000	4,500	76	78

Table 6

Comparison of indices of production, investments and costs
with calculation of idle capacity of machinery

Yarn count Ne 40 combed

Spindles	Size looms	Index of investment per unit	Index of cost per unit
2,000	43	100	100
6,000	130	72	69
10,000	214	63	64
18,500	396	60	60
26,000	560	60	60
37,000	800	59	59
60,000	1,280	58	58
100,000	2,140	58	57

172. However, it was noted that although beginning at about 2,000 spindles and increasing up to approximately 25,000 spindles, investment and production costs per unit of output became progressively lower, the difference tends to be relatively small. It was borne in mind that in some of the developing countries with limited markets, smaller-sized units might be of particular interest, since they would avoid the need for large-scale capital investments, and reduce management and technical problems. Thus, mills smaller than the above-mentioned minimum size may be installed, with future expansion adequately provided for, and may achieve a better balance of equipment utilization and reduction of costs. It was stressed however, that very small installations (less than 4,000 spindles) would give rise to disproportionate increases in costs.

173. It was unanimously suggested by the Workshop that the process of growth of a textile mill in a developing country proceed gradually. At each step, the alternatives of modernization, re-organization and expansion should be studied and the decisions reached should be the result of careful evaluation of the existing situation. Attention should also be paid to the kind of product, i.e. counts, grey or fancy - and to whether the mill should be integrated or not. Some participants indicated that modernization might be preferable in order to increase productivity and to avoid many problems associated with obtaining spare parts.

174. Much attention was given to the question of the economic size of finishing plants. It was generally agreed that this economic size was very difficult to define, because of the variety of production and the diversity and technical complexity of the processes involved. It was, however, agreed that this stage of textile processing implied an advanced stage of expansion in spinning and weaving operations. A finishing plant may be installed as part of an integrated mill, or as an independent unit serving several weaving plants, whereby one economic plant can cater for a large number of looms. The practice of installing complete and modern finishing equipment for one weaving mill with a small number of looms should be avoided. It was mentioned that in some countries, plans are in progress for establishing finishing plants on a co-operative basis, similar to plants already operating in other countries, such as India.

175. The determination of minimum or optimum economic size involved studies of a large number of economic, as well as institutional, variables. The Workshop suggested that such regional institutions as the Economic Commission for Latin America (ECIA), the Economic Commission for Asia and the Far East (ECAFE), the Economic Commission for Africa (ECA), the Organisation for Economic Co-operation and Development (OECD), the Latin American Free Trade Association (LAFTA) and others, should initiate or continue these studies as far as possible.

XI. MILL BALANCE, INTEGRATED AND NON-INTEGRATED MILLS

A. Mill balance

176. A balance of production should exist not only within, but also between, the various mill departments. With a department there may be a shortage of capacity in carding or roving or even spinning, and individual machines may have to operate either longer hours, wherever possible, or under forced conditions, such as excessive speeds or too heavy slivers or rovings, etc. These conditions may be detrimental to the quality of the product and to machine performance.

177. Between departments, the weaving department should operate fully and must, therefore, be supplied with a sufficient quantity of yarn. Changes in cloth weight or style may create difficulties which should be, as far as possible, predicted and calculated to minimize the imbalance between the spinning and the weaving departments.

178. Consideration should also be given to the correct use of labour and to machine lay-out so that changes in the spinning departments may be carried out with minimum interference.

B. Effect of integration

179. The participants considered the advisability of vertical and horizontal integration. The following possible advantages of vertical integration were discussed:

(a) The introduction or the improvement of quality control, using modern statistical techniques;

(b) The reduction of production costs;

(c) The possibility of creating conditions for the better training of personnel;

(d) The possibility of reducing the fluctuations in demand, which are most marked in the spinning process.

180. In certain countries, integration is encouraged by the tax structure, which may be applied at each stage of sale.

181. It was pointed out that in some developing countries, particularly in countries with a tradition of woven handicraft fabrics, commission weaving might be carried out. Often this weaving operation is controlled and financed by the spinners who supply yarn or yarn beams. For developing countries, such a practice constitutes an effective form of vertical integration employing existing skills and avoiding the problems of management encountered in larger integrated establishments.

182. In this context, it was strongly stressed that successful integration presupposed the existence of highly qualified and highly trained personnel. The integration of firms scattered over a district or country was hindered by the lack of suitable transport and communications.

183. For economical reasons, it was suggested that integration between departments in an enterprise should not cover more than the production stages, leaving marketing to an appropriate body, which should have close liaison with production, although new trends in industrial countries are moving in the direction of vertical integration, including appropriate distribution organizations. The principles of vertical integration seem generally valid for the textile industry as a whole, particularly for the manufacture of standard goods. It was noted, however, that vertical integration might not be advisable in the case of firms producing highly elaborate goods or goods influenced by style and fashion such as some knitwear and worsted articles.

184. The vertical integration of production is economically possible only if a certain degree of horizontal integration exists. This leads to the study of the magnitude of grouping. In some cases, where vertical integration seems necessary in order to co-ordinate production, horizontal integration should probably precede such vertical regrouping.

185. The Workshop made it clear that the problem of the economic size of a group was not to be approached only from the technical point of view, but also from a more general aspect, with due attention to economic and financial conditions. It was strongly recommended that the specialized agencies of the United Nations and the regional economic commissions undertake a study of this problem in depth, as a follow-up of the present Workshop.

XII. TEXTILE MILL CONTROLS

186. In the last few decades, remarkable administrative progress has been achieved in the textile industries of the industrialized countries. The organization of labour has been improved and working methods have become more efficient. Training has been intensified and workloads have been determined by a scientific approach. Methods have evolved for controlling the quality of products, improving the efficiency of various processes, regulating waste, selecting correct raw materials, reducing manufacturing costs and improving the yield per worker. It has therefore become possible to determine and correct most causes contributing to low productivity, defective quality and wastage of resources.

187. Careful planning alone is not sufficient in a modern textile factory; in developing countries particularly, effective controls and the establishment of correct standards are imperative. These should be based on optimum performance goals, which are understood and applied at each mill.

A. Mill control programme

188. An efficient mill control programme should include the following:

(a) The establishment of tests and controls at strategic points in the production process from the raw material to the finished product, in order to pinpoint any deficiency at each stage of production;

(b) The establishment of optimum production levels, combining maximum speed and efficiency with satisfactory quality, as well as of precise standards indicating the acceptable tolerances. This will require the maintenance of adequate statistics, so that immediate discovery can be made of any deviations from the fixed standards which could cause problems in subsequent operations;

(c) The establishment of standards for the control of the quantity and quality of allowable waste. The expected amount of waste should be calculated for each stage of the process and actual values compared with these standards;

(d) The establishment of a machinery maintenance programme, which would necessitate the setting up of a machine inventory, an inspection plan with time-tables and a programme for cleaning and maintenance. The need for a preventive maintenance programme was stressed. The Workshop also discussed the problem of the availability of spare parts and the need for a proper ordering system which would take into account both the expected requirement and availability. It was noted that the availability of spare parts might depend on adequate governmental policies.

189. In order to carry out the required tests and thus effectively control operations in the mill, it is necessary that each firm set up a special mill control laboratory for the purpose of correctly assessing the quality of products at various stages and promptly reporting its findings, so that the required action can be taken by the management as quickly as possible.

3. Quality control programme

190. This programme, which should be carried out by the central laboratory, should include:

- (a) A description of the tests to be carried out, their scope and the testing methods to be employed;
- (b) A description of the materials to be tested, e.g., raw materials, wastes, products and machine outputs at various stages in the process;
- (c) Frequency and number of tests to be made;
- (d) The reporting of test results in accordance with proper statistical techniques.

However, mill control programmes should be introduced very carefully and judiciously, in order to avoid further difficulties in production, and frictions between production and control departments.

191. The achievements of effective mill controls can be summed up as follows:

- (a) Better and more uniform over-all quality of the products;
- (b) Reduced costs by operating under conditions of optimum efficiency of both equipment and labour;
- (c) Reduction of waste.

XIII. PRODUCTIVITY MEASUREMENTS IN THE TEXTILE INDUSTRY

192. The main objective of plans for increasing productivity is to raise the standard of living by improving the relationship between output and the corresponding input of the factors of production. The Workshop agreed that this concept must be considered in a broad scope and must be inspired by the sustained effort towards the better use of men, equipment and materials. All these objectives should be examined by a firm, when taking decisions on investment plans and directing their operation. The improvement of some partial aspects of efficiency often has a negligible effect if these aspects are not integrated with the productivity plans of the entire mill and also with the over-all productivity of the country.

193. In this context, it was pointed out that it would probably be useless to increase productivity if this would cause unemployment. Such a situation could result in difficulties from representatives of labour who might be opposed to productivity measures when new jobs are not created.

194. Productivity measurements have been one of the most important instruments used to indicate when and where decisions for improving operations should be taken. Such measurements have been particularly useful to the textile industry, and specifically in the cotton spinning mills. The latter were among the first to demonstrate the good results obtained by the application of the modern techniques of measurement.

195. It is necessary to be aware of the purposes of making measurements, in order to select the best possible methods for implementation. It must be remembered that these measurements are the tools of productivity planning and are not themselves an objective. Productivity measurements can be examined at two main levels: the factory level and the country level.

A. Factory level measurements

196. One of the first systematic studies at the factory level of the textile industry was undertaken by the Textile Committee of the Organisation for European and Economic Co-operation, in accordance with the methodology presented by Van den Abeele, in which labour productivity was selected as the main index to show plant operation efficiency by comparing the actual labour output to three standards:

(a) Expected productivity, which is defined as the best possible labour out-put with existing machinery lay-out and plant conditions;

(b) Improved productivity, which is defined as the best possible man out-put with the improvements which can be effected, but with the same machinery;

(c) Optimum productivity, which is defined as the best possible man out-put with the best machinery available for the specific mill.

197. It was pointed out that the level of productivity itself, measured in "hours worked by operatives per 100 kg" (HOK) will not reflect accurately the different positions of mills, in that the proper requirements to be considered for this purpose are the relationship between:

(a) The ratio of the present HOK to the expected HOK (organizational index);

(b) The ratio of the present HOK to the improved HOK (operational index);

(c) The ratio of the improved HOK to the optimum HOK (obsolescence index).

198. This methodology was followed in Europe during the fifties and was also recently adopted by the Argentine Productivity Centre. The latter study determined the organizational index only, which was considered to be the most useful tool for managers.

199. In the case of Western European countries, the measurements now cover more than 500 mills, but refer not only to the production of an optimum mill, but to a mill selected for the whole group as the most efficient mill for the zone, relating productivity to size. This particular mill is referred to as the "usine patron".

200. There are other systems of inter-firm comparisons, such as the system used by the Shirley Institute. However, before selecting a system, due consideration must be given to the receptivity of the mill management, the cost of the survey and the methods of its financing. The experience in Latin America shows that the Van den Abeele methodology may be the most useful for similar developing countries. The participants made it clear that it was not possible to apply any of the available methods without considering a comprehensive study, taking into account the particular conditions of each area, to determine the exact purposes envisaged by the proposed programme of productivity measurements.

B. Country-level measurements

201. The objective of measurements at the country level is to provide guidelines for the policy to be adopted for the industrial development of the country.

202. The Van den Abeele system must be sponsored by an institutional organization which can prepare the questionnaires, provide the necessary follow-up and assist mill managers in the preparation of the data needed to determine the HOK of the mill and the indices of organization.

203. Similarly, for country surveys undertaken by international bodies, such as ECLA, the collaboration of local industrial as well as governmental organizations is required with regard to the questionnaires, the mill visits and the follow-up action required to correct the problems identified in these surveys.

C. Prerequisites of increase in productivity

204. It was agreed that the textile industry had four basic areas where better performance could be obtained:

1. Management qualifications

205. The importance of good management for the correct operation of industry was well illustrated by those countries with an outstanding level of productivity within their regions, mainly as a result of an efficient and well-organized administration of mills and firms. On the other hand, it has been demonstrated that in many countries a major part of the deficiencies of operation are due to poor management. Therefore, it was recommended that all developing countries give high priority to



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improving the qualifications of administrative personnel and undertake programmes for training and retraining at all levels of management.

