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FACTORS AFFECTING THE QUALITY AND RELIABILITY OF PRODUCTS

by

A. V. Glichev

Standarty i Kachestvo, No. 6,
pp. 69-71 (1966)

Translated from the Russian

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FACTORS AFFECTING THE QUALITY AND RELIABILITY OF PRODUCTS

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A. V. Glichev

Quality and reliability of products are significantly affected by various factors. Since some have common features they can be put into groups of factors such as technical, organizational, economic, etc. Discussed in this report are factors affecting the quality and reliability of products.

The quality and reliability of products, as proven by investigations, are significantly affected by various factors which act independently and by interacting with each other. Some of them have common features; therefore, they can be joined together into groups of factors, such as technical, organizational, or economic (Figure 1).

A correct evaluation of the role played by technical factors helps to solve many scientific and engineering problems involving the planning, production, and operation of products. For this it is important to know the composition and the real possibilities of using each factor individually and also their total number together.

An analysis of the data on failures of products in many branches of industry indicates that, as a result of incorrect designs, there appear a definite and, in certain cases, a substantial number of faults which reduce the efficiency, capacity, and other parameters. In connection with this, typical for certain types of products, are inadequate strength, unsuccessful choice of methods of joining the parts together, and of their location. Depending on the level of reliability of individual parts and their role, the design may use a version requiring either a successive or a parallel connection of the parts. In each specific case, the degree of reliability of a product, as a whole, depends on the method selected for joining the parts. The selection of the kinematic schemes for machines and mechanisms affects the efficiency level, noise and vibration levels, dimensions, and weight of the products. In the final analysis, all of these manifest themselves in the generalized characteristics of the quality and reliability of the products.

