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Expert Group Meeting on Quality Control in the Textile Industry

THE ORGANIZATION OF QUALITY CONTROL IN A TEXTILE MILL: SOME GENERAL ASPECTS AND PROBLEMS[1]

by

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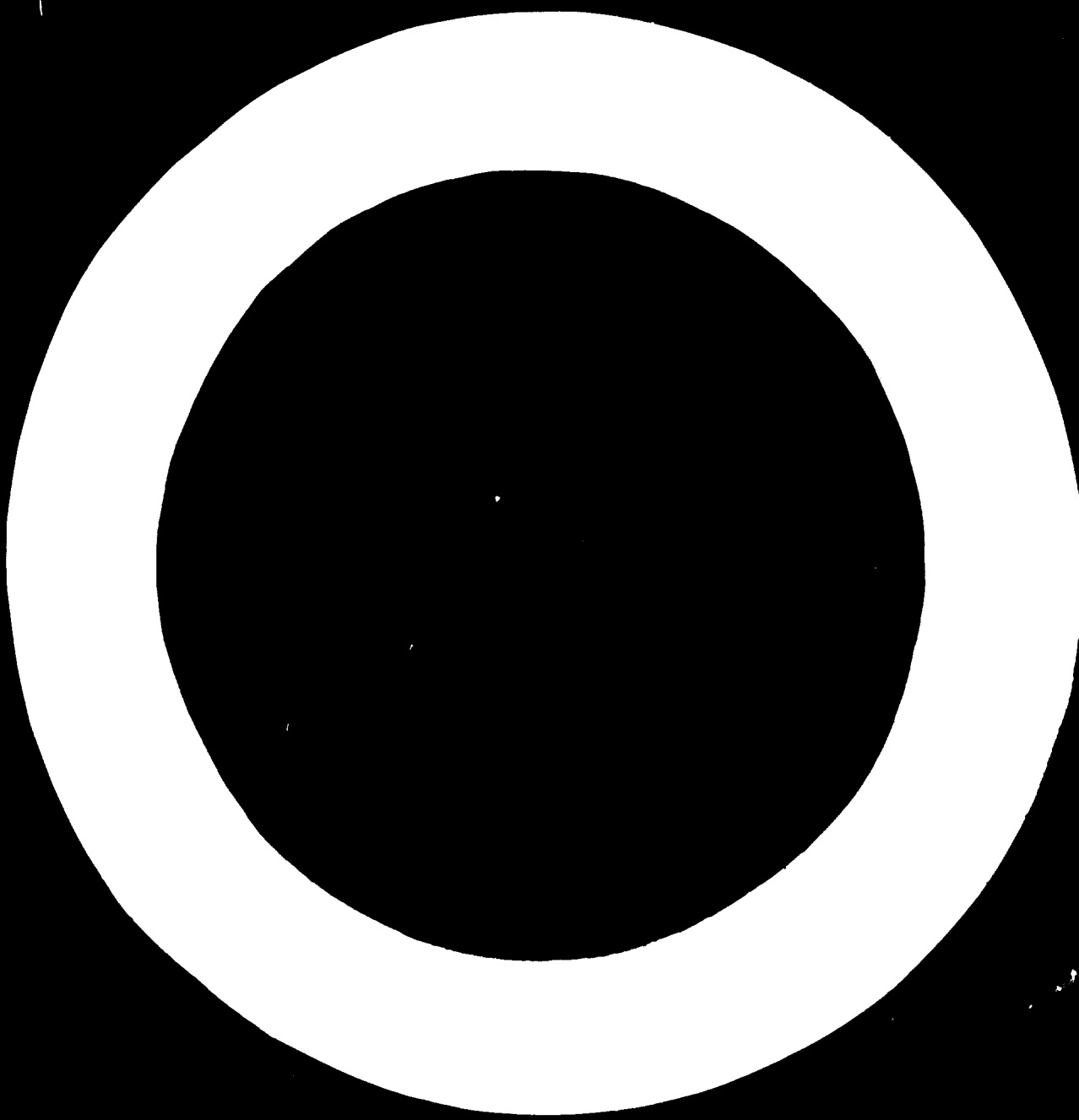


THE PURPOSE AND FUNCTIONS OF QUALITY CONTROL

The present, swift pace of the technical progress manifests itself in the changing living conditions of all mankind, but it also deeply affects the domain of production. More and more new raw materials, techniques and technologies are introduced on a mass scale owing to the automation of individual machines and of whole aggregates. New, hereto unknown products are offered on the market, or the conventional products are made with improved wear and care properties.

The changing conditions urge constant changes into the production processes, bringing in the necessity of mastering new raw materials, new machinery, and new ways of management. The present complex production cycle necessitates careful orchestration of all the units which co-operate in an industrial process.

Quality control, of which the responsibilities were, until recently, limited to the elimination of faults and fualty products, is regarded now as an essential element of every production.

The problem of quality of a modern product has become very complex, and it entails constant technical, economic and organizationel modifications. Whereas, in the past, the factors ensuri the wholesomeness of the final prodcut were the proper qualifications of the makers, proper instruments (machines) and proper raw material, today, quality control has to be added as a necessary conditio...

Also, the range of the connotations of quality control is becoming wider and wider. Not long ago quality control was limited to raw materials, half-products and final products. The modern

systems of quality control, without neglecting the responsibility of evaluation throughout the different phases of a product making, are extending control over the processing conditions. Control is applied to the technological processes (control of the machinery parameters) and their management, or to the performance of individual operations.

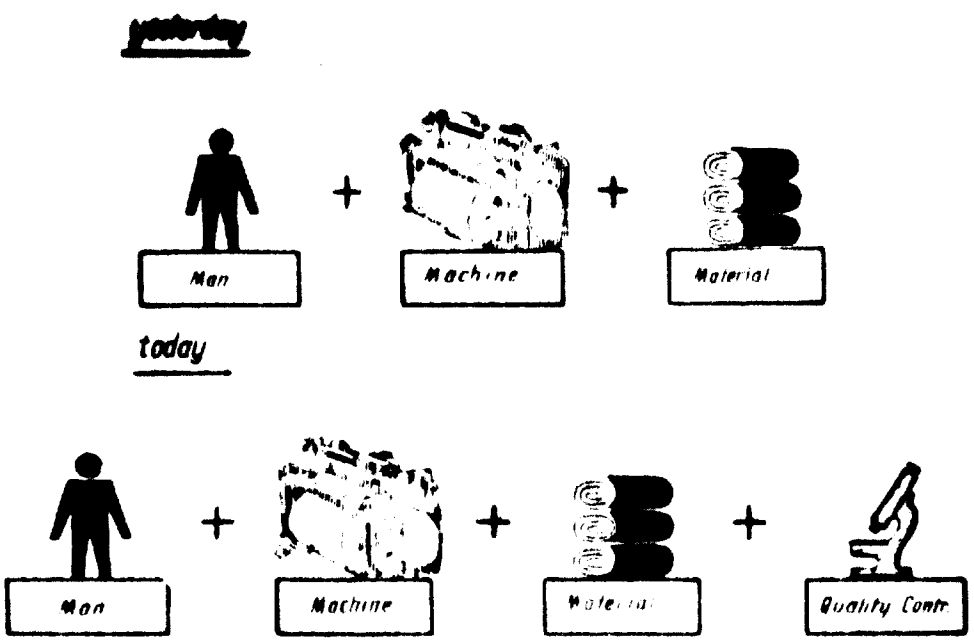


Fig. 1. The necessary elements to obtain a correct product.

The Specificness of the Textile Industry in Aspects of Quality Control

Like any other industry, the textile industry has to include in its complex structure the questions of quality and quality control, but these are different in many respects.

Thus, reliability in the case of textile products is a divided notion. It has its own regimes and measures, and this property is differently viewed in relation to a filter fabric and differntly in the case of a decorative fabric.