2. Standardization and quality control of production

206. Adequate standards defining the mill requirements for raw materials, for the textile machinery industries and for spare parts and finished textile goods are essential to productivity measurements at the mill level. In addition, an effective programme of quality control should be undertaken. The programme should be designed to provide continuous and reliable information to top management about specifications and conditions of goods, and should be conducted in such a way so as not to interrupt the normal processes of production.

3. Job description and job rationalization

207. Some participants remarked that there was great diversity in the descriptions of jobs in different plants in many countries, and they advocated a more technical and sound description of jobs, which would lead to higher productivity and also provide a basis for evaluating such jobs and establishing salary incentives.

4. Adequate maintenance

208. Maintenance was considered to be a crucial element in productivity considerations. The Workshop also agreed that Governments should facilitate the import of spare parts by adopting adequate policies.

D. Institutional instruments

209. The Workshop took note of the institutional instruments being established in some countries for promoting and spreading technical and industrial knowledge as a means of increasing productivity in enterprises. Special institutions have been created which are now working on various aspects, such as problem surveys and studies, training, consulting activities, etc. The specific tasks to be accomplished by these institutions depend, to a large extent, on the particular conditions of each country.

210. The Workshop agreed to recommend that all countries consider the establishment of institutes for the development of productivity. Basically, these institutes should conduct the necessary studies for the application of the general principles of productivity to local conditions; they should also set standards for production and efficiency, impart the information concerning these topics and promote the integration of these concepts with both management and labour. The Workshop stressed the need for these institutes to establish and maintain close co-operation in order to share their experiences and acquired knowledge and in order to accomplish a universal distribution of the results of their activities.

211. The dissemination of information is of paramount and increasing importance to the promotion of higher productivity. Very few countries have created special organizations to deal with the question of compilation and distribution of documents, technical literature, books, scientific and technical papers and other informative material. The Workshop took note with interest of the work of the Lodz Centre for Textile Documentation which collects and makes available an increasing number of

documents on subjects of interest to the textile industry. In view of the need to have easy access to this kind of information and since important sources of information may not be easily accessible, the Workshop agreed to emphasize the necessity of making available, without unnecessary limitation, all material and information of common interest to the textile industry throughout the world.

212. During the Workshop's discussions of the subject of productivity, it was pointed out that the work of the United Nations Economic Commission for Latin America in this field was in line with the trend towards modernization and rationalization upon which Latin America's textile industry is now embarking. The same process took place in Europe after the Second World War. It is consistent with the realization that conditions existing in this industry will bring it to a standstill unless drastic measures are taken to remedy them. The industry's stagnation was reflected in the slow growth of consumption during the 1950's, and it was not until the early 1960's that it appeared to take a more favourable turn as a direct result of the innovations made in both products and technology.

213. It was pointed out by the participants from Latin America that one of the most pressing requirements of Latin America's textile industry was the rationalization of its structure of production. It is considered that the output so far attained is far from satisfactory, and is also far below that which could in many cases be obtained with existing equipment. In general, the data given in table 7 reveal that, considering its degree of "up-to-dateness", \surd the machinery is under-utilized, both in terms of the total number of hours of operation and the unit output obtained. Likewise, labour productivity indexes are very low, the main reasons for this being inadequate training and deficient organization of the enterprises. These factors, together with excessive wastage of raw materials and the unsatisfactory dispersal of production owing to the small size of the market, have raised costs over and above the limits which the region could afford.

214. It was pointed out by some participants that defective operations, although attributable mainly to the organization of the enterprises concerned, are also influenced by the degree of up-to-dateness of the available machinery. Accordingly, wherever there is a substantial amount of obsolete machinery, internal re-organization must be accompanied by selective re-equipment. The process of modernization should be in keeping with the specific technical and economic criteria of a given investment policy.

215. The eleven Latin American countries in which operating conditions in cotton and wool-spinning and weaving mills were studied, can be classified into four well-defined groups which reflect the over-all position.

216. In countries of the first group, a well-balanced situation of a high degree of up-to-dateness was observed to be coupled with a high level of operating efficiency, reflected in the productivity levels of the industry. This ideal situation exists in a few countries, such as in the cotton-spinning and weaving mills in Colombia and Paraguay and the wool-spinning mills in Colombia.

\surd The definition of an "up-to-date machine" takes into account the machine age, the degree of automation, production capacity, size of spindles and loom speed. This definition of "up-to-dateness" is also implicit in the standards of unit output of machinery and labour productivity.

217. The second group includes countries where a high degree of up-to-dateness of equipment is not accompanied by equivalent efficiency, e.g. as manifested in an adequate use of capital. This imbalance may be corrected by organizational changes without additional investment in machinery. These characteristics of medium or low productivity were observed in cotton-spinning and weaving mills in Argentina, Chile, Uruguay and Venezuela despite the existence of modern machinery.

218. Countries maintaining an intermediate level of "up-to-dateness" and operating efficiency constitute a third group, in which both organizational changes and re-equipment on a moderately intensive scale are required. This situation applies to wool-spinning mills in Argentina, Brazil and Ecuador, wool-weaving mills in Colombia and Venezuela, and cotton-spinning mills in Ecuador and Mexico.

219. The fourth and largest group covers situations where little of the equipment is up-to-date and operating efficiency is low. It includes eight of the eleven countries studies and involved one or more of the processes considered.

220. The main indicators relating to operating conditions in a number of countries in Latin America were outlined both from the standpoint of the fibres processed, whether cotton or wool, and of the process used, whether spinning or weaving. These data cover the degree of up-to-dateness of the equipment, its utilization in relation to the number of working hours, labour productivity and unit output of machinery. 2/

221. In connexion with the aforementioned grouping, the standard adopted for utilization of textile machinery was three daily shifts (two eight-hour shifts and one six-hour night shift) in 300 working days per year, i.e., a total of 6,600 machine-hours per year. Labour productivity was defined as the physical output of one operator in one hour. In order to facilitate a comparison between mills or between countries, the nominal labour productivity values obtained are converted to, or weighted in terms of, an equivalent product.

222. As a point of reference, a so-called "standard for Latin America" has been established, which is considered to be a feasible level under prevailing Latin American conditions of manpower training, conventional up-to-date machinery and available raw materials. It should be noted that this standard is far below the level of productivity in the United States and is also considerably lower than the European level.

223. Lastly, unit output, which is defined as the ratio between the physical volume of output and the number of machine-hours required to achieve it, also relates to a standard for Latin America, which is the production capacity of equipment regarded

2/ ECLA. La industria textil en America Latina. I. Chile (United Nations publication, Sales No.: 1963.II.G.5), II. Brazil (United Nations publication, Sales No.: 1964.II.G.2), III. Colombia, IV. Uruguay, V. Peru, VI. Bolivia (United Nations publications, Sales Nos.: 1964.II.G/MIM/2,3,4,5), VII. Paraguay, VIII. Argentina (United Nations publication, Sales No.: 1965.II.G/MIM/7), IX. Ecuador, X. Venezuela, XI. Mexico (United Nations publication, Sales No.: 1966.II.G/MIM/1), and The Textile Industry in Latin America.

as modern. The figures, reduced to indexes or percentages, refer to the average for the industry in each of the countries studied. It was pointed out that these averages logically conceal the variations from the mean in all countries. Accordingly, the relative position of the indicators concerned provides a preliminary assessment of the situation in every country. At the same time, an analysis of the highest level reached in each mill makes it possible to draw conclusions on the country's actual and potential competitive position with regard to a specific group of dynamic enterprises in the world market.

224. If the maximum productivity recorded in each country is considered separately, it is seen that in practically all countries the productivity of the most successful mills is above standard. The implications of this fact for a rationalization policy are very clear and open up wide prospects for an improvement in the textile industry's operating conditions. Conversely, the productivity levels of some enterprises are far below the average for the country and are therefore only a fraction of the standard. This situation also deserves to be thoroughly examined with a view to offering practical solutions to such enterprises which might be of benefit to the textile industry as a whole. The coexistence, in the same country, of enterprises whose ratio of productivity is 5 to 1, 10 to 1 and even 12 to 1, also raises the question of how far costs are influenced by market forces and how far by institutional and operational factors.

225. The Workshop recommended unanimously that studies similar to those outlined above for Latin America be undertaken by the United Nations Centre for Industrial Development. These should extend the above methodology to developing countries in Africa, Asia and the Far East and allow the responsible authorities in every developing country to assess accurately the progress of their textile industry.

Table 1

Indexes of operating conditions in cotton-spinning mills

Country	Up-to- dateness a/	Product- ivity b/	Utiliza- tion c/	Unit output d/
Standard for Latin America	100.0	100	100.0	100
Venezuela	98.0	74	87.6	82
Uruguay	95.6	45	76.3	86
Colombia	90.6	127	104.6	86
Argentina	87.7	66	56.1	86
Chile	81.3	45	72.6	85
Mexico	69.2	79	92.9	63
Ecuador	60.1	53	65.0	68
Paraguay	57.3	83	90.7	93
Peru	31.3	55	72.0	81
Bolivia	26.5	26	65.5	77
Brazil	20.8	46	85.3	64
United States		290		
Europe		128		

Source: ECLA, La industria textil en America Latina. I. Chile (United Nations publication, Sales No.: 1965.II.G.5), II. Brazil (United Nations publication, Sales No.: 1964.II.G.2), III. Colombia, IV. Uruguay, V. Peru, VI. Bolivia (United Nations publications, Sales Nos.: 1964.II.G/MIM/2, 3, 4, 5), VII. Paraguay, VIII. Argentina (United Nations publication, Sales No.: 1965.II.G/MIM/7), IX. Ecuador, X. Venezuela, and XI. Mexico (United Nations publication, Sales No.: 1966.II.G/MIM/1).

Note: These figures are subject to revision in the regional report on the textile industry in Latin America.

- a/ Completely modern machinery = 100 per cent.
- b/ Grammes per man/hour; standard for Latin America = 4.300.
- c/ Utilization: 6,600 hours per year = 100 per cent.
- d/ Grammes per spindle/hour; standard for Latin America = 22.

XIV. TRAINING IN THE TEXTILE INDUSTRY

226. The problems of training were discussed extensively. It was agreed that the most urgent need is for on-the-job training, especially at the level of supervision and medium-level direction of the mills. The T.W.I. (Training Within Industry) methods were considered the most suitable for this purpose.

227. Some participants pointed out the necessity of training technicians who could fill the gap between the engineering staff and the skilled workers. In nearly all developing countries there is a serious lack of this kind of personnel and it was considered necessary to increase the facilities for filling this gap. Increasing the number of technical schools and colleges which prepare such technicians could solve this problem, but such expansion cannot take place very rapidly.

228. On the engineering level several problems were analysed. Almost everywhere, there is a need to implement methods to bring the colleges and universities in closer contact with the industry. Such contact would make the passage from the university to the mill easier and more efficient. In some countries there are no textile engineering schools, whereas a developing textile industry requires the services of graduates from such institutions.

229. The participants agreed that in addition to the technological knowledge and skill considered necessary for the senior medium-level and supervisory management, attention shall be given to improving skills according to the requirements indicated by job evaluation and productivity achievements.

230. The Workshop considered that vocational training for the skilled worker has to be given by means of an apprenticeship system in which the textile industry could participate.

231. It was pointed out that some of the Latin American countries had independent systems such as those created in Brazil, Colombia, Peru and Venezuela. The pattern was set by Brazil some years ago. Between 1 per cent and 2 per cent of the wages of a plant are paid by the industry to an apprenticeship fund, whose board administers these funds to pay expenses and to finance investments in schools and for equipment. Industrial representatives are also members of this board.

232. The best solution must be carefully evaluated in every country. The above solution seemed to offer good results in some countries, but in other cases there seemed to be a need for a more advanced technical education, and this system may limit the expected expansion of technical schools.

