

THE RELATION BETWEEN SOCIAL NECESSITY, QUALITY CHARACTERISTICS AND THE FUNCTIONS OF THE PRODUCTS

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Abstract. Quality of a product is one of the important factors which determine the product’s success on the market. Quality means conformity with needs, with the social requirements at a certain moment. Quality is obtained through quality characteristics: technical, economical, functional, aesthetic and social characteristics, which are identified in different existence stages of a product. The quality characteristics are realised through different features (physical components) of a product. These features fulfil one or many functions, which give the product value (use value). The paper emphasis these aspects, illustrate he relation between quality characteristics and functions on the “bearing” product.

Keywords: quality, quality characteristics, functions, product

1. General framework

In order to be able to deal with fierce competition nowadays, manufacturers in many fields think about manufacturing more and more competitive products. This implies the manufacturing of more and more diverse products, quickly adapted to necessities, manufactured with lower costs, without affecting their functionality, whose manufacturing cycles are as short as possible and which have an as low as possible impact upon the environment. In other words, manufacturers have to come up with quality products.

The researchers’ concerns related to product/ services quality have lead to several definitions of the concept:

- J. M. Juran defines quality as being “the aptitude or usage adequacy”;
- G. Taguchi gives the following definition: “quality is the minimum cost a product/ service/ activity imposes on society”;
- The ISO 9000:2000 standard defines quality as being “the degree in which a number of intrinsic characteristics fulfill requirements.” Moreover, the standard defines requirements as being “expressed needs or expectations, generally implicit or compulsory”.

The term “requirement” covers the requirements of the market, the ones stipulated in the contract as well as the internal requirements of an organization. These requirements can be developed, detailed and updated in different stages

of product manufacturing. So, some consider quality as being “the conformity to customer requirements, related to its functionality, price, delivery deadline, security, feasibility, compatibility with the environment, service, usage cost, consulting etc.

The definition of quality according to ISO 9000:2000 associates quality with the ability of an entity (product, process, organization, system, person or any combination of all these) to fulfill their functions. Fulfilling functions can be obtained from product characteristics. In this way, quality is associated with a required number of characteristics, as well as with the accomplishment of the performances required by each and every characteristic.

To conclude, quality represents the number of features of a product or service which grants it the power of satisfying explicit or implicit needs.

2. The product’s quality characteristics

In the field of product manufacturing, and not only in this field, quality is associated with a required number of characteristics (which reflect the connection to the internal and the external client and are his implicit or explicit requirements but also to the accomplishment of the performances required for every characteristic) [1, 2]. Ishikawa considers that “the foundation quality is based on are quality characteristics.” The same author defines quality characteristics as representing “any dimension, chemical feature,

which grants the product the quality of being adequate for usage“ [2].

In the ISO 9000:2000 standard, a quality characteristic is defined as being “a distinctive intrinsic feature of a product, process or system referring to a requirement“. The term intrinsic characteristic is used in the sense that the characteristic is proper to an entity, as a permanent characteristic.

2.1. Technical characteristics

Technical characteristics are those feature which confer the product its potential of satisfying customer needs. The technical characteristics are materialized into physical, chemical and biological features, intrinsic characteristics of the material structure of the product playing a determining part in assuring its functioning. The technical characteristics are determined by the constructive-functional product conception, its execution technology, and the level of knowledge in the moment of product conception etc. The technical characteristics can be objectively measured with enough precision, with the help of technical devices [3, 4].

The establishing of a certain level for a product's technical characteristics (by measuring) represents the technical dimensioning of the product, an activity endowed with great significance in the designing phase of the product. Designing attempts to establish the required level (the level accepted on the market) of technical performances.

2.2. Economic characteristics

Economic characteristics refer to the expenses that occur when using products. They are reflected in the usage, maintenance and assembly expenses.

Economic characteristics are directly connected to the technical ones. For this reason, in order to assure a high level of competitiveness, the correlation between the technical and economical aspects is vital.

