



# ASPECTS OF PRODUCT QUALITY CONTROL: DETERMINATION OF QUALITY COMPONENTS AND PRODUCT QUALITY FACTOR

Olha Martynova

Kherson National Technical University, Ukraine

## ABSTRACT

The article concerns studies of quality factor, and problems of product quality control. Such components of quality as meeting demands of customers of target segment of market, conformance to standards, and lasting financial results are determined. Product quality factor is proposed.

## JEL CLASSIFICATION & KEYWORDS

■ L15 ■ Product Quality ■ Components of Quality Formation ■ Assessment of Product Quality ■ Quality Factor

## INTRODUCTION

Today, world economy as well as economy of Ukraine goes through tough times. Restoration of industries and their progress are among the most important problems. The majority of product markets are characterized by saturated demand and high levels of competition both according to price factor, and to quality factor. Nevertheless, price factor becomes less important if we mean diversified goods among which softgoods are. Nowadays problem of quality turns out to be the most substantial factor of raising of living standards, economic security, social security and environmental security, and competitiveness is a factor of economic strength as well as stable progress of community in the competitive environment.

Terminological difficulties in the process of studies of product quality idea and complexity of factors result in implementation speed-down or incorrect implementation of quality control systems at the enterprises. Hence, studies of quality class, its components and problems of product quality assessment are of overwhelmingly importance.

The article object is to study and clear up idea of product quality, to determine the heaviest quality components, and to form generalized factor of product quality.

Principal home and world economists pay much attention to studies of theoretical background of quality class (Vaderman, 2003; Vakulenko, 2006; Kruglov, 2006; Sakata, 1980; Feigenbaum, 1986; Hoyer, 2002; Shapoval, 2003). Papers of the scientists cover thorough approaches to quality determination as meeting the demands of customers and level of product specifications. However, the problem can not be considered as totally studied. Clear definition of quality as well as detailed analysis of a class is important for activation of practical studies concerning formation mechanisms, stability, and quality improvement.

Problem of general idea of quality determination for future control of the economic class in operating activities of enterprise is significant. Depending upon approaches to quality determination priority of its components is separated.

### Main Text

Philosophy gives fundamental definition to quality. Aristotle, Locke and Hegel are initiators of quality class studies.

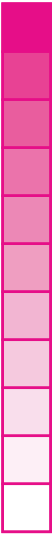
Thus quality gets its categorical definition in Aristotle's philosophy (Lukyanov, 1982). Aristotle starts quality class studies from "first" essences and "second" essences. For

him "first" essence is objective reality of material world, characteristics of subject matter, and "second" one is utility measurement of the characteristics in cooperation with human. In such a way Aristotle considers essence from ontological (physics) and epistemological (metaphysics) viewpoints (Lukyanov, 1982). He defines assessment of quality role as an essence notion: quality helps essence to be determined and stable. As quality class mirrors scope of relations and changes of objective reality it is implemented in numerous meanings, and the class is free, fluent, and flexible (Lukyanov, 1982). "Quality is the thing thanks to which subject matters are called in such a way", wrote Aristotle (Aristotel, 1975). Considering viewpoint of Aristotle as to quality definition it is required to shift priority of influence of first and second essences because the paper objective is to study and to specify essence of product quality, and to determine the most important components of quality. It should be noted that quality conformance to customer demands is parental to compare with conformance to specifications. First of all, it should be pointed out which product characteristic determines demand for it, and then maintain stability of the characteristics in manufacture.

It is worth noting stable actuality subject matter characteristics and quality interrelation studied by Aristotle. Locke developed "quality" class. He paid specific attention to division of qualities into "primary" and "secondary". In his opinion primary and secondary qualities outline formal essence of subject matter determined by sense perception of human, and tangible nature is inner (physical, chemical) structure of subject matter (Lokk, 1960). Modern method of analysis can not find it expedient to divide them into formal essence and tangible nature as metrological method and organoleptic method of quality assessment are applied as a whole, and should be in accordance with quality of specifications.

It was Hegel who developed problem of quality and peculiarity in the deepest way and comprehensively from the point of view of dialectics. Uniqueness of Hegel's definition of quality is that "at all quality can not be separated from existent objective reality being just certain qualitative objective reality" (Gegel, 1997). He considers "reality" and "sublation" as the two moments which create quality idea because it covers end, limit, and variations. It should be noted that Hegel does not consider "quality" class as a total of particular characteristics, and does not explain alternative of uniformity of subject matter against multiplicity of its peculiarities which sets measures to the field of results of his studies use to develop methods for quality improvement or assessment of product quality.