233. The Workshop pointed out that the greatest number of workers in the textile industry were semi-skilled and they usually learnt on the job by observing other workers.

234. The Workshop considered that the more improved methodologies of training may provide an excellent tool for management to prepare workers or to improve their ability to perform their tasks. In-plant vocational training has often been of great help both for the mill and for the labourers involved.

235. Consideration should be given to the organization, implementation and follow-up of all training activities of the mill through a training department, reporting to top management.

A. Group in-plant training

236. The Workshop noted that, in contrast with other agencies and organizations of the United Nations, the Centre for Industrial Development deals only with one aspect of training of technical personnel for developing countries, namely, with group in-plant training of engineers and technicians. This field of training activity helps to solve the problem of how to bridge the gap between the fundamental knowledge gained at the university and its application in industrial practice. In addition, it emphasizes the development of the graduate engineers' and technicians' abilities to acquire skills and to exercise judgement in concrete cases, rather than the addition to technical knowledge. It also makes it possible to ascertain the suitability of individual graduate engineers and technicians for particular occupations. Actual experience in the various technological departments of the plant, although for short periods of six to twelve months, provides the trainee with the necessary practical background and framework for assuming responsibility quickly and efficiently.

237. It was brought to the attention of the Workshop that the Committee for Industrial Development, in its fourth session, had recommended that the Centre for Industrial Development promote "arrangements for carrying out joint or participation projects" with the member countries. 3/ The group training programmes bring the industrial experience and the wide knowledge of a national industry together with the United Nations industrial and technical assistance machinery to establish a necessary project in a field of recognized importance. Subject to detailed agreements, a co-operating Government is invited to contribute towards the preparation of the training material and to the local costs of the trainees, while the United Nations assumes other costs.

238. It was emphasized during the discussions of the Workshop that the primary objective of group training programmes was to give engineers and technicians who were already working in industrial establishments of developing countries the benefits of modern in-plant practices. This aspect was emphasized in the Secretary-General's report on training of national technical personnel for accelerated industrialization of developing countries (E/3901, Add.1 and 2), in the reports of the Committee for Industrial Development, as well as during the recent session of the Economic and Social Council. Such training programmes possess several distinct advantages over the individual fellowship programmes in industry. Group training programmes in industry are also amenable to the promotion of training projects at the country level and can be systematically planned in advance, thus providing adequate training facilities to suit the needs of the developing countries. The costly procedure of dealing with individual cases in terms of both time and money can be substantially eliminated by organizing such programmes for a homogeneous group of qualified engineers and technical personnel for a few months in the industrialized countries. As experience and teaching material accumulate, these training programmes can be repeated without additional large costs depending on the interest of the countries. They may also be utilized to establish training activities in the developing countries, in co-operation with the regional economic commissions.

3/ Official Records of the Economic and Social Council, Thirty-seventh Session, Supplement No. 6, para. 144 (f).

239. The approximate size of a group is estimated at twenty-five to thirty persons. The duration of the training period is expected to be about four to six months depending upon the nature of the training and the level of the participants. Training may be conducted through lectures, discussions, demonstrations, and visits to exhibitions and industrial centres. However, in-plant training and familiarization with actual problems and practices should be the predominant feature of the programme. It was noted with satisfaction by the Workshop that the Centre for Industrial Development had already made arrangements for organizing group training programmes in some industrialized countries, such as Sweden (for electrical machinery and equipment), the Federal Republic of Germany (for machine-tools), France (for the prevention of corrosion and fertilizers), the USSR (for iron and steel), and Yugoslavia (for non-ferrous metals industries).

240. The following programme was considered and endorsed by the Workshop for group in-plant training in the textile industry for engineers and technicians from developing countries.

1. Level of trainees

- (a) Graduates with an academic degree in textile engineering technology, with or without previous work experience in the textile industry;
- (b) Graduates of pre-college level, with work experience in the textile industry of not less than four to five years. This may involve practical experience in any of the major production or testing departments, or in the technical administrative departments of a textile mill;
- (c) Practitioners in textile engineering without any university training, but with practical experience of at least five years in the textile industry in any of the activities mentioned in (b).

2. In-plant training programme

241. The programme will provide practical in-plant instruction in laboratories of technological or textile institutes, and will include the following subjects:

- (a) Raw materials. This subject will deal with traditional raw materials and newer fibres, especially synthetics, the various blends for the best end-use, criteria for selection of raw materials and the various testing methods available, as well as a prediction of the processing properties and end-use.
- (b) Modern spinning methods. Instruction in this subject will deal with the conventional and modern spinning methods of the cotton system, the spinning of synthetics, the Bradford, French, and American worsted spinning systems (including preparation of wool tops), the woollen carded spinning system, etc., as well as the importance of proper mill operating conditions, selection of raw materials and determination of work-loads. New trends in automation will also be dealt with, as well as an analysis of the advantages and disadvantages which may be faced in this connexion in developing countries.

(c) Modern preparation and weaving methods. Modern winding methods, including automatic winding and up-to-date warping and slashing are to be dealt with under this heading. Of special importance will be the investigation of modern looms, including the shuttleless type, their advantages and disadvantages, problems of maintenance, etc. This section of the training programme will pin-point the optimum operating conditions and work-loads.

(d) Modern dyeing and finishing techniques. Inasmuch as dyeing and finishing are a more specialized aspect of the textile industry, modern dyeing and finishing methods including the new continuous techniques will be reviewed in this section to a degree sufficient to give plant engineers and plant managers a working knowledge of these methods. A special course for trainees primarily interested in dyeing and finishing may be planned in the future.

(e) Modern mill management methods. This subject will deal with mill organization, production planning, co-ordination between production and distribution, cost controls, labour controls and mill and quality controls. Special importance will be attached to mill controls, which will include a complete mill control and quality control programme, the setting of quality standards of in-process and finished products, production standards, a testing programme, waste control, and a machinery maintenance programme.

XV. EQUIPMENT AND MACHINERY FOR TEXTILE INDUSTRIES IN DEVELOPING COUNTRIES AND DEGREE OF MACHINERY SPECIALIZATION

A. Equipment and machinery for textile industry in developing countries

242. The creation and formation of a new textile industry is apparently in progress. The traditional techniques of producing yarn have been modified and extended. Completely new methods of producing fabrics and other textile products have been introduced.

243. In the chapter dealing with textile processes, it was noted that improvements have minimized the traditional processes to such an extent that in the cotton and worsted systems, the number of operations have been cut in half.

244. This reduction in operations has been accompanied by a great increase in the production rate of individual machines. During the last decade, the production rate of a cotton card increased by a factor of four, the draw frame by a factor of eight, gills by a factor of two and certain types of looms by a factor of three.

245. Many of these improvements have been brought about by a better understanding of the function of the individual machines and by improved design and engineering. In some instances, particularly in weaving, new principles are being applied.

246. This dynamic rate of change tends to confuse those responsible for the purchase of textile machinery. However, the situation can be rationalized to a certain extent if consideration is given to the factors which may limit a particular machine performance.

B. Limits to the production rate of textile machinery

247. In some instances, the performance of a machine may be limited by mechanical considerations, but in many cases the limits imposed are due to the properties of the material being processed and also to the inevitable interference and interaction between process elements. Some of these problems are fundamental, and unless there is a total change in the process, methods or material used, an ultimate performance limit, independent of the problems peculiar to developing countries, would probably be established.

248. The production of a textile machine operating at 100 per cent efficiency is obtained by multiplying the output linear speed by the weight per unit length of the delivered material multiplied by the number of production units per machine. Actual production is the product of this quantity and the efficiency of the machine.

C. Production at 100 per cent efficiency

249. Production can be increased by increasing the value of any or all the three factors mentioned above.

1. Increasing the linear speed of the machine

250. Considerable increases have been observed in the linear speeds of certain machines. Problems may occur due to the disturbance of fibres moving in an air stream, or certain other mechanical problems may be encountered. By implication, increasing the linear speed of a machine which is inserting twist means higher spindle speeds. In the case of the speed frame, limits are being reached due to the centrifugal bursting of packages. In ring spinning, higher spindle speeds necessitate higher spinning tensions and thus a limit, imposed by yarn strength, is reached. It is also necessary that a careful choice be made of spinning package dimensions for any particular yarn count and strength.

2. Increasing weight per unit length

251. This action can only be carried out for intermediate products. Care should be taken in employing this method, since in some instances quality may fall off as, for example, in the case of the card or the cotton process where more complex and expensive drafting systems may be required on the ring frame.

3. Increasing the number of production units per machine

252. Textile machinery can be classified into two classes: class A, where action on one position does not affect the neighbouring positions, and class B, where action on one position affects neighbouring positions.

(a) Class A machines. Typical of this class are machines whose individual ends can be pieced together without affecting the remainder of the machine. The doffing and creeling actions will generally affect the entire machine; however, the stoppage time is a small proportion of the total cycle.

(b) Class B machines. These machines often reach a limit in performance due to interference between the production units. Thus, draw frames are now produced as either single or double-headed machines to increase the working efficiency.

4. Efficiency

253. Machine efficiency determines the actual production of a machine and is affected by the following factors:

- (a) Whether the machine falls in class A or class B;
- (b) Size of creel package and time element to creel;
- (c) Size of produced package and time element to doff;
- (d) Down time for cleaning, maintenance and to allow for poorly trained labour.

254. If the machine falls in Class A, e.g. the ring frame, then the size of the individual machine is determined by limits imposed by the machine-maker and considerations of layout. If it is in class B, e.g. the speed frame, the size of the individual machine will be determined mainly by considerations of machine interference.

255. In recent years, sizes of packages, particularly sizes of cans, have increased considerably to such an extent that a machine may not be able to produce one per shift. Clearly, under these circumstances, very marginal improvements can be achieved if the size is further increased.

256. The output package of one machine becomes the input package of the next, so the space available in the creel of the subsequent machine may be a consideration. Thus, the sizes of cans for a cotton card are appreciably greater than those for a draw frame feeding a speed frame.

257. It must be recognized that down time is essential for preventive maintenance for which a proper schedule should be laid out.

258. The operational speeds of many machines have increased to the extent that in some instances very few machines are required; for example, two operations of four draw frames each would be sufficient for a 10,000-spindle plant producing Ne = 20 cotton yarn. Considering maintenance problems, any further reduction in this small number may show only very small gains.

259. The arguments developed above show that the law of diminishing returns affects machine design and influences the development of machines. Thus the Workshop considered that greater improvement might be obtained by a reduction in the price of machines than in a further reduction of the HOK which are at present already extremely low when absolute values are compared with conventional modern machinery.

260. During the discussions on machinery, the Workshop agreed that an important objective of industrialization plans in developing countries was the creation of new jobs. In this connexion, two cases had to be considered: countries where a textile industry does not exist, and countries where an obsolete industry is in existence (India, United Arab Republic and Latin America).

261. As regards the first group of countries, the creation of a new industry, at whatever technical level, must take into account the necessity of offering new jobs. For this group it was generally considered that the establishment of such an industry should be fairly modern, or rather of modern type, adapted to the existing operating conditions. For instance, it was suggested that modern types of machinery could be installed and supplemented with automatic devices in the future, if required.

262. Such development has to be envisaged with the aim of establishing the best balance between fixed and variable costs according to the market, the variable cost being primarily represented by wages, while the fixed cost is mainly concerned with amortization.

263. For the second group of countries where an industry already exists, it was stressed that the essential problem was modernization of the existing plants and, possibly, the establishment of new firms. The situation for such countries is rather complicated, because modernization often means a reduction in employment.

264. Some participants stated that developing countries should take into account the prevailing level of wages when planning a modernization programme. Such a reorganization is rendered more difficult in countries where the demand for textiles is increasing slowly and where activity in other sectors is not sufficient to absorb the manpower freed by such modernization.

265. In this context, the findings take note of the analysis undertaken by the Economic Commission for Latin America in its study of the textile industry of Brazil, where different hypotheses of technology were considered and their effects on production costs were assessed.