2.3. Functional characteristics

The functional characteristics materialize in three types of product features: ergonomically, reliability and maintainability.

The ergonomically features refer to the ease and the safety of product exploitation, the optimization of physical and psychic requests, together with the optimization of time consumption in order to obtain the desired useful effect.

Quantitatively, the reliability of a product represents the likelihood that the product will fulfill its functions with certain performance and without malfunctions, within a given time span and in certain given exploiting conditions.

Synthetically, maintainability represents the likelihood that a malfunctioning product can be made to function again, within a given time span and under specified maintaining conditions.

2.4. Aesthetic characteristics

The aesthetic characteristics are expressed by means of aesthetic categories: shape, line, color, ornament, symmetry, harmony, style etc. The aesthetic characteristics of products determine the degree of products' perfection, gathering the spiritual requirements of both individual and social requirements. It must be noticed that these characteristics, together with the economic and ecological ones play a determining part when deciding upon buying many products. In other words, these characteristics become main criteria when distinguishing different products on a market in which different organizations offer products whose technical and functioning performances are similar or equivalent.

2.5. Social characteristics

Social (ecological, sanogenetical) characteristics refer to designing, manufacturing, using and post-using that interact as little as possible with the environment (during the entire life span of products), for example: the content of different polluting substances of biodegradable components of products, the possibility of re-usage at the end of their commercial life cycle, product manufacturing that takes into account the phenomenon of limited natural resources, etc. - for the ecological characteristics.

3. The determining of products' quality characteristics

In any situation, the quantitative evaluation of product quality implies, first of all, the identification of all product characteristics, and then the formation of typological groups according to different criteria.

The characteristics that define the quality of a product are determined by systematic actions that aim mainly at the relation with the purchaser. This assures the information regarding their requirements. Also, the determining of products' quality characteristics encompasses the activities of designing and development, with the role of turning requirements into

technical, functional and exploiting characteristics with values that can be measured [5].

Table 1 presents quality characteristics grouped into categories for the bearing product, a product that will be the object of a value analysis study.

Table 1. The quality characteristics for the “bearing” product

No.	Categories of characteristics	Units
1.	Technical characteristics: - Exterior diameter - Interior diameter - Width - Tolerances - Mass - Dynamic load (axial/radial) - Static load (axial/radial) - Maximum speed	mm mm mm precision class kg kN kN RPM
2.	Functional characteristics (operation characteristics): - reliability (durability); - the noise or vibration level	hours dB
3.	Economical characteristics: - durability; - the facility of assembling – disassembling	hours hours

Establishing the level of quality characteristics is a complex and difficult activity. Beside the fact that it is very difficult to obtain an absolute optimum for the quality characteristics of a product, they depend on many factors among which we can mention: product destination, technical progress registered in the field, the market segment the product is destined to.

The level of quality characteristics can be established in different ways [1, 2]:

- by comparing the data resulted from the investigation of users’ requirements (surveys, market research) with the data resulted from the statistical data processing regarding technical and constructive parameters of similar products produced worldwide;
- by measuring and monitoring clients’ level of content;
- by technical and economical optimization calculation.

In the bearing manufacturing, internal standards have been established and they specify the quality parameters specific to different type of products. These standards are used especially for products that are largely used and they represent instruments which simplify the evaluation quality activity and contracts perfecting.

4. The connection between a product’s quality characteristics and its functions

Taking into consideration all the aspects mentioned above, we can conclude that the notion of quality is, without any doubt, connected to the idea of product value. A product is valuable for the client, whether he is internal or external, if it possesses features, aptitudes and performances according to his requirements, and, moreover, if it can be purchased at a price and (usage) costs accepted by them.

Moreover, the notion of quality is strongly connected to that of value of usage, without overlapping though. The value of usage represents the total amount of qualities and services (useful functions) offered by a product in order to accomplish, material or spiritual needs, either directly, as individual or collective consumer goods, or indirectly, as components necessary for the manufacturing of new economic goods [4].