Marxist approach to quality class is close to Hegel's point of view according to which certain integrity, specificity of subject matter adequate with its objective reality is crucial point of quality; going off subject matter stops to be what it is. Other scientists believe that quality should be assessed through idea of attribute: as integrity, whole, certain absoluteness of interconnected attributes



(Materialisticheskaya dialektika, 1981). Determination of quality within the approach gently separates quality of subject matter from need for it and conformity with terms of its use.

Modern philosophy gives such generalized definition: "Quality is essential clearness of subject matter under which it is this very subject matter but not another one differing from other subject matters. As a rule, quality does not come to its individual peculiarities...idea of quality is connected with objective reality of subject matter" (Filosofski slovar, 1987). The definition of quality can be background for development of applied definitions of quality adequate to modern economic climate.

As V.N. Azarov, B.V. Boytsov, Yu.V. Kryanev note that in theoretical and logical aspect class "quality" is shown with the help of relatedness not only with classes "quantity" and "degree" but also with classes "consistency", "structural properties", and "organized nature" (Azarov, Boitsov, Kryanev, 2002). Stability can complete the list of classes connected with stability. Aristotle (Lukyanov, 1982), V.A. Sheremet (Sheremet, 2004), and Sakata Siro (Sakata, 1980) take the view.

"Quality" class is worth characterizing as dynamic and developing one as experience of quality varies gradually, and engineering capabilities of business improve. Robert Hoyer and Brook Hoyer propose the two levels of quality determination (Hoyer, Hoyer, 2002):

1. First level of quality is output of such goods or provision of such services which measurable characteristics are adequate to specific performance attributes having numeric values.
2. Second level of product quality depends on the fact how much expectations of customers are met as to the product or service application or use.

Maybe such approach to quality is expedient for some types of goods but it has many disadvantages too. Second level of quality can not be considered individually, and exist autonomously as usable specific goods should meet demands of consumers. Thus, conformance is required even if insufficient condition of quality determination.

Determination of quality only as aggregate of specifications was widely used under command and administration economy. Such an approach means specified determination of requirements, and preset consumption conditions. N.A. Cherednichenko, O.G. Voronkov, Yu.P. Kushchevski (Cherednychenko, Voronkov, Kushchevski, 1991), M.I. Moldavanov (Entsyklopedychny slovnyk biznesmena: Menedzhment, marketyng, informatyka, 1993), and S.V.Mocherny (Ekonomichy slovnyk-dovidnyk, 1995) support the viewpoint. However, such point of view originates inadequacy between goods manufactured and consumer needs. Besides, N.A. Cherednichenko, O.G. Voronkov, and Yu.P. Kushchevski propose determining requirements of community instead of consumer groups (Cherednychenko, Voronkov, Kushchevski, 1991). In the mass, requirements of community will gear enterprises to bulk product with standard characteristics.

I.G. Leonov and O.V. Aristov propose similar one-sided approach to determine product quality. They say that "...improving quality of product is not improving all its properties but only those which influence goods' performing its missions" (Leonov, Aristov, 1990). The tendency in quality improvement will be quite adequate if list of characteristics of goods stipulating functionality are added with aesthetic and ergonomic characteristics important for

customer. V.M. Prykhodko, G.A. Shvydanenko (Prikhodko, Shvydanenko, 1989), Yu.V. Savitsky, V.A. Rybynok, O.V. Lyutkevych (Savitskiy, 1987), S.M. Kyryukhin, and Yu.V. Dodonkin (Kiryukhin, Dodonkin, 1986) emphasize technical parameters of quality of goods. It should be noted that technical characteristics of goods determine level of quality if only a list and boundaries of the characteristics are determined for specific groups of customers.

Recognized researcher F. Crosby proposes determination of quality keyed technical parameters of products: quality of goods is equivalent to the fact that measured characteristics of product or service are in accordance with accepted technical requirements. Any inadequacy means lack of quality (Hoyer, Hoyer, 2002). Such a determination has disadvantages: first, undervaluation of requirements of customer, and second, impossibility of gradation of quality levels. Hence, only the two values are available: quality and lack of quality.