266. It was pointed out that this type of analysis was a useful tool from the point of view of economic policy and industrial development policy in general, and could provide an over-all framework for the determination of investment policy for the textile industry as a whole. It was pointed out, however, that the evaluation of individual projects should also be included within such a general programme.

267. In the case of the study referred to above, several situations were considered, i.e. one related to the existing status of the equipment and involving better use of existing machinery (hypothesis I), the second related to the reconditioning of some machines of the conventional type (hypothesis II) and the third related to re-equipment with highly automatic machinery (hypothesis III).

268. The characteristics of the machinery and labour requirements are set out in the study mentioned above and may be summarized as follows:

(a) Hypothesis I does not involve any large-scale replacement of equipment, but is based on the introduction of certain administrative and organizational reforms in the mills that would enable them to expand their output by increasing labour productivity and the unit output of the existing machinery;

(b) Hypothesis II envisages partial re-equipment with up-to-date machines of the conventional type, such as those used in the average mill in most Western European countries, as well as the reconditioning of existing machinery, whenever this is an economically and technically sound proposition;

(c) Hypothesis III provides for re-equipment with highly automatic machinery with a high output capacity, such as that now being manufactured by various international firms and used by the best textile mills in Europe and the United States.

269. By means of these hypotheses, it was possible to make a thorough assessment of the situation of industry in Latin America by giving a precise picture of the degree of obsolescence of the industry. Moreover, this study made it possible to appraise the value of applying the different solutions envisaged in the above-mentioned hypotheses, taking into account investments and amortization costs, employment, final costs of the products, etc.

270. According to the above method, the indices of the part-cost of a metre of cotton fabric comprising the cost of raw cotton, labour and capital under the three hypotheses mentioned were as follows:

	<u>Two shifts</u>	<u>Three shifts</u>
Existing situation	100	100
Hypothesis I	27	87
Hypothesis II	33	32
Hypothesis III	92	92

The Workshop recommended that such studies be made, particularly in connection with an old, established industry structure.

D. Degree of machinery specialization

271. The degree of machinery specialization required depends on technical and economic factors. Among the technical factors are:

(a) The characteristics of the raw material; e.g. a particular type of drafting system may be satisfactory for short, reasonably uniform fibres, whereas a completely different system will be necessary for processing long fibres of varying staple lengths;

(b) The characteristics of the final product, with particular emphasis on whether the process is designed for mass-consumed products or fashion products. In the latter case, the cost of greater flexibility, such as that provided by the quick setting equipment of a versatile drafting system on a warped rim frame, may be justified, or, alternatively, it may be preferable to use shuttle rather than shuttleless looms.

272. Mill balance is one of the main economic factors. The number of ring spindles required is very nearly proportional to yarn count being spun, and thus changes which can be accommodated technically may cause upheavals in the balance of the mill, both from a machine and a labour utilization point of view, adding to the cost of the product.

273. It is necessary to have a clear idea of the present and future requirements of a particular plant, since this would influence the number and flexibility of machines to be installed.

XVI. RECENT TECHNOLOGICAL DEVELOPMENTS AND THEIR APPLICATION IN DEVELOPING COUNTRIES

274. In recent years, textile processing has seen a number of new technological developments, creating for the industry new economic opportunities and altering its relative economic position. Many factors show that the industry is presently passing through a period of "renaissance" in techniques. Traditional articles and techniques may constitute the major field of activity in developing countries for some years. It is important, however, to examine the present developments in the textile industry and evaluate them in the light of their possible applicability to situations in developing countries. Several reasons, economic as well as technical, determine the rate of progress in textile technology.

275. Some of the technical factors affecting the development of the textile process are the dynamic rate of new technical developments, the introduction of man-made fibres and the new techniques in textile processing.

276. Man-made fibres are produced in an increasing amount and variety by the chemical industry, and offer new fields for designing a wider range of fabrics. In the past, man-made fibres imitated with varying effects some of the properties of natural fibres. At present, synthetic fibres are produced with characteristics which are useful in both traditional and new technological processes. Some properties of man-made fibres are not only an improvement, but also an extension, of the range of properties occurring in natural materials. Examples of these are the thermoplasticity of synthetics, enabling the use of texturing techniques; the "standard" and "high shrinkage" of acrylic fibres, allowing the production of "high-bulk" yarns; and the low specific gravity of polypropylene fibres. Suffice it to say that constant progress is being made in this field, and new species of synthetic fibres are being developed all the time with still more attractive applications, as, for example, the use of polyurethane foam and oriented synthetic foils. A great variety of man-made fibres produced at present may also be used in blends with natural fibres. The blends may be successfully processed to produce articles with a particular end-use.

277. Plastic materials in forms other than fibres are the basis of some recent technical developments in textile technology.

A. New production techniques and products

278. The use of many new textile production methods makes possible a much more diversified structure of the industry and a greater assortment of products suited to demands and economic possibilities. Non-wovens, stitch knitted and stitch bonded fabrics, foambacks, tufted carpets, textured yarn products, etc. may all be considered new developments of the last few years. Non-woven goods are a new textile product which does not require any traditional techniques such as spinning, weaving or knitting. By the use of various techniques, a finished product is made directly from loose fibres.

228. The Workshop noted that many new products were being developed in the textile processing industry. Only a few important examples will be cited in this report in order to show the rapid changes taking place in this industry.

229. Chemical fibres are being processed in the majority of the countries of the world. While chemical fibres can be processed without supplementary investment in new spinning mills (i.e. by use of conventional cotton-crowd equipment), there are new techniques adjusted exclusively to the processing of man-made fibres. The conversion of tow and the texturing of yarn are two such techniques particularly worth mentioning. The converter technique makes use of the natural formation of fibres by chemical plants. Converters are being manufactured by many textile engineering companies. This system may be used for the production of 100 per cent man-made fibre yarns, or the converted top may be blended with natural fibres. The tow transformation by converters has shown that the resulting sliver quality is superior to that attainable with conventional technology. There is also an indication that the converter technique may be applicable to cotton-like spinning, if some adjustments of draw-boxes are made. The converter system is an attractive technology for authorities considering investment in spinning plants for processing chemical fibres.

231. Continuous filaments, as, for instance, synthetic fibres, are textured by techniques which utilize their thermoplastic properties. Other texturizing methods are available for regenerated fibres, such as acetate. The importance of texturizing is seen by the following factors:

(a) Textured filament yarns eliminate completely the conventional process of spinning and they have properties near to those of yarns spun of staple fibres;

(b) Articles made of textured synthetic yarn have great aesthetic value as well as superior wearing properties.

232. Moreover, textured yarns make possible the use of man-made fibres in a large variety of various textile products and thus increase substantially the demand for those fibres.

233. Mention should be made of thermoplastic techniques, such as false twist, stuffer-box, edge-crimping and the non-thermal technique of air texturizing.

234. All the above-mentioned aspects of textured yarns, economic as well as with regard to end-use properties, increase the importance of their production, and should not be overlooked by any developing textile industry.

235. The Workshop also took note with interest of the new development in the field of non-woven goods. Extensive studies have been carried out and have led to fruitful results. The production of non-woven textile products was several million square metres in 1964. One type of non-woven fabric is replacing articles made of cotton and artificial leather at competitive prices. In the same group of non-woven goods, filtering fabrics (flat and bulky) are assuming importance, as filtering material is replacing cotton, wool-woven fabrics and felts. Another group of non-woven fabrics is created by the shrinking of web-containing thermoplastic fibres. Such fabrics are resistant to heat and fire and to chemical and biological factors.

286. The above-mentioned examples do not represent an exhaustive list, but are intended to illustrate the trends in textile process developments.

287. Taking into account present requirements of the consumer of textile products, finishing operations must aim not only at a higher commercial value of the processed material, but must also enhance the physical properties with respect to the end-use, such as resistance to creasing and shrinking or "wash and wear" properties. The constantly growing use of man-made fibres, particularly of the polyester and polyacrylic varieties, partially eliminates these problems. However, it must be considered that at present, and in the future, the substantial raw material for a large assortment of apparel goods in many countries will be cotton, wool and rayon. In this case, the improvement of wearing properties can be achieved by physical and chemical treatment, e.g. the use of thermoset resins and reactants for cellulose fibres and the use of modern reducing, chlorinating or cross-linking agents for wool.

288. Taking into account the present situation of finishing techniques and noting the rates of their development, it seems apparent that most marketed apparel goods should have "wash and wear" properties, and these appear to be increasingly introduced to all new fabrics.

289. Waterproof finishing is also finding increasing application. In the past, this finish was applied only to coatings. At present, owing to newly developed impregnating agents, it is also applied to suitings, dress and furnishing fabrics, etc., protecting them not only against staining from aqueous solutions, but also against grease and oil. The increased use of synthetic fibres has also contributed to the importance of waterproof finishes.

290. The Workshop noted the increase in programming of such discontinuous operations as finishing, dyeing of loose stock and yarn in pressure machines, dyeing and washing of fabrics in dye baths for piece goods and reversible jig winches, raising of woven and knitted fabrics, hydraulic pressing, and also the aggregation of separate machines to form continuous automated finishing plants.

291. Within recent years, much has been done with regard to the aggregation of machines. The major achievements in this respect are the continuous bleaching for fabrics in rope form and in full width, the fabrics being made of cotton, flax or blended with man-made fibres.

292. In the past, conventional, discontinuous bleaching took many hours for caustic scouring, and for treatment with hypochlorite and other agents, after which the material was stocked again for more hours. All this limited the production rate to an average of about 200 kg. per hour. Newly developed bleaching agents (hydrogen peroxide, sodium chloride) have made possible the construction of aggregates working continuously at a speed of 100 metres per minute, yielding about 600 kilos of material per hour. Continuous aggregates for the processing of loose stock represents another major development. This equipment comprises units, which, together with some preliminary and final auxiliary machines, can be listed as follows:

(a) Padders;

(b) Steam chambers of various types, including pressure steamers of new design recently;

(c) Washers;

(d) Dryers.

293. Units of this type can dye almost any kind of fibre in top or in the form. New auxiliary chemicals make possible the dyeing of greasy wool, thus eliminating the troublesome process of scouring before dyeing.

294. The last machines of the set (washers and dryers) are used for various final treatments, e.g., the shrink-proofing of wool. The output of such units is 125-200 kg/hr., making possible the replacement of four old discontinuous-process dyeing machines. The use of steam has now dropped to 30-35 per cent, and that of electric power to 90 per cent.

295. Experience with plants using the continuous system for dyeing has shown that if the lot to be processed is 200-600 kg., the dyeing costs are approximately the same as with the discontinuous system, whereas with lots larger than 600 kg., the costs are quickly lowered.

296. Aggregates for piece-dyeing, both woven and knitted, have been developed during the last two years. All aggregates follow similar techniques, i.e.:

(a) Immersion of the material in the solution of dyestuffs and auxiliary chemicals;

(b) Setting of the applied dyestuff by saturated steam, hot air, or other means (melted metals, fluid beds, aqueous solutions);

(c) Rinsing to remove the residual dye which has not been bound by fibres and to wash off auxiliary chemicals applied to the material.

Production lines for the complete finishing of woven and knitted goods have also been introduced. There has been considerable development of sets of machines for the full finishing of woven fabrics and some knitwear. Such lines mainly comprise a section for the primary cleaning of fabrics (usually omitted when fabrics are made entirely of synthetics), a dyeing section, or a section where the two methods are combined, washing and eventually, drying.

297. Impregnations of all kinds are applied on wetting machines, or by sprays, which also may be included in the line of continuous processing.

298. It is expected that continuous processing lines for a complete finishing will develop further. The use of such techniques is possible, provided that there is a specialization of finishing plants and a standardization of assortment groups to be finished.

299. The Workshop noted that experience has shown that foambacked woven and knitted fabrics had good warmth-retaining properties, owing to the polyurethane foam, the other properties being unchanged. This diminishes the share of textile fibres used for such fabrics. In view of the fact that foambacking techniques are simple and require little special equipment, their application may be of serious economic importance for some countries.