Also the idea of modernity has here a specific meaning, since most of the textile production has to conform with the requirements of fashion. The same is true of the question of the durability of textile products. An unfashionable pattern, design or colour will eliminate the textile product regardless of its other excellent properties.

Additionally, the user is more and more interested in such properties of a textile products as would minimize and facilitate the necessary care. The demand is increasing for such properties as crease-resistance, soiling-resistance, easy washability, and no need to iron.

The exemplified, specific aspects of a textile product make its manufacturer face the paramount problem of how to secure consistence between its quality level and its utility value. This question is closely correlated with the economics of production. The utility value of a textile product is a decisive factor to which the methods of processing and choice of the raw material are subordinated, and it also determines the optimum values of the quality indices.

A simple illustration to the above statements can be given by comparing two cotton shirts: a visiting shirt of poplin and a sports shirt of flannelette. Either shirt will have, under

specific conditions, an optimal utility value, although the one is made from top quality long-staple cotton through a costly technological process, while the other is made from short-staple cotton and cotton waste and through a relatively simple process. Nonetheless, in both cases the properties of the raw material, half-products and products as well as the technological processes have been selected so as to guarantee the expected utility value.

Fig. 2 is a graphic illustration of the necessity to harmonise the fibre properties with the applied technology in order to obtain the expected utility value.

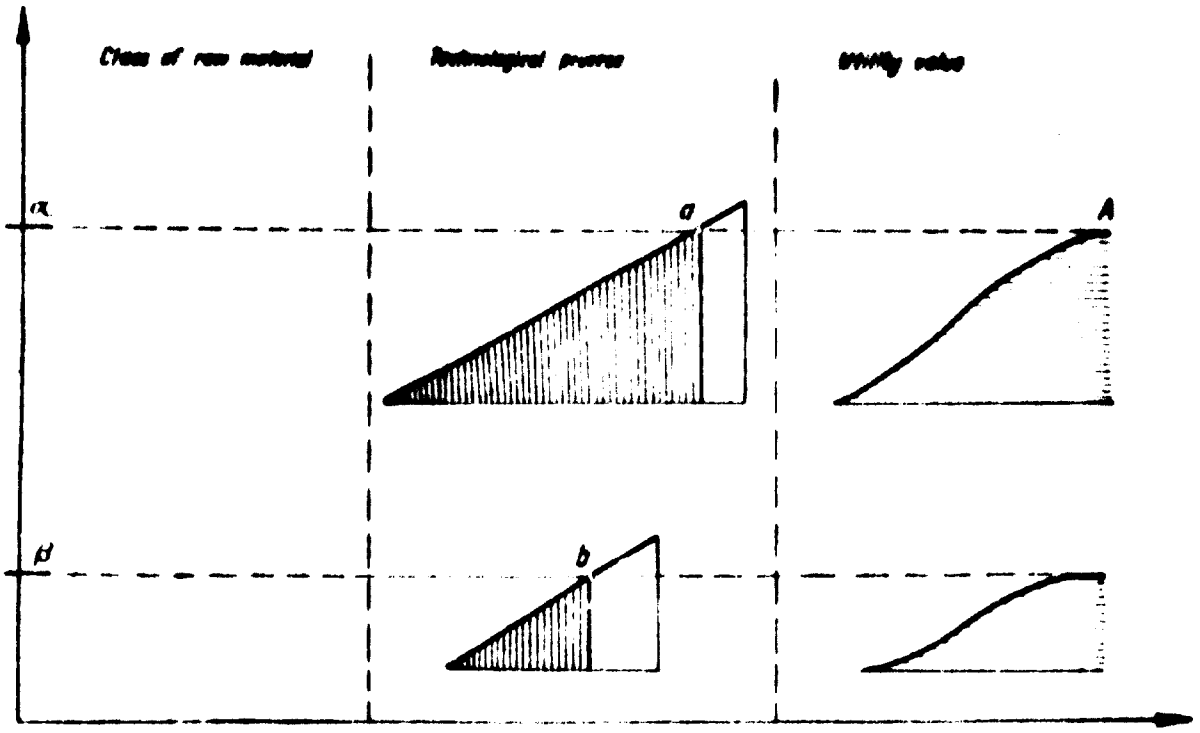


Fig. 2: Relationships between the optimal class of raw material, the optimal process, and optimal utility value.

It it also evident that using an inappropriate fibre, however of a higher quality, results in inferior utility value. Referring to the above example, the utility value of a flannelette made from long-staple cotton would be inferior because of the lower bulkiness of the resultant yarn.

The Factors Determining the Status of Quality Control in a Textile Mill

The textile industry with its diversified raw materials, technologies and assortments has developed diverse outlooks on the question of quality control. When visiting various textile mills, one is liable to encounter very different positions of the quality control departments in the mills and so is their influence on the production. In extreme cases, quality control services are either almost non-existent or, on the contrary, they are so well staffed and well equipped - sometimes with unique apparatus - that they can conduct their own research. The sources of the situations are not easy to find in the forest of reasons and opinions versed on the plausibility of this or that system of quality control. It is not easy either to establish the factors which determine the status of quality control in a mill.

The following opinion concerning the general reasons which determine the role of quality control in an enterprise should be regarded only as an attempt to generalize the essential factors on the basis of the Author's experience of the textile industry in many countries.

The essential factors which determine the role of quality control in a mill seem to be:

1. Efficiency of the management
2. Size of the mill
3. Age of the mill
4. Standard of the production
5. Prices of the raw materials.

The management level in a mill is the most fundamental factor determining and establishing the level of the quality control department and the forms of its exerting influence not only on the quality of the production but also on its preparation and management. And vice versa, the level of the quality control system in a mill can be regarded as an index of the management level.

The size of the mill is a factor that largely determines the position and function of quality control. It is evident that larger enterprises would naturally attach more importance to the question of quality control. Almost as a rule, the role of quality control is proportional to the size of the mill. The bigger the mill the stronger is the unit of quality and process control that stands at its disposal.

The age of the mill is also a factor influencing quality control, although this influence is perhaps less regular. It is almost a rule rule that the older enterprises, which have well established process organizations, would have acquired routine practice of management. Finding quality in their establisment, they attach less importance with any major modernizations of the processes

and management. The newly founded enterprises, which are equipped with new machinery and which also adopt modern methods of production management, usually have better equipped and better organized quality control departments.

The standard of the production reflects proportionally the influence of the quality control. Admittedly, top standard products have to be manufactured from carefully selected and tested raw materials through well controlled processes.

The raw material prices also exercise proportional influence on the state and level of the process quality control.

A diagram illustrating the effect of the mill characteristics on the level of quality control is presented in fig. 3.