Another tendency of "quality" idea determination is that product quality and its value in use are agreed, and qualitative aspect of economic class of "product quality" is shown. It means ability of the product unit to meet specific demand; quantitative aspect of "product quality" is a measure of certain requirements meeting by the product unit (Amirdzanyants, 1987). K. Marx is the approach founder (Marx, 1978), and B.A. Minin has similar view on the idea (Minin, 1989), but with "orientation to consumer interests" V.G. Gerasimova (Gerasimova, 1989). The determination of product quality is more adoptable for consumer industry but it is not complete as assessment of technical characteristics of product is followed by assessment level and level of customer satisfaction.

V.N. Stroitelev pays more attention to technical characteristics as to quality determination: the key component of determination with customer orientation is that "quality of subject matter can be determined only after certain influence on human" (Stroitelev, 2002). It should also be noted that degree of utility of subject matter under its influence on human or adoptability are predetermined during manufacturing process with the help of technical characteristics. Thus, quality is being formed only during manufacturing process, and interaction with human just helps to show quality level of product. V.N. Stroitelev considers quality of subject matter as results of the subject matter development, efficiency of its properties and characteristics, progress of "spiritual" level of human, and influence of public opinion (Stroitelev, 2002).

The determination has limited applied value as spiritual level of human as well as influence of public opinion concern not only product quality. They characterize social environment too. As the factors have only collateral effect on conformity of goods in question to consumer requirements their assessment may be more expensive to compare with expected utility for enterprise.

Besides it is necessary to study evolution of "quality" definition by directing agencies in the field of standardization and quality control. According to GOST 15467-79 (Upravleniye kachestvom produktsii. Osnovnye ponyatiya. terminy i opredeleniya, 1991) quality is determined as integrity of product properties stipulating its abilities to meet specific demands in terms of its mission. Ukrainian Association of Quality gives such definition: quality is a process of continuous improvement, way of running business when it is necessary to be better, to be improved to compare with others instead of having better product. International Standard ISO 8402-86 (Standart ISO8402-86

Kachestvo. Slovar, 1995) determines quality as integrity of properties and characteristics of product or service helping them to meet specific or expectable needs of consumers. International Standard ISO 9000-2000 (Systemy upravlinnya yakistyu, 2001) gives another determination of quality: it is the grade up to which complex of own characteristics of product, process or system meet formulated needs or expectations generally comprehensible or mandatory. The International Standard ISO 9001:2008 emphasizes permanent quality improvement to be categorical requirement of progress of control systems (Pylypenko, 2009).

Maybe, above division of quality into two levels is expedient for specific types of product but it has disadvantages as well. Second level of quality can not be considered in isolation from first level existing autonomously. The matter is that specific product fit for service should meet the demands of customers. Hence, conformance is required but insufficient condition of quality determination.

Level of consumer satisfaction is in the International Standards ISO 8402-86 and ISO 9000-2000. It should be noted that some aspects of determination of quality in International Standard ISO 8402-86 are reasons for discussion. For example, expectable needs of customers can not be determined categorically. As a result, process of quality assessment is complicated, and its subjectiveness rises. In the majority of cases enterprises or market research agencies assess level of consumer satisfaction, and their point of view differs from point of view of final customer. Accordingly, assessment of product quality becomes more contorted. The problem is solved in the International Standard ISO 9000-2000 which explains that list of needs should be limited. It helps to make assessment of quality more adequate and strict being foundation of future developments.

M.G. Kruglov and G.M. Shyshkov believe that from the viewpoint of enterprise logic of quality looks like closed cycle covering such components: qualitative human capital, infrastructure, manufacturing environment; qualitative business processes; high level of client satisfaction; good financial results (Kruglov, Shyshkov, 2006). At the first stage such definition of quality formation within specific enterprise should be completed with qualitative information concerning market and customer need that is qualitative market research. Otherwise grade of customer needs consideration will increase with each cycle but the process of product quality improvement is too slow and expensive.

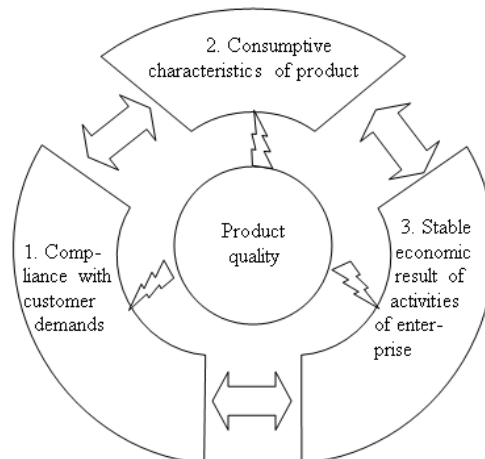
Taking into consideration above, we can give such definition of quality: relationship of level of customer characteristics and accordance with demands of individual customers and community in whole resulting in stable economic results for enterprise.