XVII. UTILIZATION OF NEW VERSUS SECOND-HAND MACHINERY

300. The question arose during the deliberations of the Workshop as to what extent second-hand machinery could be imported and utilized in the textile industry in the developing countries.

301. It was agreed that where a process has become obsolete, there is no advantage in modernization; for example, ring frames are rapidly replacing mules, but there are instances of old ring-spinning frames being very usefully rebuilt by modern drafting systems and other superior devices. This could apply to other existing machines as well. It was considered by the Workshop that wherever a process has become obsolete, the associated machinery should be destroyed also. It was also agreed that if the performance of an individual machine were so improved in comparison with machinery in present use, as in the example of cotton draw frames, then consideration should be given to the early replacement of the associated machinery which is also becoming obsolete. The issue, therefore, involves deciding which machines should be replaced by new machines, and which could be rebuilt to extend their usefulness.

302. The possibility of mass export of second-hand machinery from developed countries to developing countries was discussed. It was felt that while there was a danger of importing certain types of second-hand machinery which would quickly cause the industry in the developing country to operate uneconomically, there was some substance to the proposal to evaluate such machinery or machinery parts for their usefulness and permit restricted imports, according to the results of such evaluation. If, for instance, an industry in a developed country acquired highly advanced machinery and found it necessary to scrap part of its useful capacity, then some machinery might be rendered surplus in the process, which could still be usefully employed in certain developing countries where capital is scarce and foreign exchange is short and where such second-hand machinery could produce satisfactory products particularly for the home market. It was, however, pointed out that extreme care should be taken to evaluate such plants and machinery before they are recommended for use in a developing country. A system of inspection and certification would probably be necessary before purchase was authorized. At present, such a system is not generally applied.

303. The Workshop noted with satisfaction that a meeting of experts was to be convened in December 1965. This group of experts will deal with the problem of second-hand machines in all industrial sectors.

XVIII. AUTOMATIC DEVICES AND AUTOMATION IN THE TEXTILE INDUSTRY

304. Many developing countries are intent on building up their potential for manufacturing yarns and fabrics. Some are eager to set up the most modern plants which might not satisfy either their desire to absorb the available labour or their ability to compete effectively with the highly developed mills in countries more industrially advanced.

305. It is useful in the above context to consider automatic machinery or devices and automation and to differentiate appropriately between these.

A. Automatic devices

306. These may be designed to achieve either the reduction of labour or the improvement of the product, or both.

307. In the first instance, mention may be made of automatic lap-doffing on the scutcher and can or package-changing on draw frames. It may be noted that the advantage of such devices may not be the fact that labour is reduced, but that the need for an operator to carry out an operation at a particular time is removed. Automatic cleaning devices may both reduce labour and improve quality, and are therefore worthy of careful examination.

308. Automatic levelling devices do not increase productivity, but they improve quality and may also reduce the work required in laboratory checking. They have been very successful in the worsted system where they have found universal application, but they have not found commercial application in cotton-drawing.

309. There is a new trend towards central monitoring of qualities and quantities, and electronic devices are making this possible.

310. Automatic slub-catchers on winding machines improve quality and increase efficiency on the looms.

311. From the above examples of automatic machinery and devices, it may be concluded that each of these may find application in developing countries and should be carefully considered. Consideration should take into account the existing financial, labour and commercial factors, together with the technical aspects. The Workshop felt that the introduction of automatic devices designed to reduce the labour requirements should be considered very cautiously, especially in countries with unemployment. Whenever quality is definitely being improved, such an introduction may be justified.

B. Automation

312. Automation implies the manufacture of a product, or part of a product, with the minimum of human intervention. The output of an automated system should be automatically controlled and faults should be automatically corrected.

313. Revolutionary approaches to techniques for producing yarn, fabric and other final products have been, and are being examined. It should be noted, however, that in the field of cotton processing, all proposed or existing solutions to automation employ traditional techniques without improving the quality of the yarn compared with that obtained with modern conventional machines. Therefore, a large part of the problem is reduced to that of material handling.

314. Over half of the labour required in the spinning process is to be found in the ring-spinning room. It is reasonable therefore, to think in terms of reducing the labour requirement at this stage of the process.

315. Automatic doffing and winding is being developed, as well as creeling equipment. A basic requirement of this type of equipment is that it must be extremely efficient if labour is to be saved. There is a danger that unskilled labour will be replaced by a smaller number of highly skilled workers who are not available in developing countries. It should be noted that most of the equipment falling under this heading has not yet found application in developed countries.

316. More than twelve systems are already available for processing cotton from bales to ring frames in an automatic or semi-automatic manner. None of these remove all labour from this process, and if the entire spinning plant, including ring frames, is taken into account, HOK values are reduced up to 25 per cent compared with modern conventional machines.

317. One of the basic problems when machines are connected is machine interference. Thus, the efficiency of the whole line approximates to the product of the efficiencies of the component machines. It may be that some part of a linked system can be justified and, therefore, any proposals should be examined from this point of view.

318. The Workshop felt that automation systems, as at present proposed for the cotton-spinning sector, should not be advocated for installation in developing countries, since the unnecessary advantage of reduced labour can be completely offset by the following factors:

- (a) The high cost of introducing the system;
- (b) The high quality of management required;
- (c) The high degree of technical knowledge required, especially of linked electrical controls;
- (d) The high degree of maintenance necessary;
- (e) The necessity of an adequate supply of spare parts;
- (f) The necessity of rapid fault-finding and correction.

319. While the above conclusion was considered to be correct for the spinning sector, the Workshop agreed that automation in a continuous flow, tension controlled finishing plant might be advocated for bulk production.

320. It was noted by the Workshop that the winding and weaving machines or devices introduced recently were largely automatic and thus did not need to be considered in the context of automation.

XIX. COUNTRY STATEMENTS

321. During the deliberations of the Workshop, participants made statements on the status of the textile industry in their respective countries. A brief summary of these is given in the following pages.

Argentina

322. Argentina has established an organization to formulate a general plan for economic activities in the country. An agency called CONADE (National Council for Development) has the purpose of establishing targets for the privately owned textile industry, which represents 70 per cent of the industry. One of the enterprises which is state-owned was established in order to provide yarns for handlooms, which exist in some less-developed areas of the country. It was noted that textiles no longer represented the most important industrial activity in Argentina. Mechanical engineering products and the automobile industry have surpassed the textile industry in their importance to the economy of the country. According to the priorities of the over-all plan, national financial agencies provide long-term credits to the industry. The country has good facilities for the technical education of labour.

Brazil

323. In Brazil, a programme has been set up which includes incentives for the modernization of the textile industry, improvement of the textile machinery industry, and the amelioration of the national cotton production. In the Nordeste (north-east) region, after the determination of technical, economic, financial and administrative problems, the official agency for the development of that region (SUDENE, Superintendency of Development of the North-east), has established for the textile industry supervised credits and intensive training courses for managers and foremen to increase productivity. In the central-south area of Brazil, a survey was made by the Economic Commission for Latin America (ECLA) with the support of the Spinners and Weavers Association, which was the basis for a reorganization and modernization programme of the textile industry. Based on these studies, the Brazilian Government created, in the Ministry of Industry and Commerce, a special agency named GEITEC (Executive Group for the Textile and Leather Industry) to carry out a development programme for the textile industry. The chief aspects of the proposed action in this field include the replacement and reconditioning of equipment, the improvement of organization and management, the achievement of higher standards of labour productivity and the training of personnel.

Colombia

324. The textile industry in Colombia has reached an advanced stage in comparison with other Latin American countries. It dates back to the first decades of this century and has grown spontaneously and according to the expansion of the domestic market. Production closely matches internal demand as to both the total quantity and quality of products. Cotton, among other fibres, predominates, but in recent

years the wool and synthetic industries have made important strides. The textile industry encompasses about 20 per cent of all gross manufactured output.

325. Although the industry has grown significantly in the last twenty to twenty-five years, only recently has there been an effort to plan its development. Studies had been carried out by ECLA concerning labour productivity and the economic conditions. However, it was not until 1960, when the Government issued a general plan for economic development with emphasis on industrialization, that a programme was proposed for textiles and other branches. In order to follow the programme, the association of manufacturers made a survey of the general characteristics of the textile industry, including such aspects as value of production, demand, equipment, employment, capital invested, availability of raw material and forecasts. During the period from 1961 to 1965, the industry closely achieved the goals set.

326. Following the experience of other Latin American countries, Colombia asked the ECLA in 1963 to conduct a more detailed study of some specific aspects, such as productivity, level and composition of cost, degree of integration of mills, etc. This work was performed by ECLA in close co-operation with the Colombian organization of manufactures, and it has been very useful for determining the possibilities of the country within the Latin American Free Trade Zone (LAFTA).

327. The basic instrument used recently by the Government to foster and direct the industrialization of the country, is the regulation of imports, which are placed entirely under official control.

328. In addition to the above, Colombia is fortunate in possessing highly qualified management and responsible manufacturers. This has resulted in a large increase in the productivity of labour, by far the highest in Latin America at present.

329. One of the main goals of the industry at present is substantially to increase its exports. Although until recently, little progress had been made in the liberalization of the Latin American markets for textile goods, the producers are trying to obtain preliminary agreements with their counterparts in other countries, such as Mexico, Argentina, Brazil and Peru, in order to begin intensifying textile trade in accordance with the Montevideo Treaty.

330. The industry has organized an institution for modern personnel management methods, which also distributes information on marketing and on the training of foremen, and promotes the undertaking of studies on industrial administration.

331. Another feature of the Colombian textile industry concerns the organization of cotton marketing. The consumers have organized a co-operative which negotiates purchases from cotton growers and ensures adequate and proper distribution to the mills.

Czechoslovakia

332. Czechoslovakia faced the problem of complete modernization of its textile industry after the Second World War. The industry was nationalized and organized into large units. Usable machinery was pooled together. The spinning machinery

was reconditioned; however, the greater part of the loss was on the replacement of the machines. The process was slow, and although financing was insufficient, considerable contributions were made by the engineering branches of the textile mills. In this way, the industry has not only survived, but has also become stronger. The industry has been so successful that it now plays an important part in the economy. The present policy makes it imperative for the mills to show a profit, the incentive being a share of the profit, which is not available in foreign currency. A programme of extensive modernization is under way.

Hong Kong

333. Hong Kong has virtually no natural resources other than its sheltered, deep-water harbour and advantageous geographic location for trade.

334. Since 1948, the textile industry has expanded rapidly to its present position as Hong Kong's major industry. The industry undertakes the spinning of cotton, rayon, silk and woollen yarns, and mixtures of artificial and natural fibres; weaving, knitting, dyeing, printing and finishing; and the manufacture of all types of garments and textile goods. The spinning mills, operating 710,000 spindles at the end of 1964, are among the most modern in the world and adequate benefits are generally provided for the workers. Cotton yarn counts range from 10 to 60 s., carded and combed in single or multiple threads. Production of all counts in 1964 was over 261,000,000 lb., the greater part of which was consumed by local weaving establishments.

335. In the weaving sector, which has 20,700 looms installed, cotton grey drill, canvas, shirtings, striped poplin, gingham and other bleached and dyed cloth and prints are the main items. Production in 1964 exceeded 579,000,000 square yards, most of which was exported. Other products of Hong Kong's weaving industry are silk and rayon brocade in traditional Chinese designs, tapes, military webbing, lace, mosquito-netting, cotton open mesh, carpets and rugs. Development in the dyeing, printing and finishing of textiles has not been as rapid as in other sections of the industry, but some progress has been made in the past few years. Multi-colour roller and screen printing, pre-shrinking by several processes under licence and polymerizing for the production of "drip-dry" fabrics are undertaken for exported piece goods and for cloth used by the local garment industry. An almost unlimited variety of garments is manufactured in Hong Kong, such as shirts, silk and brocade house coats and outer coats. In recent years, custom and mail-order tailoring, principally of men's suits, has rapidly developed into an important branch of the industry.