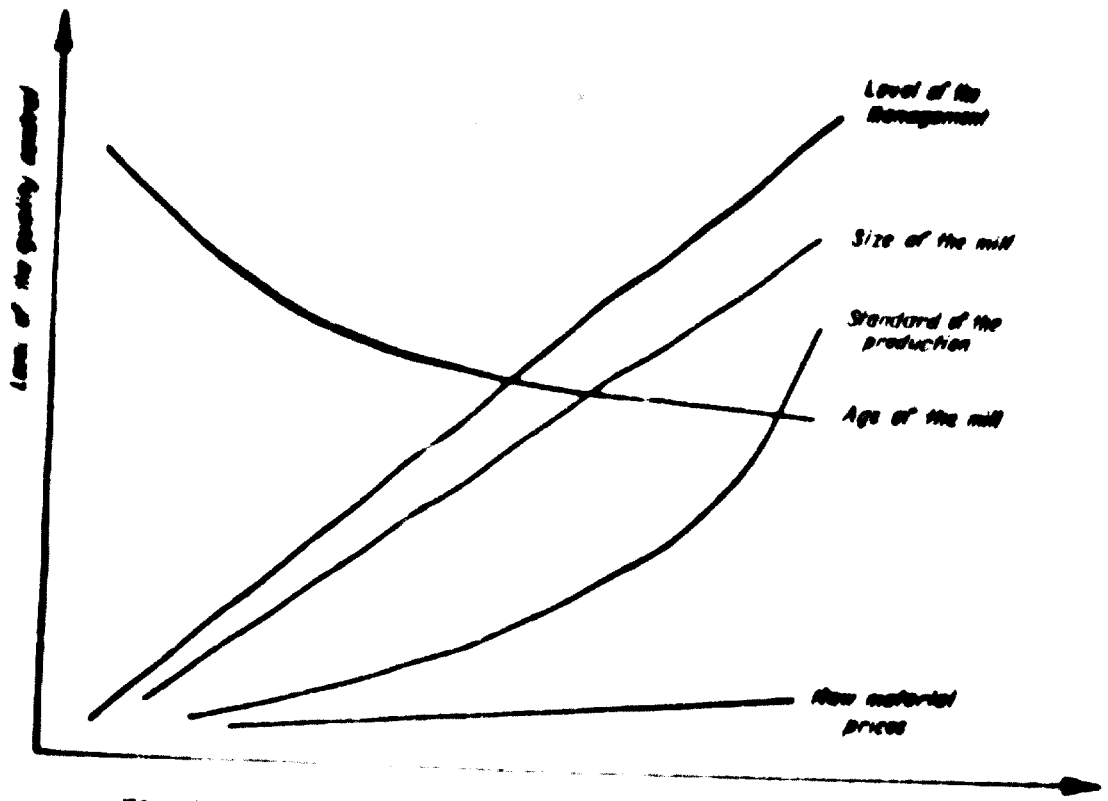


Fig. 3: The effect of the fundamental characteristics of a mill on the level of quality control.

It should be noted that the universal high rate of technical and organisational developments raises daily the general level of production and projects, at the same time, on the development of the quality control services in textile mills.

The Place of Quality Control in the Organisation of a Textile Mill

From the above considerations and on the grounds of the theory which says that every organisation should be elastic and adjusted to the actual needs, it follows that an all-round or most reliable organization of quality control is impossible to be authoritatively prescribed.

The system of quality control in a textile mill is dependent on the external conditions such as the country's system of product quality control and its standards and the state of the specialised research background, e.g., Higher Schools, Research Institutes, etc.

Admittedly, it will be still possible to find manufacturing enterprises with weak quality control service, unnoticeable in the organization chart of the enterprise (Fig. 4), but the number of properly organized enterprises encreases daily and here the questions of proper production preparation and quality control are granted the appropriate, independent rank, as showed in Fig. 5.

By detaching quality control from the production management and subordinating it directly to the mill management the quality control service gains the necessary independence, which permits

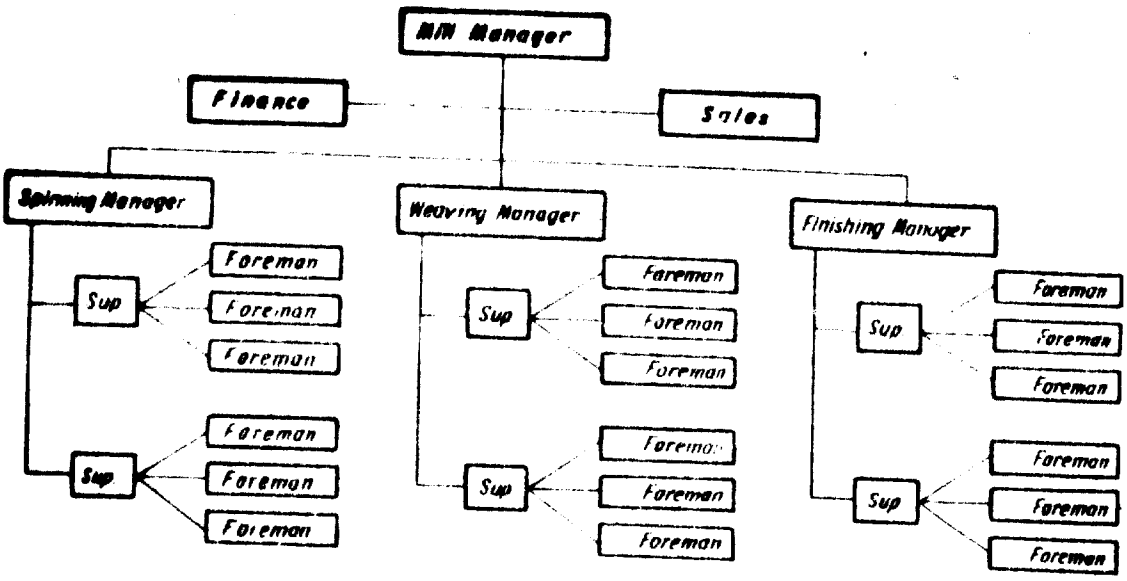


Fig. 4. Traditional - Organisation Chart.

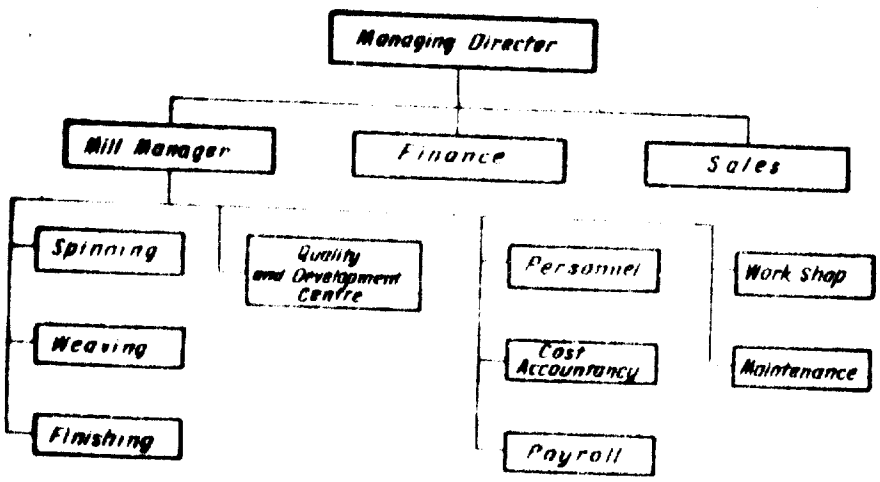


Fig. 5: Modern Organisation Chart.

objective analysis and evaluation and onables the mill management to take appropriate correcting steps. Having an independent quality control service, controlling all the productive activities of the mill, does not release the production management from care about quality. The organization system of a mill should provide for a smooth cooperation between the production departments and the quality control service. This particularly concerns:

1. Co-operation in establishing a common system of quality control;
2. Division of the duties and responsibilities concerning the quality of the production;
3. Responsibilities with regard to the preparation of new products.

Especially important for the control the current production is division of the responsibilities between the concerned production department and the quality control service and the referring of the test results to an established, uniform system of quality document circulation ensuring immediate decisions at the mill-management level.

The Range of Responsibilities of a Quality Control Service

As it has been pointed out, the role of quality control in a textile mill may be either limited to testing the raw materials, half-products and products, or it may cover all the elements of the production processes and extend its responsibilities onto the

quality of the current production or even, as it happens more and more often, it may assume an active attitude and, not satisfying itself with controlling the current production, it encroaches into the problems of preparation (jointly with the production departments) of the future production. Thus, the responsibilities of quality control can be divided into:

1. testing and evaluating the current production;

2. preparation of the future production.

Both the categories of activities of quality control should constitute a unity because of their common aim and method of realization. The common aim is good quality of the production; firstly, of the current production, and, secondly, preparation of the mill for future production. The common method consists in that each category bases on research and the tasks are fulfilled by the same staff belonging to the production departments and quality control service.