Therefore, it is necessary to evaluate products’ quality by means of indicators which are adequate to define situations. Products’ quality research has been and still is the subject of study for a number of methods and instruments such as: Value Analysis Method, The Multicriterial Analysis, Quality Function Deployment (QFD), The Zero Faults Method, The Failure Mode and Effect Analysis, the Ishikawa diagram, the statistic control, the Pareto diagram and many others.

These methods, together with their specific instruments are used in different stages in the existence of products, according to the purpose aimed at. Some of these, such as the Value Analysis Method together with its specific instruments, have certain polyvalence, in the sense that it can be used for different purposes. In this way, value analysis is used both in the research-designing phase of products and at the end of the maturity phase of the product.

According to functionality, the basic principle of the value analysis method, the physical structure of a product is subordinated to its usefulness, the product being first of all a sum of all the functions which result from the social need that has to be performed [1].

The identified quality characteristics of products are materialized by means of material carriers which accomplish one or more functions within the product. Consequently, in order to produce quality products it is necessary for these products to be designed or redesigned, starting from the functions they are to accomplish.

The Value Analysis studies are conducted in order to determine which ones of the product's functions are useless (meaning that they are not required by the purchasers) and which are the functions that do not add value to the product. Identifying the functions of the product is difficult and involves a certain degree of subjectivity. The study [1] reveals two ways of delimiting different functions:

1. The establishing of the functions starting from the discrete elements of the system
2. The addition of functions bearing general character such as: reliability, durability, maintainability etc. The same paper specifies that both ways can be used depending on the subject of the study.

Taking into considerations the quality characteristics which must be accomplished, the research proposal of value analysis study for the "bearing" product has the following objectives:

- The assessment of product quality through find and quantification of adequate indicator;
- The establishing of adequate directions for the optimization of the report between U_v/P_c .

The component parts of the "bearing" product fulfill the following functions:

- The rolling elements: transfers the rotating motion from shaft to boring through inner rings (radial bearings) / sheave (thrust bearings); sit in for discharge chain of forces.

The inner ring and outer ring: allows elements assembling on the shaft and in boring (is a mechanical interface between bearing housing and shaft); take over the loads.

- The bearing cage: maintains equidistance between the rolling elements; maintains the rolling elements on the contact line; protect against contamination.

Taking into consideration the previous functions and the rules for characterization and function's symbolizing [3, 4] in table 2 are proposed a classified list of functions for the "bearing" product.

The determination of relative importance for product's functions will be done an opinion survey, over a representative number of specialists. After data processing, will be determine the score n_i (the importance level of each function), and will be find the weight p_i of each function in the global product's use value. Technical and economical dimensioning activities of product's functions together with critical analysis, will allow the product quality global appraisal.

Table 2. Classified list of functions for the "bearing" product

No.	Function	Function's symbol	Function's category (range)
1.	Support (maintain) the shaft	A	Principal, objective
2.	Transfers the rotating motion	B	Principal, objective
3.	Decrease of friction	C	Principal, objective
4.	Sit in for discharge chain of forces	D	Principal, objective
5.	Allows elements assembling	E	Auxiliary, objective
6.	Carry on information	F	Auxiliary, objective
7.	Has durability (is reliable)	G	Principal, objective
8.	Is ergonomic	H	Auxiliary, objective

5. Conclusions

Quality, generally speaking, determines the utility of products and reflects the degree of utility, meaning the degree in which the characteristics and features incorporated into the products satisfy certain necessities of the society at a certain moment. The quantitative evaluation of product quality implies, from the very start, the identification of all product characteristics. The identified quality characteristics of products are materialized with the help of material carriers which, in that product, fulfill one or more functions. Consequently, the production of quality products requires that these products are designed and redesigned starting from the functions they are meant to fulfill.

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