336. Hong-Kong's knitting mills produce towels, tee-shirts, singlets, underwear and nightwear, swimsuits, gloves, socks and stockings, in a variety of fabrics. The production of woollen knitwear has shown an exceptionally rapid growth in recent years. Backed by a wool and worsted spinning industry which now has an annual productive capacity of some 12 million lb., the industry's exports have grown considerably in recent years. Exports of woollen knitwear in 1964 reached a value of \$371.0 million, compared with \$271.6 million in 1963.

337. While the textile industry plays a vital role in the economy of Hong Kong and accounts for some 52 per cent by value of domestic exports, the search for new products, materials and processes continues. The most recent developments

includes the spinning, weaving and finishing of polyester/cotton and polyester/sisal yarn mixtures. The textile industry has achieved a considerable amount of diversification during the last ten years.

Iran

339. In Iran, one quarter of the cotton textile industry is owned by the Government, while the balance is held by the private sector. Production at present meets the requirements of the domestic market.

340. The country also has an industry of woollen and worsted fabrics as well as jute. Some quantities of worsted and silk fabrics are imported in order to meet the domestic requirements. The country is self-sufficient in cotton and, in fact, has a surplus to export.

Israel

340. In Israel, the Government has shown interest in the development of textile production by providing long-term loans and financial support for training personnel. The Government has been guided by the following basic principles:

- (a) The dispersal of the population, providing for resettlement in new development areas;
- (b) The absorption and integration of immigrants, coming from all parts of the world;
- (c) The provision of employment;
- (d) The utilization of local raw materials.

Quality is maintained by means of standards established by the Israel Standards Institute.

341. The following technological and commercial institutions are at the disposal of the textile industry, with a view to rendering assistance and advice:

- (a) The Standards Institute;
- (b) The Institute for Fibre and Forest Products Research;
- (c) The Productivity Institute;
- (d) The Export Institute.

These institutions render services to the textile industry on all matters concerning technological innovations and scientific research, labour productivity, market research, exhibitions, fairs, etc.

Japan

342. In Japan, a law enacted on 1 October 1964 controls the spinning equipment and will remain in force for four years. The main purpose of this law is to rationalize the textile industry by regulating the installation of spinning equipment. Under this law, no installation of spinning frames is permitted unless it is duly registered with the Government. Moreover, no new registrations are permitted, as there are considerable surplus spindles in registration. Any part of the registered spindles which are deemed redundant at the time of enactment of this law in the light of the estimated demand position will be frozen for three years through joint action of the enterprises concerned, under instructions from the Minister of International Trade and Industry (MITI). As of 1 October 1964, the actual number of frozen spindles was about 3,320,000 including cotton, spun rayon and worsted. In this way, surplus capacity has been frozen, but as it is estimated that the textile demand will expand to some extent by 1968, the final year of the law, it is provided that any spinner wishing to increase his operable capacity to meet such a demand may instal machinery, or release it from his frozen equipment, at the rate of one spindle for each two spindles scrapped from his frozen equipment. It is hoped that this provision will act as a stimulus to encourage scrapping of surplus capacity.

343. A total of 1,311,000 spindles were scrapped between October 1965 and June 1966, about 122,000 new spindles were installed, and about 487,000 spindles were released from freezing during the same period.

344. For the export trade, the "Export Inspection Law" serves to maintain the good quality of those export goods which have been designated by MITI (Ministry of International Trade and Industry).

Mexico

345. Mexico has a considerable quantity of obsolete equipment installed, especially as regards the traditional sectors of cotton, wool and henequen (hard fibre of the sisal family). Generally, there exists a surplus capacity of production. New equipment has been installed to produce man-made fibres efficiently.

346. In order to solve the problems of the traditional sectors, the following measures have been taken:

(a) Each firm intending to modernize its equipment must scrap an equivalent obsolete production capacity;

(b) The purchase of second-hand machinery is prohibited, since it has been shown that such purchases do not increase productivity;

(c) In certain circumstances the industry can be declared saturated in order to avoid unnecessary allocation of capital;

(d) The construction of textile machines under foreign licences for the cotton sector has been initiated;

(e) A trade association has been created to promote the export of cotton goods;

(f) The Government has purchased part of the henequen industry, in order to modernize this branch, which is an important outlet for manpower;

(g) A Textile Programming Committee has been established, the principal tasks of which are modernization, productivity, business administration, control of quality and decentralization of the industry.

Poland

347. Poland has a well founded tradition of textile operations, including the production of textile machinery. After the Second World War, over half of the textile mills which had existed before the war were destroyed or made inoperative. There was also a serious shortage of skilled manpower. In the reconstructed mills there were problems due to absenteeism of peasants who had become textile workers and there was also competition for skilled labour from other sectors.

348. Initial planning, which had to avoid new investments, had the main purpose of establishing intensive personnel training, increasing productivity per worker, and introducing the concept of multi-shift work.

349. In this period, less attention was paid to the problem of cost and quality of products. These aspects are, however, being carefully considered at present.

350. Poland imports both raw materials and some finished textile articles, but is an important exporter of made-up goods. Some man-made fibres are produced in the country.

351. Through the channel of the central plan, the basic needs and problems of the industry are progressively solved. These include modernization, growth in demand and, consequently, selection of productive capacity, the proper use of raw materials and investment priorities.

United Arab Republic

352. The first modern textile mill in the United Arab Republic was erected in 1911. The Second World War substantially helped the expansion of the industry. In those years and under the flourishing conditions of a closed market, the industry neglected proper machinery maintenance, training of technicians and foremen, labour productivity and quality control. As a result, exports experienced difficulties from international competition. These were overcome gradually after the establishment of the Permanent Committee for Consolidating the Cotton Textile Industry, the purpose of which was to promote marketing, impose standard specifications, plan a policy for applied research in cotton textiles, and render advice in the field of training, production costs and raw material utilization.

353. During the early 1940's the United Arab Republic faced acute problems, such as poverty, unemployment and unequal distribution of income and wealth. A dense and rapidly increasing population was outgrowing limited agricultural production and resources. Rapid industrialization was therefore considered necessary for economic growth.

354. The Ministry of Industry established the foundation for the development of the textile industry based on (a) expansion, modernization of machinery, preventing the import of second-hand machinery, ensuring that all units operate at least at their minimum economical rate and planning the production capacity to suit the requirements of export markets; (b) establishing training centres for technical and administrative personnel; (c) providing the specifications for textile products; (d) taking protective measures against foreign competition; and (e) locating new mills in areas where labour is readily available and where raising the standard of living is most urgently needed.

355. When most of the textile industry was nationalized, the General Egyptian Textile Organisation (GETO) was set up in 1961 to carry out the functions of expansion, modernization, marketing, training and quality control. These policies led to a substantial improvement, both in the technical and economical aspects of the industry.

356. The textile industry statistics of 1964 show a significant increase in machine capacity over the 1953 figures. The number of installed spindles increased from 517,364 to 1,397,000. Power looms increased from 15,760 to 23,069. The production of cotton yarn in 1964 was 131,230 tonnes as compared to 59,310 tonnes in 1953. In 1953 cotton fabric production was 319 million running metres and increased to 582 million in 1964. Raw cotton consumption increased from 63,343 tonnes in 1953 to 143,543 tonnes in 1964.

ANNEXES
ANNEX I
PROGRAMME

6 September 1965

- 9.00 a.m. - Registration
- 10.00 a.m. - Official Opening
- Address by Polish Minister of Light Industry, Mr. Z. Wojtkowski
- Address by the Mayor of Lodz, Mr. E. Kazmierczak
- Address by Polish Minister K. Olszewsky, Head of the Committee for Co-operation with Foreign Countries
- Address by Dr. I.H. Abdel-Rahman, United Nations Commissioner for Industrial Development
- Reading of Messages
- Election of Chairman and Rapporteur
- Adoption of the Provisional Programme
- 2.30 p.m. - Working Session No. 1. Assessment of textile needs and adoption of textile policies in developing countries. Discussion Leader, Mr. V. Saxl
- Working Paper
- Textile industries in developing countries by Ing. V. Saxl, F.T.I., United Nations Technical Consultant
- Background Papers:
- Textile Outlook for the Sixties by the United States Department of Commerce (No. 9)
- International Cotton Industry Statistics of 1965 (No. 12)

7 September 1965

- 9.00 a.m. - Working Session No. 2. Aspects of the international setting concerning the textile industry. Discussion Leader, Professor J.L. Juvet

7 September 1965 (continued)

Background Papers:

Some Aspects of the International Setting for Textile Industrialization in Developing Countries by J.I. Juvet (No. 8)

International Cotton Industry Statistics
by The International Federation of Cotton and Allied Textile Industries (No. 12)

Modern Cotton Industry
A Capital Intensive Industry (No. 13)

- 2.30 p.m. - Working Session No. 3. Methods of assessment of needs and formulation of optimum policies at the regional and country level. Discussion Leaders, Mr. M. Pollner and Mr. R. Haour

Background Papers:

Textile Outlook for the Sixties (No. 9)

Policies Regarding the Development and Operation of Textile Industries in Developing Countries, by R. Haour (No. 21)

Report of the ECAFE Expert Working Group on Textile Industries
(No. 34)

Problems and Prospects of the Textile Industry in Latin America - E/CN.12/L.6 - Economic Commission for Latin America (No. 19)

The Textile Industry in Latin America, II. Brazil. E/CN.12/623 (United Nations publication, Sales No.: 64.II.G.2) (No. 10)

The American Textile Industry - Competition, Structure, Facilities, Costs, by L.D. Howell (No. 11)

8 September 1965

- 9.00 a.m. - Working Session No. 4. The Wool Industry - Raw Materials, Processes and Products. Discussion Leader, Mr. V. Sexl

Background Papers:

New Finishes Giving Additional Advantages to Wool Products, by A. Pleumeeckers, International Wool Secretariat (No. 2)

Competitive Operation of Woollen and Worsted Plants, by J. Matthews, International Wool Secretariat (No. 25)

Modern Methods of Fellmongering, by The International Wool Secretariat (No. 32)

8 September 1965 (continued)

Modern Weaving Techniques, Styling, Designing and Fabrication of Wool Fabrics, by A.Z. Sliwerski, International Wool Secretariat (No. 26)

Selection of Wools in Relation to End-Uses
by J. Matthews, International Wool Secretariat (No. 24)

2.30 p.m. Working Session No. 5. Relative importance of domestic manufacture versus imports of textiles in developing countries.
Discussion Leader, Mr. M. Pollner

Background Papers:

Textile Outlook for the Sixties (No. 9)

The American Textile Industry - Competition, Structure, Facilities, Costs, by L.D. Howell (No. 11)

Problems and Prospects of the Textile Industry in Latin America, United Nations publication E/CN.12/L.6, Economic Commission for Latin America (No. 19)

Some Aspects of the International Setting for Textile Industries in Developing Countries, by J.L. Juvet (No. 20)

Policies Regarding the Development and Operation of Textile Industries in Developing Countries, by R. Haour (No. 21)

9 September 1965

8.00 a.m. to

12.00 p.m. - Visit to Worsted Spinning Mill of Gwardia Ludowa in Lodz

2.30 p.m. - Working Session No. 6. Drafting of report on Working Sessions Nos. 1, 2, 3, 4 and 5.