The ultimate motivation in each category is the economic effectiveness of the enterprise.

The Organization of Quality Control Service; The Quality and Development Department

Correct realization of each category of the productive activities of a textile mill necessitates the institution, in the management system of the mill and in accordance with its actual needs and possibilities, of a special quality and development service.

Such an independent organizational unit should be in every modern textile mill where its size, equipment, responsibilities, and activities would be adjusted to the management system, and to the type and magnitude of the production.

A quality and development centre as an independent organizational unit is the principal but not the only institution responsible for quality of the production. Undoubtedly, for the quality of the production are responsible all members of the mill's personnel and particularly those who are directly engaged in production.

The responsibilities of a quality and development centre can be outlined as follows:

1. Establishing a system of quality control of the current production and distributing the responsibilities between the production departments and the specialized service;

2. Giving objective opinions about the current level of the production on behalf of the management;

3. Preparing the future production so that it can be smoothly started the moment an appropriate decision is reached;

4. Investigating the markets of sales and supplies, and the developments in raw materials and technology in order to secure, for the mill, a full economic reconnaissance regarding the current production and the planned, future productive activities.

A graphic illustration of the organization of a centre with a correct set of responsibilities and of its range of cooperation is presented in Fig. 6.

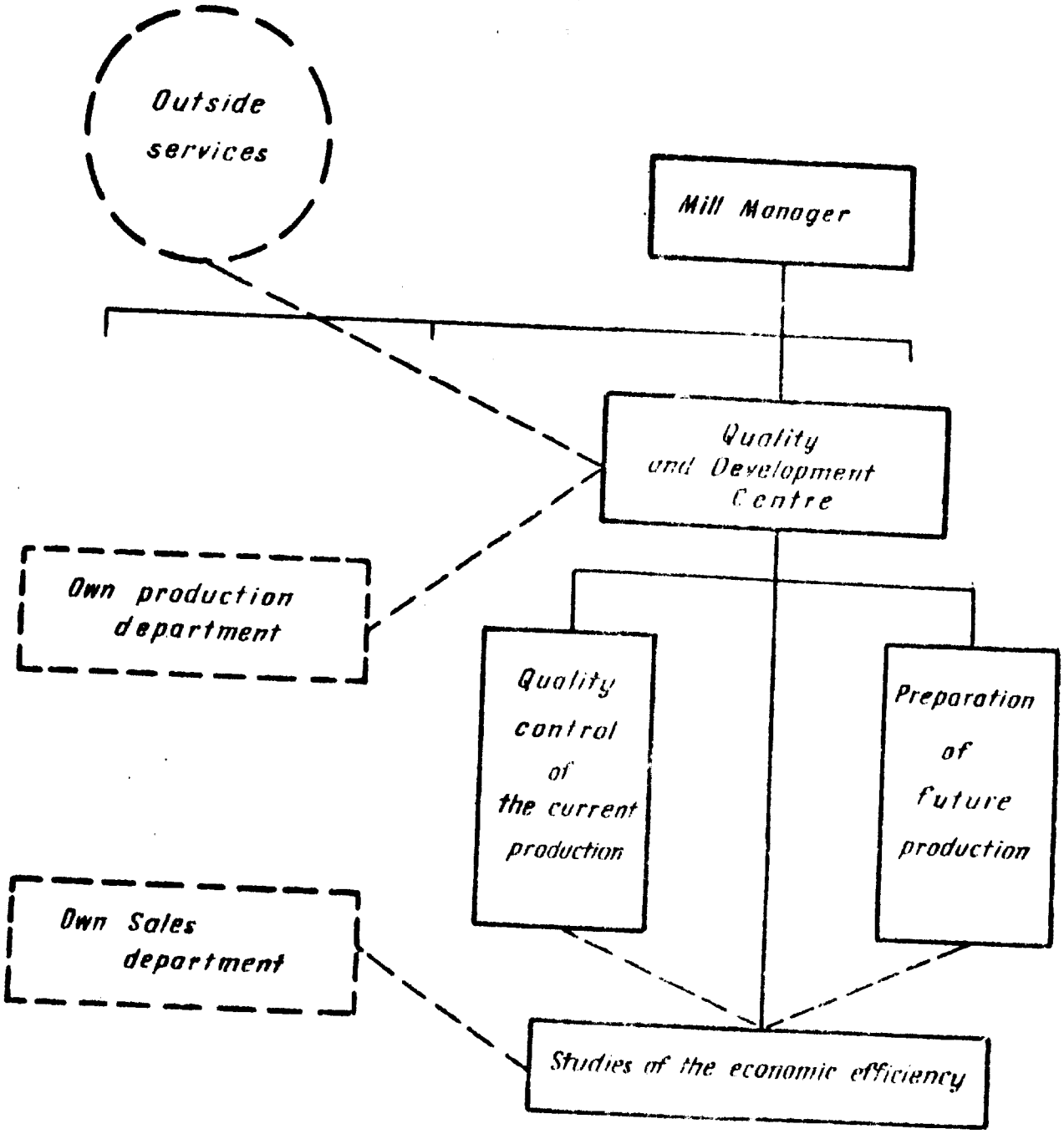


Fig. 6. A diagram of the activities of a Research and Development Centre in a Textile Mill and of its co-operation.

The centre is directly subordinated to the mill manager and its activities are persued along the three main lines:

1. Quality control of the current production;
2. Preparation of the future production;
3. Evaluation of the economic effectiveness of the present and future productions.

The cooperating activities of this unit should consist in expert and effective utilization of the facilities that can be provided by specialized services. Here, e.g., unusual analyses, requiring special or unique equipment can be performed at University or research laboratories, etc. In preparing new production, much valuable information can be obtained from some institutions and often also from the manufacutrers of the new raw material or of the respective machinery. The use of external services is a wide and more and more frequent form of introduction or acceleration of novelties. But an experienced organizer of production will realize that only an interested enterprise is capable of adopting the new development and fostering it in its own system and production rhythm. The organization which is called for adapting novelties to the production of a mill is its quality and Development Department.

As it has been already repeatedly stated a research and development centre has to cooperate with the mill's other departments, and particularly with the production department

Both the departments have to prepare a mutually recognized, and accepted by the Manager, system of quality control, which will divide their responsibilities.

In preparing a new production, the departments have to work out the technological processes, and their technical parameters, of the new assortments, and prepare a quality control system for the new product.

The starting point to the technical and technological acitivities has to be the economic effectiveness of the present and planned productions. Here, the co-operation with the Sales Department is indisponsable for a full economic analysis.

Quality Control of the Current Production;

Quality Control System

Quality control, being an integral part of the production, concerns all components of the production process, and its main objective is to obtain the highest possible technical and economic results.

Every manufacturing enterprise, even a smallest one, should have its own, suitable system of quality control.

The system of quality control should be based on the control method that is already accepted in the mill.

One of the newest methods of control is the statistical quality control which is encompassing more and more textile mills. The systems of registering results and document circulation are also adjusted to the method of quality control.

However, regardless of the adopted method of quality control it is necessary, to prepare some system of control which would serve as a programme for maintaining the quality of the products on a certain level.

A quality control system should include all the essential pertinent factors, selected at angles of ensuring the expected quality of the technological process.

Among the factors are:

1. Quality control stations;
2. Properties subject to control;
3. Frequency of control;
4. Controlling staff;
5. Methods of control;
6. Circulation of the control documents.

The control stations indicate the places where the materials, half-products and process parameters, which are essential to quality, are controlled. A quality control system should include checking on all the programmed conditions, parameters, and indices, the neglecting of which may bring about deterioration of the established quality. The number of the stations in a given stage of production depends on the standard and quality.