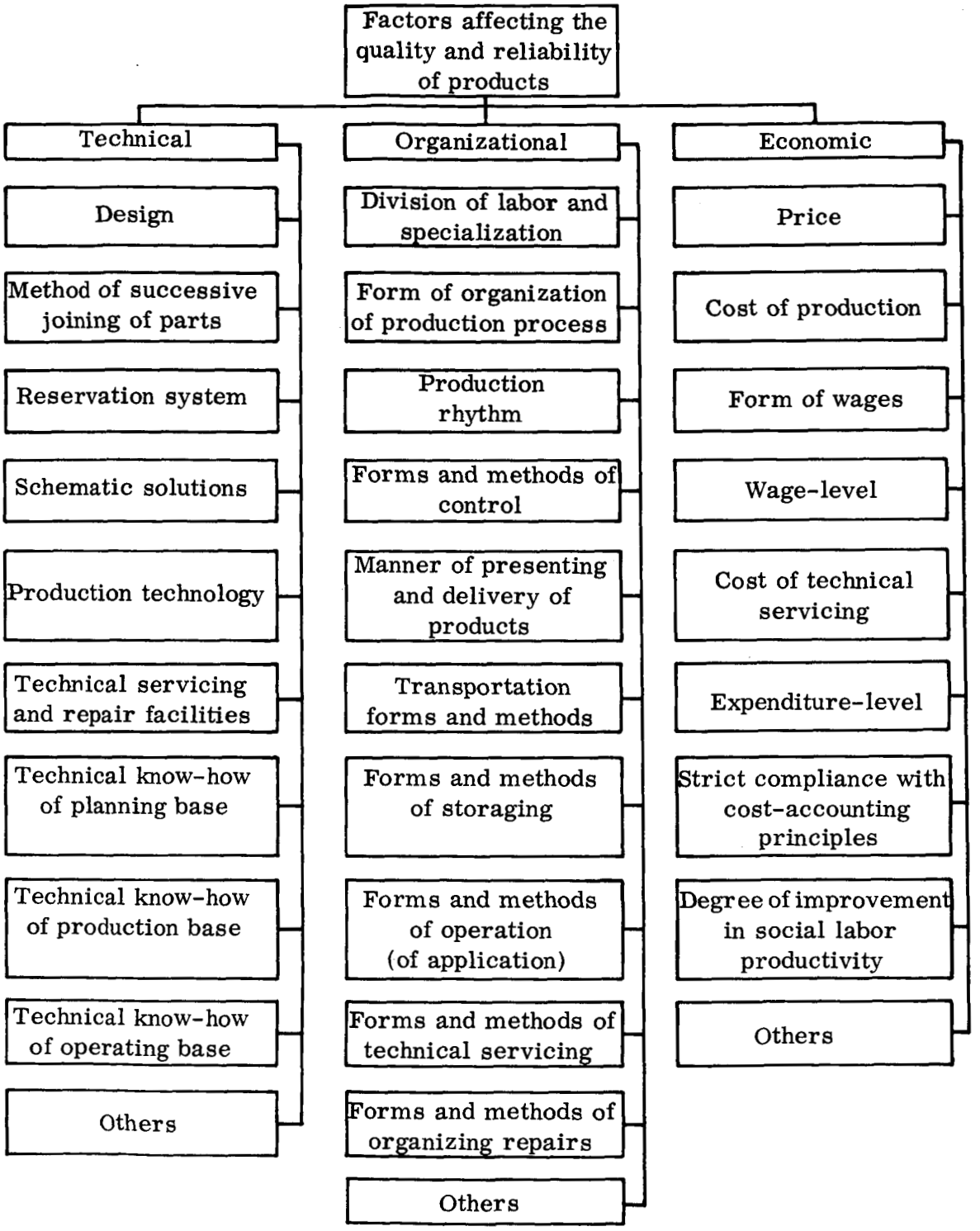

FIGURE 1. CLASSIFICATION OF FACTORS AFFECTING THE QUALITY AND RELIABILITY OF PRODUCTS

The methods of reservation also belong among the technical factors, for example, on "cold" and "hot" reservation depend the schematic solution, the level of reliability, the structural shape of the product, and the basic production methods.

The application of progressive technological processes, a high level of mechanization and automation, and the perfection of the methods and means of control and testing of products help to improve the stability of the production process, which assures stable characteristics for the manufactured product. Incorrectly selected technology and also its violation in production impair the quality, impair the external appearance of the products, and increase the number of their failures.

And, finally, a higher technical know-how of the planning and designing organizations will make it possible to carry out more thoroughly and more carefully the experimental checking of the results of the investigations and of the engineering solutions, which will not only reduce the production cost of the products but will also improve their production technology. A higher technical level in all fields of production and operation reduces the effect of subjective factors which, in its turn, serves to improve the quality and reliability of the products.

The organizational factors, whose effect was underestimated until recently, are diverse in their number and in the forms in which they manifest themselves.

The application of advanced forms of organization of production and the maintenance of the rhythm of the production process serve to improve considerably the quality and reliability of products.

The same results are obtained also by using a faultless system of production and delivery of products as soon as they are ready.

It is also frequently assumed that the quality and reliability of products are assured only by the process of their planning and production. As a result of incorrectly organized operation, many high quality and reliable products quickly become unreliable and many of their high quality features are not fully utilized.

The organizational forms of operation (utilization, repair, and storage of products) influence substantially the effectiveness and reliability of products. One should not underestimate the importance of selecting the correct methods of technical servicing and utilization of products.

Recently the role played by economics in assuring high quality and reliability for products is becoming more obvious. The solution of problems involving the production of products of optimum quality and reliability and the stimulation of production and output of high quality products are closely tied up with economics.

Among the economic factors can be listed the cost of production, the salary and wage levels and forms, price, organization of cost accounting, etc.

Therefore, it is first necessary to disclose the character, properties, and importance of individual economic factors in order to be able to use them correctly in the work of enterprises engaged in planning, production and operation of products.

Intrinsic to economic factors are the properties of analytical control and of stimulation. Among the first are those which make it possible to measure the expenditures of labor, of facilities, and of materials needed to obtain and to assure a certain level of reliability for the products.

The effect of factors possessing stimulating properties may bring with it both an improvement and an impairment of the level of quality and reliability. Certain factors may, to a larger or smaller extent, disclose one of these properties. For example, prices and wages have stimulating properties to a large degree. Properly arranged pricing stimulates the improvement of quality and reliability of products. For this, the price must cover all expenditures made by an enterprise in taking steps to improve the reliability without reducing the planned profit. At the same time, the more highly priced products (as a result of improved quality) must be more effective in operation.

Different forms of wages and salaries act differently to stimulate the reliability; for example, piecework labor helps to increase the output of products requiring a certain level of quality. Enterprises, however, frequently aim to increase the output which occasionally serves to reduce the quality and reliability. Periodic (hourly, weekly, etc.) remuneration of labor creates the prerequisites for more careful execution of production processes but is a poor stimulant for increasing the output. Improved quality and reliability require the use of forms of remuneration of labor that will help simultaneously to obtain and maintain a high level of quality and reliability of the products and to assure their high output.

To improve the quality and reliability of products means to improve the productivity of social labor as the basic economic criterion which determines the expedient level of improved quality and reliability of products.

An analysis of technical, organizational, and economic factors had shown that they are active in the fields of planning, production, and operation. For example, methodical solutions deal with the field of planning, technology deals with the production field, the technical level of operating facilities pertain to the field of utilization, etc.