10-13 September 1965

Visits to wool and cotton works in Bielsko-Biala, Cracow, Andrychow and Oswiecim

14 September 1965

9.00 a.m. - Working Session No. 7. Methods of assessment of needs and formulation of optimum policies at the mill level.
Discussion Leader, Mr. V. Saxl

14 September 1965 (continued)

Background Paper:

Competitive Operation of Woollen and Worsted Plants,
by J. Matthews, International Wool Secretariat (No. 20)

2.50 p.m. - Working Session No. 8. Raw Materials including problems of
availability and criteria for selection.
Discussion Leader, Dr. T. Jedryka

Background Papers:

The Textile Fibre: Raw Materials, Their Availability and
Application Criteria, by Instytut Włókiennictwa, Lodz (No. 19)

Synthetic Fibres of Polyamides, by J. Laub and Hans J. Zimmer AG
(No. 22)

The American Textile Industry - Competition, Structure, Facilities,
Costs, by L.D. Howell, Economic Research Service (No. 11)

A Guide to Fibres, by E.I. Du Pont De Nemours and Company, Inc.
(No. 33)

Acrylic Fibres, by E. Tsunoda, Asahi Chemical Co. Ltd.
(No. 25)

The Production of Synthetic Fibres on a Petrochemical Basis in
Developing Countries, by P. Seifert (No. 18)

Textile Fibres and Their Properties,
Burlington Industries, Inc. (No. 21)

From Crude Oil to Synthetic Fibres with Special Consideration
of Process Sequence for Polyester Type Fibres, by D. Natus
(No. 15)

A Guide to Fibres, by E.I. Du Pont De Nemours and Company, Inc.
(No. 33)

Polyester Synthetic Fibre Materials for Developing Countries,
by David Brown, Halcon International Inc.
(No. 16)

15 September 1965

9.00 a.m. - Working Session No. 9. Textile processes. Importance of mill
balance. Integrated versus non-integrated mills.
Discussion Leader, Mr. F. Greenwood

19 September 1965 (continued)

Background Papers:

New Finishes Giving Additional Advantages to Wool Products,
by A. Plemeekers, International Wool Secretariat
(No. 2)

Modifications of Textile Products by Chemical or Physical
Treatment, by Carroll L. Hoffpauir and B.M. Kopacz,
Agricultural Research Service (No. 3)

Modern Finishing Methods for Cotton Textiles, Including the
Production of Stretch Fabrics by Using Special Spinning, Twisting
or Weaving Methods, by Carroll L. Hoffpauir and B.M. Kopacz,
Agricultural Research Service (No. 4)

Surface Styling of Textiles by Flocking,
Farbenfabriken Bayer Ag. (No. 13)

Modern Weaving Techniques, Styling, Designing and Fabrication
of Wool Fabrics, by A.Z. Sliwerski, International Wool Secretariat
(No. 26)

Recent Innovations in Textile Finishing, by Ralph Badenbaugh,
United Merchants and Manufacturers, Inc. (No. 30)

Establishing of Textile Industries in Developing Countries;
Comparative Study of Weaving Costs, by RUTI Machinery Works Ltd.
(No. 31)

2.50 p.m. - Working Session No. 10. Optimum plant size and economics of scale
in the textile industry. Discussion Leader, Mr. R. Haour

Background Papers:

Economics of Scale in the Cotton Spinning Industry, by the
Economic Commission for Latin America (E/CN.12/L.7). (No. 16)

Development of a Synthetic Fibre Industry. As For Example Nylon-6,
in Developing Countries, by D. Thormann, Hoechst-Union, International
GmbH (No. 17)

Acrylic Fibres, by E. Tsunoda, Asahi Chemical Industry Co. Ltd.
(No. 23)

Competitive Operation of Woollen and Worsted Plants, by
J. Matthews, International Wool Secretariat
(No. 25)

16 September 1965

9.00 a.m. - Working Session No. 11. Textile Mill Controls. Productivity. In-plant and other training programmes. Discussion Leaders, V. Saxl and G. Lesalle

Background Papers:

Manufacturing Controls for Textile Mills,
by Werner Textile Consultants (No. 1)

Problems and Prospects of the Textile Industry in Latin America
(E/CN.12/L.6) United Nations Economic Commission for Latin America (No. 19)

The Textile Industry in Latin America
II, Brazil (E/CN.12/623) (United Nations publication,
Sales No.: 64.II.G.2) (No. 10)

Productivity and Inter-Firm Comparisons in the Cotton Textile Industry, by A. Nicol (No. 28)

2.30 p.m. - Working Session No. 12. Drafting of Report on Working Sessions Nos. 6, 7, 8, 9, 10 and 11

17 September 1965

Visit to factories in Kalisz

18-19 September 1965

Visit to Poznan Home Fair and various textile and clothing industrial enterprises

Visit to East Fibres Textile Research Institute

20 September 1965

9.00 a.m. - Working Session No. 13. Drafting of Report on Working Sessions Nos. 6, 7, 8, 9, 10 and 11.

2.30 p.m. - Working Session No. 14

Equipment and machinery for textile industries in developing countries; general considerations.
Discussion Leaders, Mr. J. Holecek and Mr. F. Greenwood

20 September 1965 (continued)

Background Papers:

The Systemated Mill. Textile Industries, February 1965
(No. 7)

The Textile Industry in Latin America
II. Brazil (E/CN.12/623) (United Nations publication
Sales No.: 64.II.G.2) (No. 10)

Modern Cotton Industry
A Capital Intensive Industry (No. 3)

Establishing of Textile Industries in Developing Countries;
Comparative Study of Weaving Costs, RUTI Machinery Works, Ltd.
(No. 31)

International Cotton Industry Statistics of 1963,
International Federation of Cotton and Allied Textile Industries
(No. 12)

21 September 1965

9.00 a.m. - Working Session No. 15. Recent technological development and
their application to developing countries.
Discussion Leader, Dr. T. Jedryka

Background Papers:

Recent Technological Achievements and Possibilities of
Their Application in Developing Countries. Instytut Włókiennictwa,
Lodz (No. 6)

Surface Styling of Textiles by Flocking,
by Farbenfabriken Bayer AG (No. 13)

New Finishes Giving Additional Advantages to Wool Products,
by A. Pleumeckers, International Wool Secretariat
(No. 2)

Modifications of Textile Products by Chemical or Physical
Treatment, by Carroll L. Hoffpauir and B.M. Kopacz, Agricultural
Research Service (No. 3)

Development of a Synthetic Fibre Industry, As for Example, Nylon-6,
in Developing Countries, by D. Thormann (No. 17)

21 September 1965 (continued)

- 2.30 p.m. - Working Session No. 16. Automation in the textile industry and problems connected with it.
Discussion Leader, Mr. F. Greenwood

Background Papers:

The Systemated Mill. Textile Industries
February 1965 (No. 7)

Manufacturing Trends in the Textile Industry,
Edgar Schlesinger, United Merchants and Manufacturers, Inc.
(No. 29)

Recent Innovations in Textile Finishing,
by Ralph Eadenbaugh, United Merchants and Manufacturers, Inc.
(No. 30)

22 September 1965

- 8.00 a.m. to
12.00 p.m. - Technological study visit to confection factory
in Lask

- 2.30 p.m. - Working Session No. 17. Degree of machinery specialization and utilization of new versus second-hand machinery in the textile industry in developing countries.
Discussion Leader, Mr. F. Greenwood

Background Papers:

Manufacturing Trends in the Textile Industry,
by Edgar Schlesinger, United Merchants and Manufacturers, Inc.
(No. 29)

23 September 1965

- 9.00 a.m. - Working Session No. 18. Discussion and drafting of report based on Working Sessions Nos. 14, 15, 16, 17.
- 2.30 p.m. - Working Session No. 19. Discussion and drafting of report based on Working Sessions Nos. 14, 15, 16, 17.

24 September 1965

- 9.00 a.m. - Working Session No. 20. Discussion and drafting of report based on Working Sessions Nos. 14, 15, 16, 17.

24 September 1965 (continued)

2.50 p.m. - Working Session, No. 21. Discussion and drafting of report based on Working Sessions Nos. 14, 15, 16, 17.

Working Session No. 22

Summary and Conclusions - V. Szal and
M. Pollner, United Nations

Statements by Workshop Participants

Introduction of Workshop Report by the Rapporteur

Adoption and Signing of Workshop Report

Closing Statements:

Chairman of the Workshop

Dr. T. Jedryka, Instytut Wlokiennictwa, Lodz

Dr. H. Beredjick, Project Director, United Nations Centre
for Industrial Development

8.00 p.m. - Farewell Reception

25-26 September 1965

Visit to Zelazowa Wola and Metal Export Company,
Warsaw

27 September 1965

Departure of participants.

ANNEX II

LIST OF PAPERS

Working Paper

1. Textile Industries in Developing Countries United Nations
Centre for Industrial Development by
Mr. V. Saxl, United Nations Technical
Consultant

Background Papers

1. Manufacturing Controls for Textile Mills Werner Textile Consultants
2. New Finishes Giving Additional Advantages to Wool Products A. Fleunseckers
International Wool Secretariat
3. Modifications of Textile Products by Chemical or Physical Treatment Carroll L. Hoffpauir and
B.M. Kopez, Agricultural Research
Service
4. Modern Finishing Methods for Cotton Textiles, including the Production of Stretch Fabrics by Using Special Spinning, Twisting or Weaving Methods Carroll L. Hoffpauir and
B.M. Kopez, Agricultural Research
Service
5. The Textile Fibre: Raw Materials, Their Availability and Application Criteria Instytut Włókiennictwa, Lodz
6. Recent Technological Achievements and Possibilities of their Application in Developing Countries Instytut Włókiennictwa, Lodz

Background Papers (continued)

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|---|---|
| 7. <u>The Systemated Mill</u> | <u>Textile Industries</u>
February 1965 |
| 8. <u>Modern Cotton Industry</u>
<u>A Capital Intensive Industry</u> | Report by the Special Committee
for Textiles (OECD) |
| 9. <u>Textile Outlook for the Sixties</u> | Study by the US Department
of Commerce |
| 10. <u>The Textile Industry in Latin</u>
<u>America II. Brazil</u> | <u>E/CN.12/623</u> (United Nations
publication Sales No.: 64.II.G.2) |
| 11. <u>The American Textile Industry -</u>
<u>Competition, Structure,</u>
<u>Facilities, Costs</u> | L.D. Howell
Economic Research Service |
| 12. <u>International Cotton Industry</u>
<u>Statistics of 1963</u> | International Federation of
Cotton and Allied Textile Industries |
| 13. <u>Surface Styling of Textiles</u>
<u>by Flocking</u> | Farbenfabriken Bayer AG |
| 14. <u>The Production of Synthetic Fibres</u>
<u>on a Petrochemical Basis in</u>
<u>Developing Countries</u> | P. Seifert, Inventa AG |
| 15. <u>From Crude Oil to Synthetic Fibres</u>
<u>with Special Consideration of Process</u>
<u>Sequences for Polyester-Type Fibres</u> | D. Hatus, Lurgi Gesellschaft für
Mineraloltechnik M.b.H. |
| 16. <u>Polyester Synthetic Fibre Materials</u>
<u>for Developing Countries</u> | David Brown
Halcon International Inc. |
| 17. <u>Development of a Synthetic Fibre</u>
<u>Industry, As for Example Nylon-6,</u>
<u>in Developing Countries</u> | D. Thormann, Hoechst-Union,
International GmbH |
| 18. <u>Economics of Scale in the Cotton</u>
<u>Spinning Industry</u>
(E/CN.12/L.7) | United Nations Economic Commission
for Latin America |
| 19. <u>Problems and Prospects of the</u>
<u>Textile Industry in Latin America</u>
(E/CN.12/L.6) | United Nations Economic Commission
for Latin America |
| 20. <u>Some Aspects of the International</u>
<u>Setting for Textile Industries</u>
<u>in Developing Countries</u> | J.L. Juvet, Professor
University of Neuchâtel |
| 21. <u>Policies Regarding the Development</u>
<u>and Operation of Textile Industries</u>
<u>in Developing Countries</u> | R. Haour
Cepiec |

Background Papers (continued)