The property subject to control refers to the selected parameters which have bearing on quality. The parameters can be of a general nature and can refer to the processing conditions as, e.g., parameters of the air. They can refer to the half-product conditions as, e.g., the index of yarn irregularity, or parameters of the technological processes as drying temperature or dye-bath concentration. They may be concerned also with the quality of the manual operations like the methods of knotting warp breaks. The selection of the properties subject to control should be done very carefully as only those parameters should be controlled which are substantially changed in an operation and may, therefore, change the programmed quality level.

The frequency of control is a definition of the time interval between the successive measurements of the same property at the same control point. Frequency depends on the incidence of the unprovided for changes in the processes (disadjustment of process), the quality standard and end-use of the product, and on the measurement method. Determining the frequency of a measurement has to be done against a thorough knowledge of the technological

process and long-enough experience, and with a view of obtaining optimal information about the process quality. The control frequency should be readjusted when changing the assortment. It should be increased, e.g., when processing:

1. Products of high wearing requirements;
2. Products of high market value;
3. Products requiring changes in the process;
4. Products from new raw materials and auxiliaries.

The control frequency has to be also adjusted to the rate of the testing. With quick, cheap and easy methods of testing, it is possible to increase the frequency until fully reliable information is obtained.

The controlling staff is composed of a large and diversified group of the employees of the mill. Part of the controlling responsibilities can and should be ascribed to employees directly engaged in the production. This concerns both workers and technical staff. Much organizational and training effort is required on the part the mill to make operative evaluate the quality of the product, to correct a fault by himself, or to bring it to the notice of his superior. For instance, a qualified spinner, when liquidating a break, resulted from unsuccessful joining (individual fault), will remove the thick section of the yarn and make a correct join. In this way, under the self-control system, the operative evaluates the quality, makes a decision, and corrects the fault (restores quality). A similar care is when a weaver, knotting broken warp, undertakes an action aimed at improving the quality

of the material. Often workers are assigned quality controlling functions, e.g., when a scutcher operative weighs the laps to determine the thickness regularity of that half-product. The same worker separates the correct laps from those which have incorrect weight and thus performs the function of quality controller. Also, the technical staff of the production department is responsible for the quality of their products, is assigned specified tasks and, by cooperating with the quality control service, obtains information about the quality level, the danger points and the irregularities that would have occured in the process.

The special quality control service, which under a system of quality control, is a part of the quality and development centre has to take upon itself those functions which cannot be realized directly at the work-place, i.e., those controlling operations which require special equipment and laboratory tests. The quality control service should also evaluate the control activities performed by the production department, contributing to establish the most appropriate quality level.

One of its responsibilities is the preparation of periodical collective analyses of the quality control in the mill.

All workers who are assigned controlling functions should have good qualifications and be absolutely honest.

The methods of control depend on many factors. Usually, they are adopted in accordance with the possessed equipment. However, the selected method ought to ensure necessary accuracy of the

measurements. It is important that the definition is "the necessary accuracy" and not "the top accuracy", since the latter may entail a longer time of the measurement, more costly apparatus, better qualified controllers and, therefore, a higher cost of the evaluation.

Therefore, the choice of a method is determined by the following factors in order of importance:

1. Ensuring the necessary accuracy of a measurement;
2. The time required for a measurement;
3. The cost of a measurement.

All these factors, constituting elements of a quality control system, should be set up in a single document in the form of a table or graph. After being approved by the mill management, the document becomes the programme of quality control in the mill. A part of such a program of control, concerning the scouring of wool, is exemplified in Table 1.

Circulation of the control documents. The registered and analysed test results obtained under a control programme should be presented in standard forms. Normally, there are three types of the documents:

1. Measurements chart;
2. Registration chart;
3. Report.

Table 1

A part of a quality control programme concerning wool scouring

	Control station	Property controlled	Control frequency	Controller	Method
1.	Fibre entering process	Grease-content	Each lot	Laboratory	All methods in accordance with the established routine of the mill
2.	Fibre after scouring and drying	Grease-content	Each lot	Laboratory	
		Degree of alkali removal from the wool	Once per shift	Laboretory	
		Moisture-content	Each lot Once per shift	Foreman of scouring room Laboretory	
		Strength after scouring and drying	On request	Laboratory	
3.	Feeding water to the bowls	Hardness grade of the water	Once per shift	Laboretory	
4.	Bowls	Lye and soap concentrations in scouring baths	Once every two hours for each bowl	Laboratory	
		Temperature of scouring baths	Continuous observation, results registered every two hours	Foreman of scouring room	
5.	Drying machine	Drying temperature	Continuous observation, results registered every two hours	Foreman of scouring room	

The measurements chart has to be prepared for every tested property, according to the method used. Often, individual mills find it difficult to prepare their own chart forms. Therefore, it would be preferable if the typical forms could be supplied centrally by industrial or technical associations or by a specialized service agency. An example of a measurements chart is presented . Fig. 7.

A registration chart is filled with totals of the results characterizing a lot or the change of a given property with time. Example of typical registration charts for statistical quality control are presented in Fig. 8.

The report is a document which concisely characterizes the situation in the quality control of the products. A report may concern either an individual lot of products or it may characterize the quality over a time period: a shift, a day, or a month. The document is prepared in accordance with the individual management system. The report should be supplemented with an emergency report or note, describing the state dangerous to quality and, where possible, indicating the reasons or sources. The emergency note circulates upwards to a place where two decisions can be taken: one to stop the process and the other to eliminate the source of the deteriorated quality.

The first two documents, i.e. the measurements chart and the registration chart, remain as a rule at the place of control. The document which is circulated upwards to management is a report or a note, and the higher it reaches the more concise and general it should be made.

Preparation date: _____ Weighing date: _____	THE TESTING OF FIBRE FINENESS BY THE GRAVINNETRIC METHOD	No. of analysis: _____ Supply date of sample: _____ Name and orgin of sample _____

Results

Ip	Tuft weight mg	Accepted mean	Deviation from accepted mean	Quadratic deviation from accepted mean
	A_i	$\bar{x}_p$	$A_i - \bar{x}_p$	$(A_i - \bar{x}_p)^2$
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Test results			Auxiliary results		
Mean fineness	Td =	den	Mean tuft weight	$\bar{x}$ =	mg
Mean fineness	Tx =	tx	Number of tufts	n_i =	
Average deviation	δ =	mg	Number of fibres per tuft	n =	
Coefficient of variation	v =	%	Tuft length	l =	cm