In each of these fields the factors have their own concrete and specific manifestation and expression. Therefore, it is possible and practically expedient to extend more thoroughly the classification of factors affecting the quality and reliability of products. For this it is necessary to introduce a new classification indicator, such as, for example, the place where the factor displays itself. When extended in this manner, the classification shown in Figure 1 will take the form shown in Figure 2.

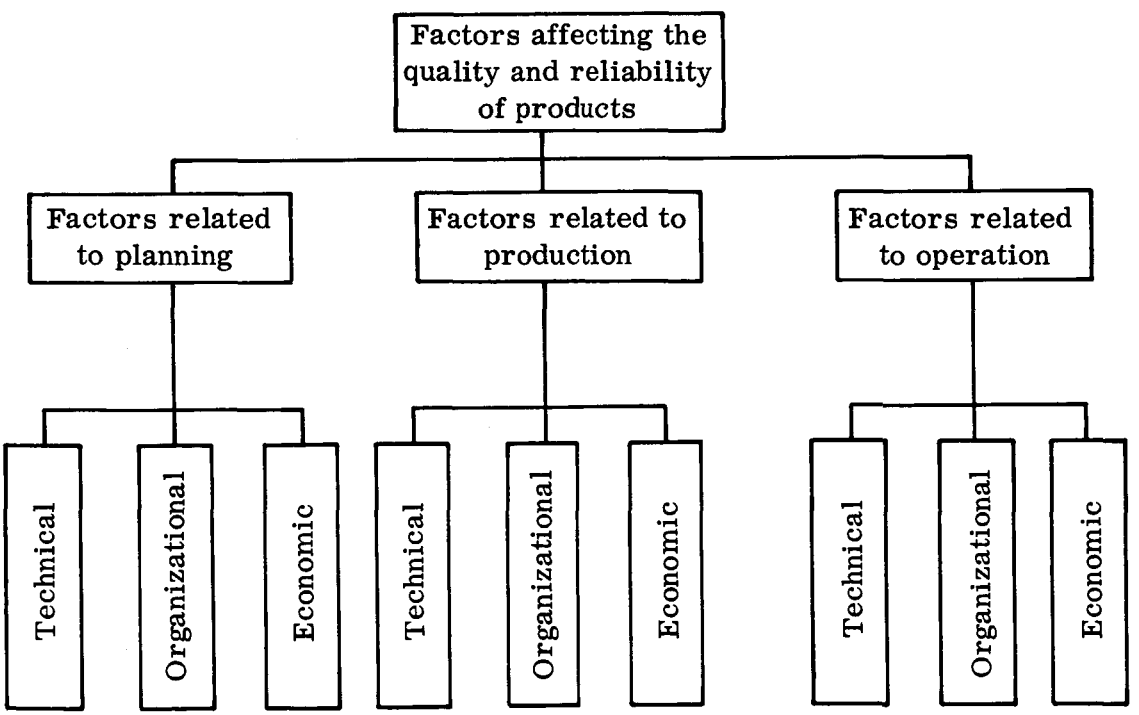

FIGURE 2. SYNTHESIZED CLASSIFICATION OF FACTORS AFFECTING THE QUALITY AND RELIABILITY OF PRODUCTS

A classification which takes into account two indicators at once — the character and the place where the factor displays itself — can be called a synthesized pattern of classification.

An investigation of factors affecting the quality and reliability of products will be incomplete if it does not take into account their individual aspects. A human being, with his professional training and with his physiological and emotional features, can affect to a very large extent the effect of many factors and on him depends the degree of complete utilization of the factors of all groups. For example, on the professional training of people engaged in planning, production, and operation of products depends the extent to which the technical factors can be put to advantage.

However, while technical factors are functioning, the role of the individuality factors is weakened because, at this stage, the process obeys the natural laws incorporated in the design.

Elements of individuality play an important part in case of organizational factors. This is due to the extensive participation of man in the action of the factors belonging to this group.

The role of the individuality elements is substantial in the process of operation because both the quality and reliability levels, which are purposely incorporated in the design, may prove to be unutilized because of the poorly organized application of the products and inadequate training of the specialists.

Taking into account the important role of man in providing an effective use of the high level of quality and reliability of products, the study and the utilization of factors related to individuality should not be neglected. Therefore, it is further necessary to separate a special group of individuality factors and to subject them to a detailed analysis.

It is also advisable to develop the principles of managing production which could overcome the present disconnected efforts aiming to improve the quality and reliability of the manufactured products.

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