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|-----|---|--|
| 22. | <u>Synthetic Fibres of Polyamides</u> | J. Lamb
Hans J. Zimmer AG |
| 23. | <u>Acrylic Fibres</u> | E. Tsunoda
Asahi Chemical Industry Co. Ltd. |
| 24. | <u>Selection of Wools in Relation to End-Uses</u> | J. Matthews
International Wool Secretariat |
| 25. | <u>Competitive Operation of Woollen and Worsted Plants</u> | J. Matthews
International Wool Secretariat |
| 26. | <u>Modern Weaving Techniques, Styling, Designing and Fabrication of Wool Fabrics</u> | A.Z. Sliverski
International Wool Secretariat |
| 27. | <u>Textile Fibres and Their Properties</u> | Burlington Industries, Inc. |
| 28. | <u>Productivity and Inter-Firm Comparisons in the Cotton Textile Industry</u> | A. Nicol
Productivity Measurement
Advisory Service |
| 29. | <u>Manufacturing Trends in the Textile Industry</u> | Edgar Schlesinger
United Merchants and
Manufacturers, Inc. |
| 30. | <u>Recent Innovations in Textile Finishing</u> | Ralph Badenbaugh |
| 31. | <u>Establishing of Textile Industries in Developing Countries: Comparative Study of Weaving Costs</u> | RUTI Machinery Works, Ltd. |
| 32. | <u>Modern Methods of Fellmongering</u> | International Wool Secretariat |
| 33. | <u>A Guide to Fibres</u> | E.I. Du Pont De Nemours and Co., Inc. |
| 34. | <u>Report of the ECAFE Expert Working Group on Textile Industries</u> | |

ANNEX III

LIST OF PARTICIPANTS

Participants nominated by Governments

<u>Country</u>	<u>Name</u>	<u>Affiliation</u>
Argentina	Prof. Eng. Gerardo Lasalle	former Director Argentine Productivity Centre, Buenos Aires
Brazil	Mr. Alberto Tangari	Executive Secretary Executive Group for Heavy Mechanical Industry
Colombia	Mr. Gabriel Poveda	Chief of Technical Department The National Association of Industries (ANDI)
Hong Kong	Mr. Elmer Jing Sung Tsu	Secretary Nanyang Cotton Mill Ltd. and Island Dyeing and Printing Co., Ltd.
India	Mr. Amal Chandra Chaudhuri	Director Office of the Textile Commissioner Government of India
Iran	Mr. Mohamed Bagher Kia	Member of the Board of Directors of Iran Factories Company, and Director of the Textile Industries Section of the Government of Iran
Israel	Mr. Shlomo Goor-Arie	Director of Textile and Leather Industries Ministry of Commerce and Industry
Mexico	Mr. Jaime Martinez Benitez	Official of Nacional Financiera
Poland	Dr. T. Jedryka	Director Textile Research Institute
United Arab Republic	Mr. Mohamed Merzban	Egyptian Public Organization for Spinning and Weaving

Experts

<u>Country</u>	<u>Name</u>	<u>Affiliation</u>
Czechoslovakia	Mr. J. Holecak	Commercial Director KOVO (Foreign Trade Corporation for Import and Export of Precision Engineering Products)
France	Mr. R. Haour	Manager Compagnie d'Engineering et de Planification Industrielle Economique et Commerciale
Japan	Dr. T. Murayama	Managing Director Japan Spinners Association
Switzerland	Dr. J.L. Juvet	Professor University of Neuchâtel Switzerland
United Kingdom	Mr. F. Greenwood	Development Director Prince, Smith and Stells Ltd.

United Nations Staff

Dr. N. Beredjick	Project Director Centre for Industrial Development
Mr. V. Saxl	Technical Consultant
Mr. M. Pollner	Economic Commission for Latin America

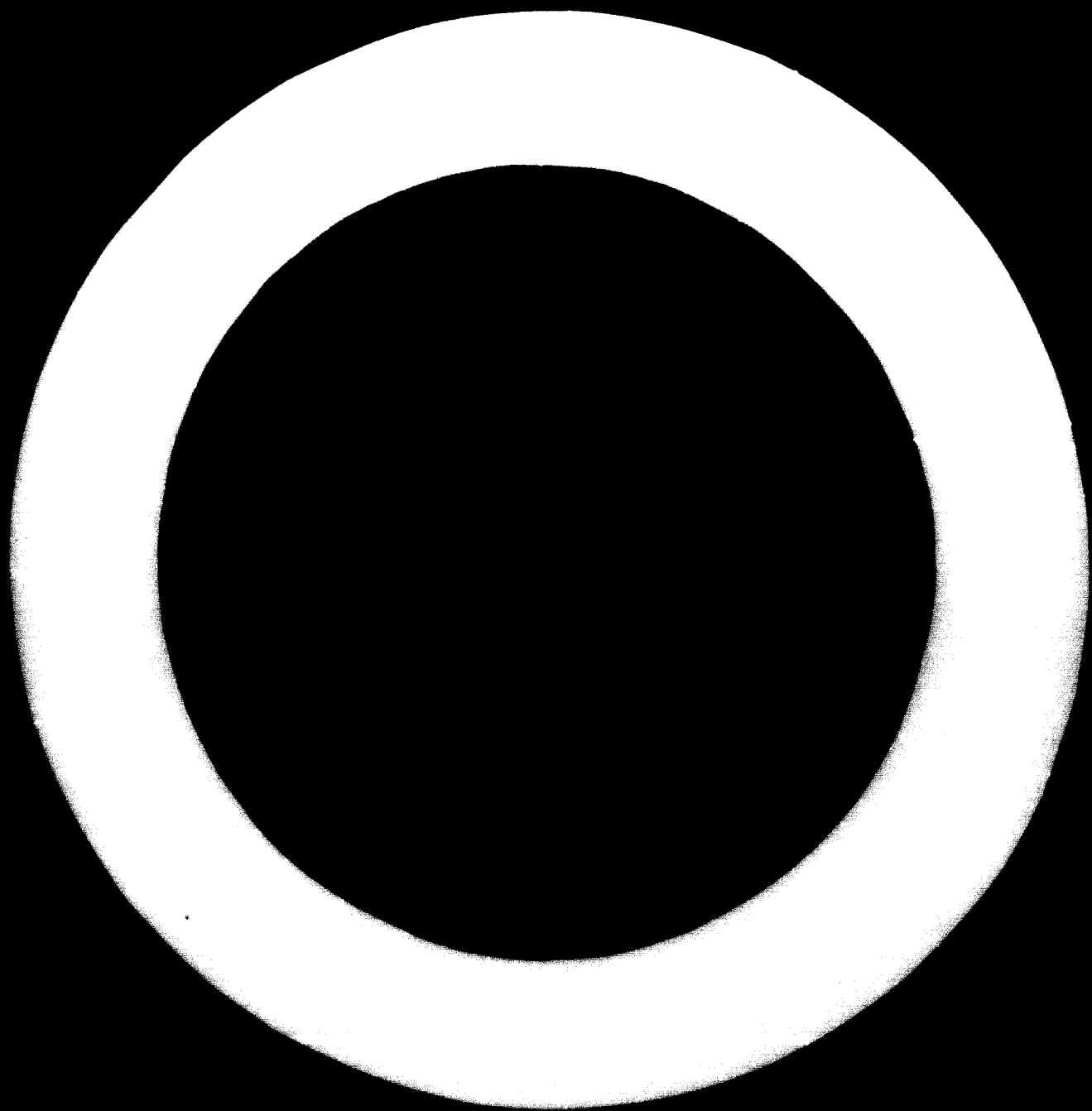
Observers

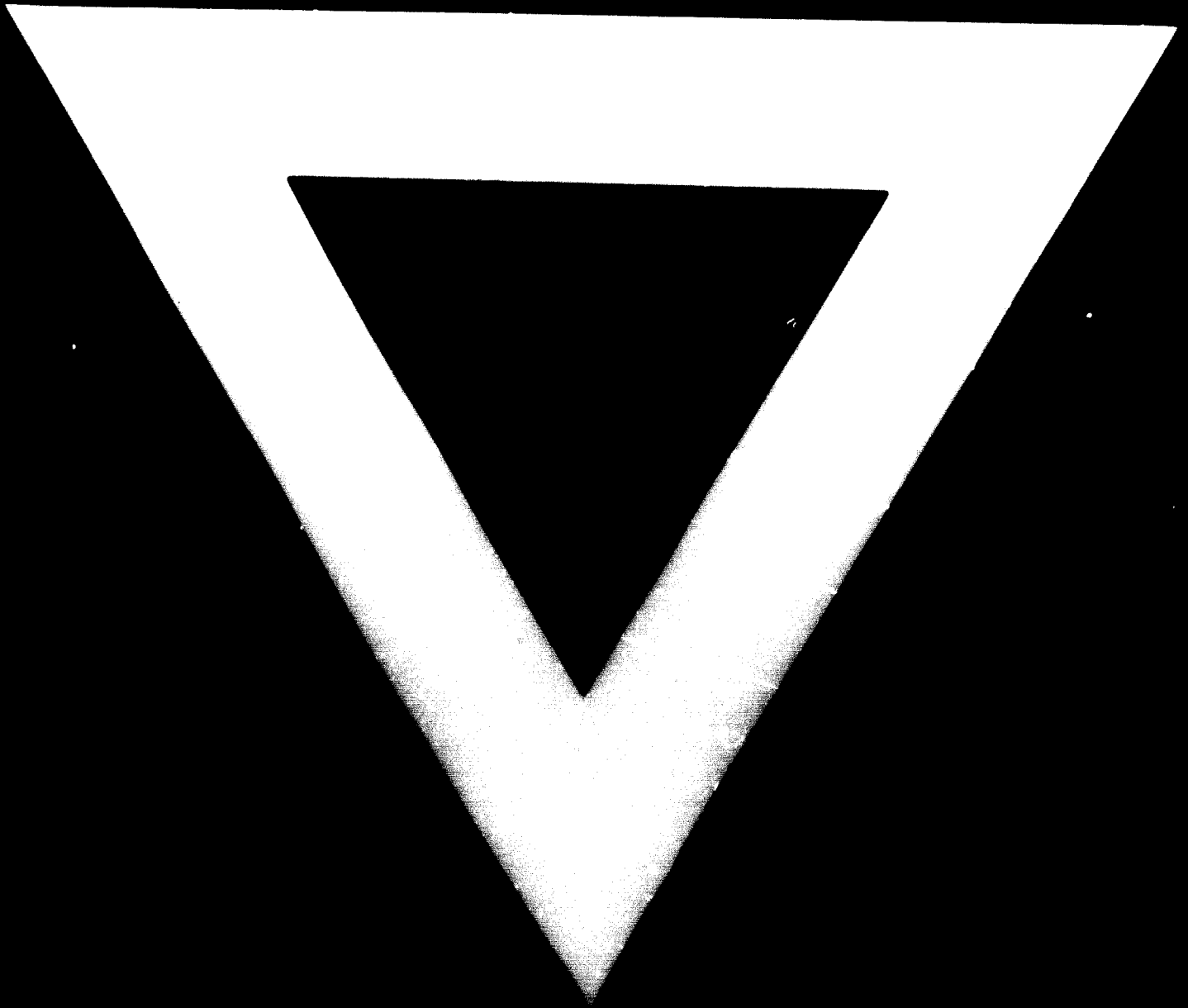
International Wool Secretariat

<u>Country</u>	<u>Name</u>	<u>Affiliation</u>
Belgium	Mr. O. Ransart	Director Market Development
Netherlands	Mr. A.J. Fleumeeckers	Director of the Technical Department
United Kingdom	Mr. J. Matthews	Director Manufacturing Services Section
United Kingdom	Mr. A.Z. Sliwerski	Industrial Officer Manufacturing Services Section

Poland

<u>Name</u>	<u>Affiliation</u>
Eng. Henryk Cichowski	Textile Research Institute, Lodz
Eng. Kazimierz Uranowicz	East Fibres Research Institute, Poznan
Mrs. Danuta Mordaka	Manager Department for Co-operation with Foreign Countries Textile Research Institute
Mr. B. Stasica	Technical Manager Textile Machinery Metal Export
Mr. Andrzej M. Witkowski	Assistant to Director General CETEBE
Eng. Wlodzimierz Kilanowski	East Fibres Research Institute, Poznan





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