Mean tuft weight $\bar{x} = \frac{\Sigma A_i}{n_i}$

Mean fineness $Td = \frac{9000 \cdot \bar{x}}{L \cdot n}$

Mean fineness $Tx = \frac{1000 \cdot \bar{x}}{L \cdot n}$

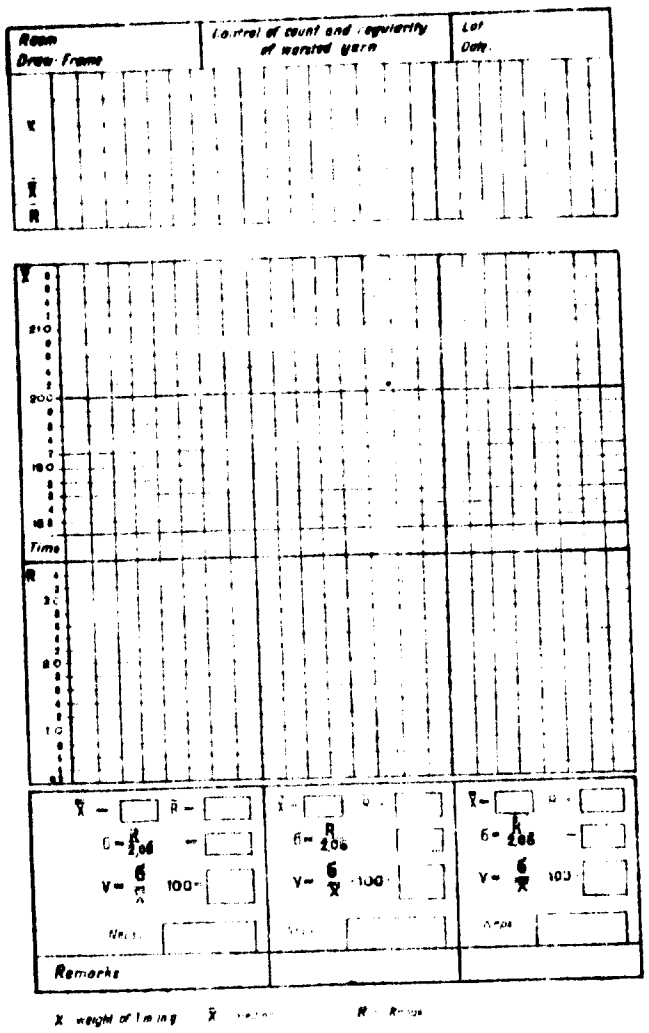
Average deviation $\delta = \sqrt{\frac{\Sigma (A_i - \bar{x}_p)^2 - n_i (\bar{x} - \bar{x}_p)^2}{n_i - 1}}$

Coefficient of variation $v = \frac{\delta}{\bar{x}} \cdot 100$

	Date	Sig.
Analysis by		
Calculated by		
Checked by		

Remarks

Fig. 7. Automatic measurements chart.



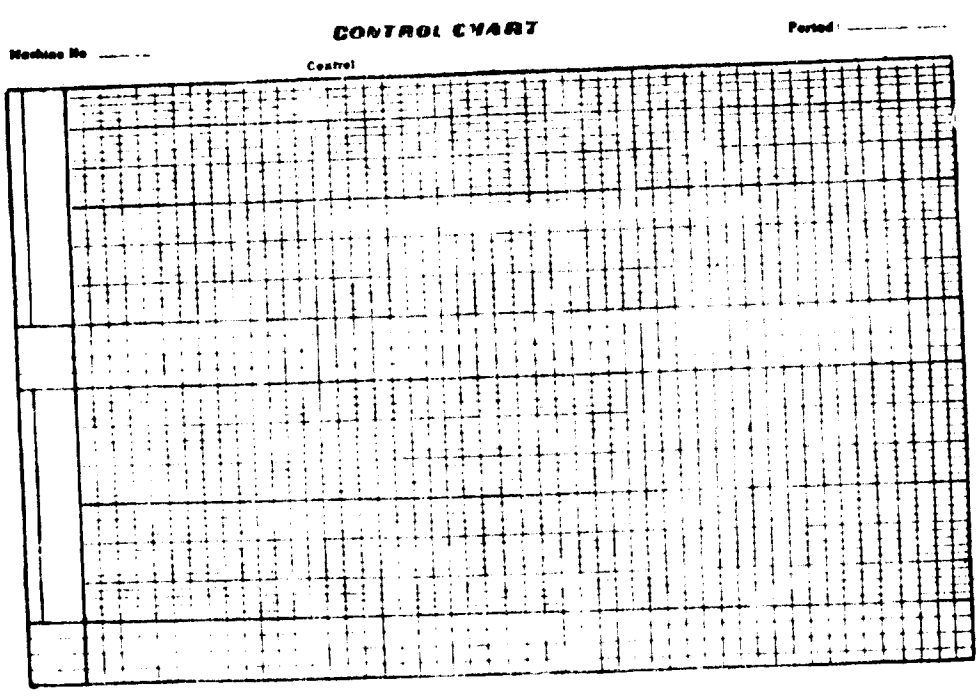


Fig. 8: Typical construction sheets for statistical quality control.

The Preparation of a Mill for Starting a New Production on a Proper Quality Level

The quality control of current production, which is a function of the quality and development centre, is done under an established system of quality control and assures the form of a stable and rhythmic set of activities which, upon practical verification, would remain unchanged. On the other hand, work towards introducing a new production consists of a wide variety of activities that are necessary to solve every individual problem and implement the solutions in the mill. However complicated is the situation which accompanies every novel introduction, a textile mill should be ready to undertake such activities, wherever it is possible, to supply the market with a new, more attractive and economically more profitable product. One of the characteristics of the textile industry is its dependence on fashion changes, and on new developments which are immediately reflected in the market demands. Especially the recent years have been fruitful in new developments in the raw materials, techniques and technologies. These, and the rapidly progressing chemization of the technological processes are posing more and more atrractive possibilities before the textile industry, but the textile manufacturing enterprises have to be prepared to accept them. These responsibilities should be encharged to the specially prepared and equipped quality and development centres. Despite the great variety of the new problems which the centres have to face in their work, there are certain universal rules applying to the general preparation of a mill for a new production and to the activities to be persued in the preparatory stage.

The preparation of a mill for the introduction of a new technology has to be based on the qualifications of the staff and on the possessed equipment. These two factors have to be borne in mind with respect to every activity in this field. The orientation of the activities should be based on the available information about, and analysis of, the market demand, the availability of the raw material, feasibility of the new techniques, and the expected economic advantages of the planned, new production. Thus, the following elements have to be provided in advance:

1. Qualified staff;
2. Suitable equipment;
3. System of obtaining information;
4. Available analytic results concerning
   a) the market demand;
   b) availability of the new technological elements;
   c) the premises for a correct initial assessment of the economic effectiveness of the whole undertaking.

Having such a background and the assistance of outside services, the mill is able to realize successfully systematic undertakings in the field of introducing new assortments.

New introductions are an everyday problem in the textile industry, if only in the province of fabric designing which is dependent on fashion.

Not all of the great multitude of the textile products are equally sensitive to the changing taste of the market, or rather the rate at which the taste changes is not the same for every assortment. Take, for instance, two cotton textile enterprises

of which one manufactures bed linen and the other makes ladies' dressings; the tastes in relation to the first change much more slowly than in the case of the latter. Therefore, the first mill can pay less attention to the question of introducing new assortments than the second mill.

As it has been already indicated every new technological undertaking is a kind of untypical individual, and its level of difficulty ranges from standard designing activities to a thorough technological overhaul as when introducing a new fibre.

Despite the great variety of the problems, it is possible to prepare a programme of activities, similar to the one graphically presented in fig. 9.The management of the activities should be left in the hands of the Quality and Development Centre which would be co-operating, in this respect, with the production department and with the available outside services.

The diagrammatic programme of activities consists of a few important tasks and a set of necessary activities.

The starting point of the activities is an inspiration which would have originated from:

1) An idea to improve the production;

2) Information obtained about the availability of:

   a) a new type of fibre;

   b) a new machine or process;

   c) a new refining agent;

3) The market demand.

Each of the elements has to be initially discussed with the production department, utilizing wherever possible the outside information from those institutions which are better acquainted with the problem.