To obtain the relationship of technical characteristics of product, compliance with customer demands and stable economic results it is required to develop a model of optimization of characteristics not only in accordance with the two assessment directions - technical characteristics and compliance with customer demands. Besides it is necessary to take into consideration profitability of manufacturer as negative financial results of enterprise can not be a guarantee of product with stable qualitative characteristics. The approach concerning determination of quality is diagrammed in Figure 1.

Under modern conditions of market relations high quality is possible if only product manufactured is in accordance with customer demands and consumption factors; and if service

support is available. The terms are based upon high level of product characteristics, their accordance with technical conditions of enterprise, world standards, environmental requirements to products and technological processes. Efficient system of enterprise organization is the precondition of formation of technical characteristics. It secures sufficient profit, stability of listed technical characteristics, and persistent service support.

Figure 1. Components of Quality Determination



Source: Author

Hence, quality formation can be shown as:

$$Q = f(P, T, F), \quad (1)$$

Where Q is function of quality;

P is influence of product characteristics accordance of product quality on consumer demands;

T is influence of technical characteristics on product quality;

F is influence of financial results of manufacturer's activities on product quality.

First and second components of quality are in the picture of international and Ukrainian standards, and were studied by Ukrainian and world scientists. Third component balances manufacturer's product quality assurance, and accordingly strengthening manufacturer in the market. It is external aim, and it can favour production expansion and specific cost reduction, restructuring expenses for quality assurance and correction of defects. It results in reduction of expenses, productivity enhancement, and company's yield enhancement.

Most of all, quality influences such results of activities of enterprise as sales revenue, expenses for correction of product defects, and quality assurance. Expenses for quality assurance and correction of effects are quite different for enterprises of various industries. Thus, it is not expedient to use absolute value of the expenses in the formula. It is better to study their variation during the period of implementation measures concerning quality improvement.

The most important thing for customers is difference between value product use as well as actual cost and operational cost. Thus, defining quality we will take into consideration cost of final product basing on change in product value and its cost during the period under study.

Author considers that product quality factor should be defined on the formula:

$$Q = (1 / I_{EQA+CDE}) \times (I_{PVC} / I_{ACOC}), \quad (2)$$

Where  $I_{EQA+CDE}$  is factor of fractional amount of expenses for quality assurance and correction of defects in total expenses of enterprise;

$I_{PVC}$  is a factor of product value (user value) for customer;

$I_{ACOC}$  is a factor of actual cost and operation cost.

The factor helps to determine relative level of quality at the enterprise to compare with prior period. First component of the factor gives ability to show how effective the enterprise takes up a problem of quality, and whether positive dynamics concerning common share of expenses for quality assurance and correction of defects is available. Second component of the factor determines if changes in level of product characteristics from the viewpoint of customer are available. It concerns prior period. Besides it shows how changes in user characteristics are associated with dynamics of product cost.

Under modern economic conditions it is extremely important to continue studies problems of competitive growth which key component is quality particularly product quality. It is essential thing in product quality to find balance among level of consumer satisfaction, level of technical characteristics of product and cost factors which stipulate economic result of activities of enterprise. As product quality is dynamic category developing in accordance with changes in technical level of enterprises, managerial methods and consumer demands it is required to improve both terminological and methodical mechanism of quality control.