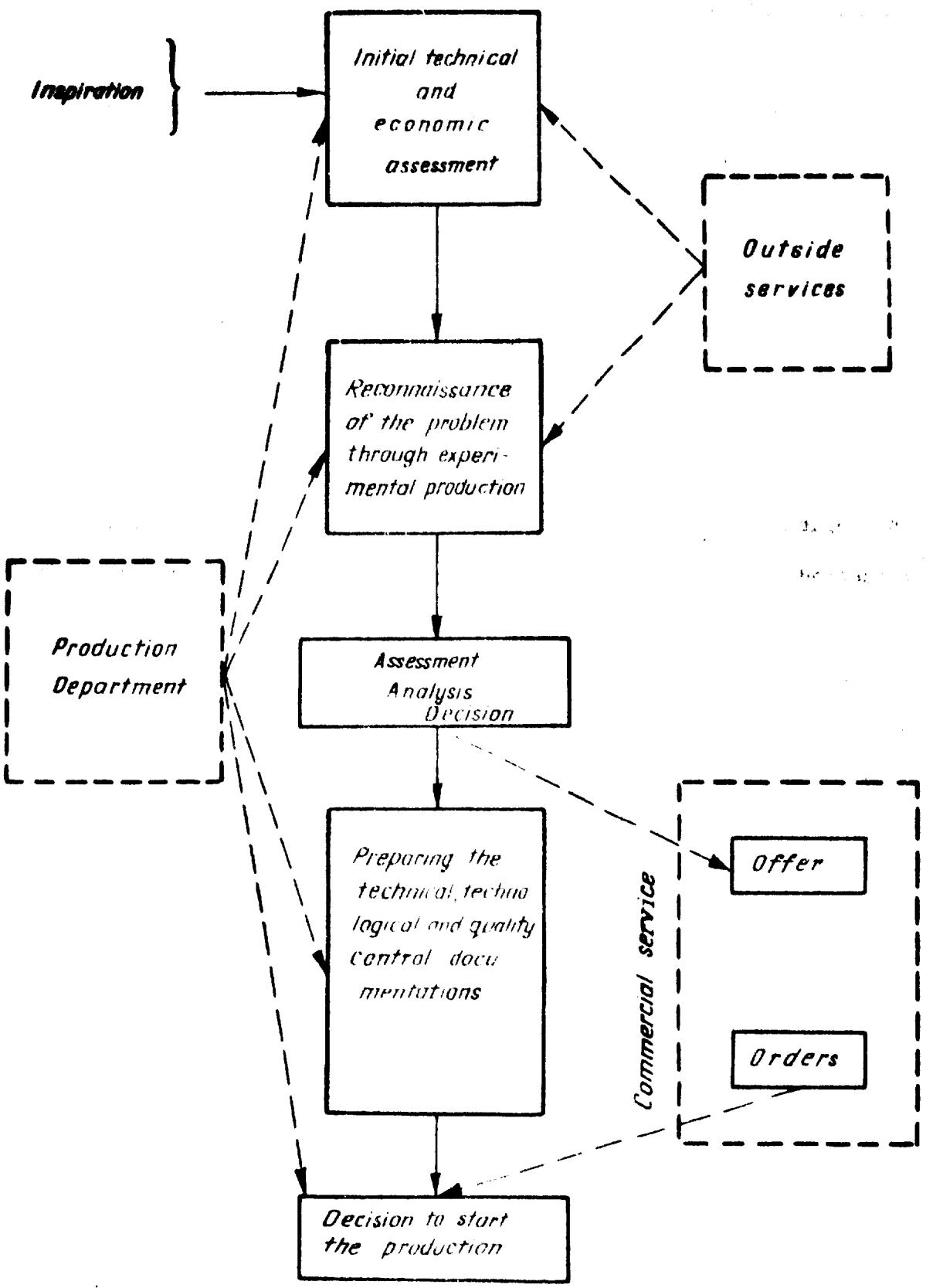


Fig. 9: A diagram of activities relative to the introduction of a new production in a textile mill.

The following aspects should be analysed:

1. The availability of the novelty for the mill;
2. The possibility of an effective mastering of the process;
3. The estimated cost of the experiment;
4. The expected economic results.

When the results of the analysis are in favour of the undertaking, the mill management should reach a decision, which would be binding to all interested departments, to start the initial reconnoitring activities.

An experimental reconnaissance of the problem is a paramount element of the whole programme. It has to be carried out according to a carefully prepared plan providing for a number of alternate approaches. The experiment is organized and managed by the Quality and Development Department which can engage specialists from the production department, or, if necessary, from outside the mill.

The results of the experiment together with the economic analysis are sufficient to reach a decision concerning preparations for the new production.

The preparations go along two tracks. On the one hand the Quality and Developmen Centre will be preparing the technical and technological documentation containing specification of the technological parameters and the project of a quality control system of the new production. On the other hand the commercial service of the mill will prepare a tentative offer and will be sounding the market for orders.

The last event in the process of the preparations is the decision to start the new production, which may take place when:

1. The technological and quality control documentations are ready;
2. The results of the market sounding are favourable.

When all is said and done, the textile mill which wants to adjust the methods and equipment of quality control to its own needs and, at the same time, to adjust them to the modern world standard should support its decision regarding the purchase of new equipment upon careful analytic measurements so as to select the most appropriate instruments. This analysis is by no means easy, and there is no all-solving prescription to guide oneself by.

There are only some rather general indications as to the criteria of the choice. The criteria have been discussed when analysing the problem of the method choice, and a diagram of such an analysis, relative to the evaluation of the property of fibre lengh, is presented in Tab. 2.

The table illustrates the difficulty of choosing the typical equipment in accordance with the prescribed types of apparatus for a particular textile production. The specification given in Table 3 does not characterize the types of equipment but it contains description of the quality properties which have to be laboratority tested under quality control systems with reference to the following processes:

spinning;
weaving;
knitting;
finishing;
and dyeing.

Table 2

Methods of measuring the fibre length

	Method	Accuracy	Rate	Cost	Range of application
1.	Staple-length diagram	○	◕	○	Rough evaluation
2.	Measurements of individual fibres	◕	○	○	Test of high accuracy
3.	Fibre comb-sorters (Johansen - Zweigle Bauer, Sutter - Jeb, Schlimberger)	◑	◑	◑	Acceptance test of supplied fibre, Spinning-process control
4.	Fibre roller-sorters (Balls, Zukow)	◑	◑	◑	Acceptance tests of supplied fibre, Spinning-process control
5.	Photoelectric (Lord, Fibrograph- Hertel)	◕	◕	◕	Acceptance tests of supplied fibre Technological-process control
6.	Electrocapacitive (WIRA, Almeter)	◕	◕	◕	Acceptance tests of supplied fibre, Technological-process control

◕ - high ◑ - medium ○ - poor

Table 3

The usual equipment of textile mill laboratories

The types of test performed	The types of instruments and apparatus used	The types of textile mills				
		S	W	Kn	P	D
Climatic conditions	Air-conditioning equipment:	○	◔	◕	◑	◑
	psychrometers, thermo-hygrographs	◍	◔	◕	◑	○
Fibre identification	Microscopes	◍	●	◍	◍	◕
Moisture-content of textile materials	Drying apparatus	◍	◔	◍	◍	○
	Weighing machines	◍	◍	◕	◍	●
	Electric moisturemeters	◍	◕	◕	○	○
Fibre tests	Apparatus for: measuring length	●	○	○		
	measuring fineness	●	◑	◑		
	measuring crimp ratio	◑				○
	measuring strength	◕			○	○
	measuring resilience	○				
	measuring foreign-matter content (fats, avifage, impurities)	●	●			●
Yarn tests	Apparatus for: measuring count	◍	◍	●		
	measuring twist	◕	◕	◕		
	measuring linear-density irregularity	●				
	measuring strength	●	◍	◕		◑
	measuring elasticity	○	○	○		
	measuring bulkiness	◑	○	○		
	measuring purity	◍	◍	◍		
	measuring package-hardness	◍	◍	●		
The testing of fabrics	Apparatus for: measuring thickness		◍	◍		
	measuring strength		◍	◍	◍	○
	measuring crease-resistance		◔	◑	◍	
	measuring shrinkage				◍	
	measuring pilling-resistance				◍	
	measuring water-permeability				◍	
	measuring colour-fastness				◑	●
The speeds and adjustments of machines	tachometers, gap gauges, stop watches	◕	◕	◕	◕	◕
The testing of dyestuffs and auxiliaries	laboratory glass, pH-meters, thermostats, etc.	◖	◖	◖	◕	●

○ — Basic equipment

◖ — Special equipment

( ) — Unique equipment

The specification is presented in an outline and does not apply specifically to the real conditions of any particular mill.

The Equipment of Mill Laboratories

It is fairly easy to give a general answer to the question of how to equip a mill laboratory, for the answer is: according to the actual needs. But the determination what would be the otimum equipment for a given mill is rather complicated and dependent on many of the analyzed factors.

The typical sets of apparatus for conventional testing of the natural fibres and their products are inivers̈ally known, but their application is decreasing for the two reasons:

1. The methods are usually too slow;
2. They are not always applicable to the new raw materials and properties subject to quality control.

On the other hand the manufacturers of the modern equipment are very actively developing new measuring techniques, offering instruments for a quick measurement of the quality properties, but the instruments are for the most part complicated and require difficult maintenance by special service and costly repairs. Often the new methods indicate the results in new units, not included in the country's standards.

Different methods are developed in different places for measuring the same new quality parameters, which is accompanied by construction of wqually differing apparatus. Such methods are not only far from being uniform, but they also give incomparable

results. Some of the properties specified in Tab. 3 may be, in justified cases, exempt from quality control, but in some other cases it will be necessary to introduce new ranges of quality testing.

The selection of the optimum equipment will rest with the management of the mill.

The Problems of Developing Countries Regarding the Organization of Qualiny Control in Their Textile Mills

Just as diversified is the whole textile production, so are diversified the problems of quality control among individual mills, and so, or even more pronouncedly, are diversified the problems of quality control of the textile products in developing countries.

The views presented in this paper, concerning quality control in developing countries, are based on two sources of information:

1. Author's personal visits in many textile mills of developing countries and his local discussions with representatives of the technical and managerial staffs of such mills;

2. Discussions with the participants of the post-graduate courses in textiles organized since 1967 by UNIDO and Polish Government and held at Instytut Włókiennictwa, Łodz. The courses have been already attended by textile engineers from 26 developing countries representing all continents.

On the basis of his experience the Author believes that in developing countries, similarly as in developed countries, there are textile manufacturing enterprises with a modern approach to quality control. At the same time, there are in those countries, textile mills where very quickly and easily very much could be done to raise the level of their quality control and, consequently, to improve their economic effects.

However, the problems of quality control in developing countries are characterized by certain distinctive features which are dictated by the general technical level of their textile industry and its relatively young age. Therefore, organization of quality control in the textile industry of developing countries encounters the following major difficulties:

1. The scarcity or want of standards regulating the problems of quality in a given country, which constitutes a handicap to attempts aimed at uniformizing the technological regimes in a textile mill;

2. The average size of a mill in developing countries is considerably smaller than in developed countries.

3. There are difficulties regarding the training of the workers and technical staff for the purposes of quality control; although it has to be admited that the higher technical staff in developing countries is for the most part very well qualified.

4. The countries have particular difficulties in obtaining objective information and export advice in the field of quality control organization and particularly with regard to the selection of equipment.

The participants of the courses held at Instytut Włókiennictwa, Łódź, who are the top specialists, in textile technology, of their countries and who had studied the organization and results of quality control in the Polish textile industry, would suggest the following conclusions and recommendation relative to the needs of

quality control in their countries for the Final Reports of the Courses:

1. The technological progress and improvement of the organization of production processes imposes upon the textile industry the requirement of a thorough quality control making use of modern equipment and newest technical developments. Modern quality control should cover the whole production cycle of a mill and should permit a quick and reliable assessment of new assortments with regard to their technological feasibility and wearing properties.

2. Many developing countries seem to need protection in respect of the international exchange of textile products, as they often have no adequate means for testing the quality of their imported goods, nor have they equal chances in the cases of international arbitration. Therefore, courses on quality control and arbitration for developing countries would be strongly recommended.

3. The introduction, in developing countries, of modern instrumental quality control based on international standards would make their textile products more attractive on international markets.

4. Consideration should be given to the establishment, in developing countries, of central quality control laboratories to disseminate information on latest quality control methods and to control the quality of textile goods for export. UNIDO might be ready to assist in the implementation of such plans.

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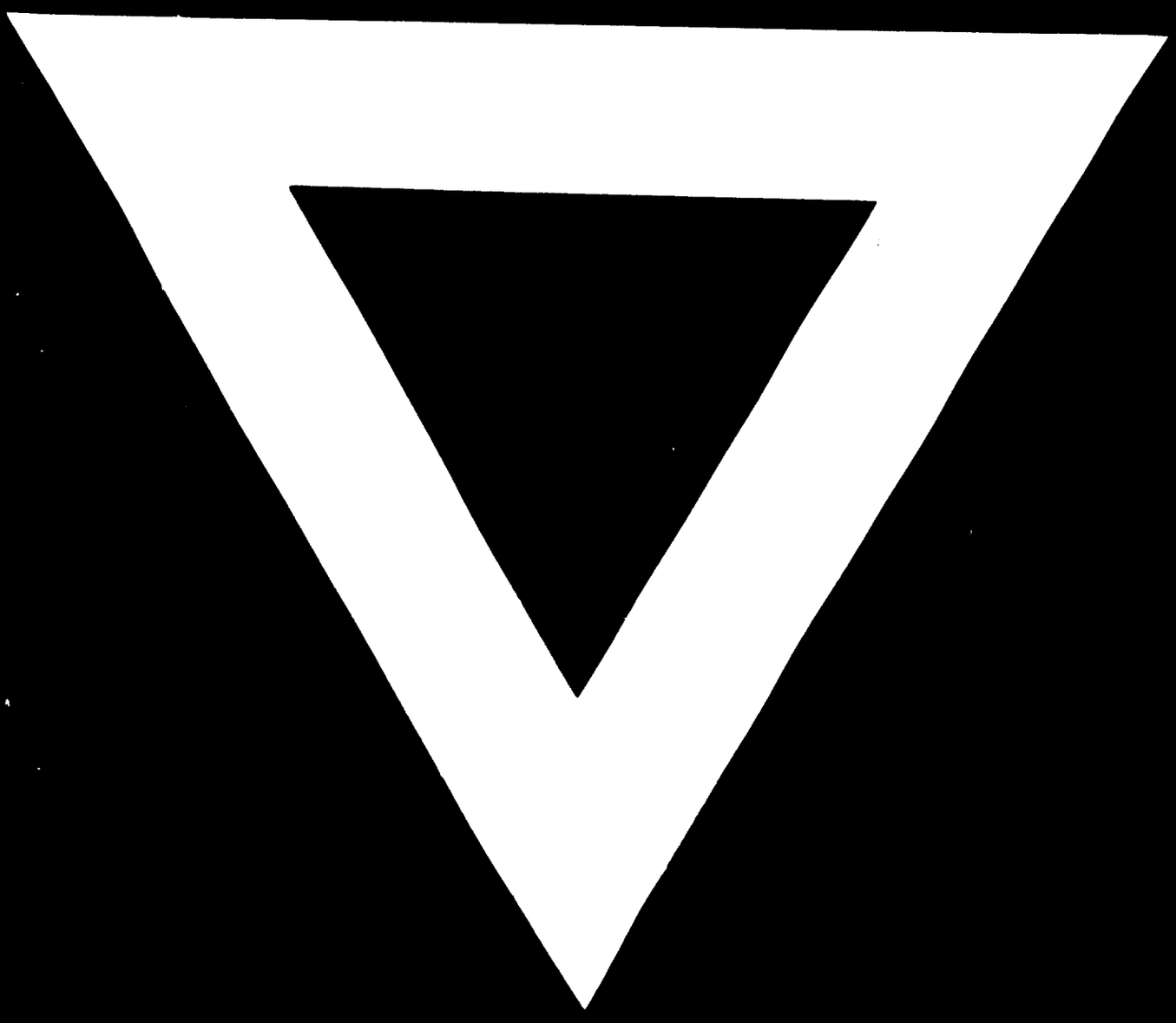

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