#### REFERENCES

- Amirdzanyants, F.A., 1987. *Ekonomika i kachestvo*, M.: Izdatelstvo standartov, 128 s.
- Aristotel, 1975. *Sochineniya: v 4 tomakh*, M.: Mysl, 550 s., T. 1., 550 s.
- Azarov, V.N., Boitsov, B.V., Kryanev, Yu.V., 2002. "Kachestvo kak natsionalnaya ideya", *Kachestvo. Innovatsii. Obrazovaniye*, No 1, s.4–7.
- Cherednychenko, N.A., Voronkov, N.A., Kushchevski, Yu.P., 1991. *Faktory povysheniya kachestva produktsii*, K.: Naukova dumka, 144 s.
- Entsyklopedychny slovnyk biznesmena: Menedzhment, marketyng, informatyka, 1993. *Pod redaktsiyeyu M.I. Moldovanova*, K.: Tekhnika, 856 s.
- Feigenbaum, A., 1986. *Kontrol kachestva produktsii; Sokrashchenny perevod s angliyskogo*, M.: Ekonomika, 471 s.
- Filosofski slovar, 1987. *Pod redaktsiyeyu I.G. Frolova: pyatoye izdaniye*, M.: Politizdat, 590 s.
- Gegel, G.V.F., 1997. *Nauka logiki*, SPb.: Nauka, 799 s.
- Gerasimova, V.G., 1989. *Tsena i kachestvo tovarov narognogo potrebleniya: Pod redaktsiyeyu V.I. Tarasova*, M.: Nauka i tekhnika, 108 s.
- Hoyer, R., Hoyer, B., 2002. "Chto takoye kachestvo?" (po stranitsam zhurnala Quality Progress), *Standarty i kachestvo*, No 3, s.97–102.
- Kiryukhin, S.M., Dodonkin, Yu.V., 1986. *Kachestvo tkaney*, M.: Legprombytizdat, 160 s.
- Kruglov, M.G., Shyshkov, M.G., 2006. *Menedzhment kak on yest'*, M.: Eksmo, 544 s.
- Leonov, I.G., Aristov, O.V., 1990. *Upravleniye kachestvom produktsii: Uchebnoye posobiye. Vtoroye izdaniye, pererabotannoye i dopolnennoye*, M.: Izdatelstvo standartov, 223 s.
- Lokk, D., 1960. *Izbrannyye filosofskyye proizvedeniya: v 2 tomakh*, M.: Sotsekgiz, T.1: *Pod obshchey redaktsiyeyu I.S. Narskogo*, 734 s., T.2: *Pod obshchey redaktsiyeyu Makarovskogo*, 532 s.
- Lukyanov, I.F., 1982. *Sushnost kategorii "svoystvo"*, M.: Mysl, 143 s.
- Marx, K., 1978. *Capital. Kritika politicheskoy ekonomiki; Perevod I.I. Skvortsova-Stepanova: v 5 tomakh. Process proizvodstva kapitala*, M.: Politizdat, T.1, kn. 1, 907 s.
- Minin, B.A., 1989. *Kachestvo. Kak ego analizirovat?* M.: Finansy i Statistika, 96 s.
- Prikhodko, V.M., Shvidanenko, G.A., 1989. *Perestroyka upravleniya kachestvom (iz opyta raboty mashinostroytelnykh predpriyatiy)*, K.: Tekhnika, 112 s.
- Pylypenko, V.P., 2009. "Quality as Philosophic Category", *DAS Management*, No 1(11–12), pp. 94–95.
- Sakata, S., 1980. *Prakticheskoye rukovodstvo po upravleniyu kachestvom; Perevod s yaponskogo S.I. Myshkinoy pod redaktsiyeyu V.I. Gosteva: chetvertoye izdaniye*, M.: Mashinostroyeniye, 215 s.
- Savitskiy, Yu.V., 1987. *Sovershenstvovaniye upravleniya kachestvom produktsii na promyshlennom predpriyatii*, K.: Tekhnika, 86 s.
- Shapoval, M.I., 2003. *Menedzhment yakosti: Pidruchnyk*, K.: Tovarystvo "Znannya", KOO, 475 s.
- Sheremet, V.A., 2004. "Stabilnost kachestva – klyuch k uspekhu", *Metallurgicheskaya i gornorudnaya promyshlennost*, No 3, s.102–103.
- Standart ISO8402–86 *Kachestvo. Slovar*, 1995, K.: Derzhstandart Ukrainy, 12 s.
- Stroitelev, V.N., 2002. "Statisticheskyye metody – osnovnoy instrumentariy spetsialista v oblasti kachestva", *Kachestvo. Innovatsii. Obrazovaniye*. No 1, s.11–17.
- Systemy upravlinnya yakisty, 2001. *Vymogy: DSTU ICO9001-2001*, K.: Derzhstandart Ukrainy, 24 s.
- Upravleniye kachestvom produktsii. *Osnovnyye ponyatiya. Terminy i opredeleniya*, 1991. *GOST 15467–79*, M.: Izdatelstvo standartov, 77 s.
- Vaderman, St.B., Jobe, J.M., 2003. *Statystichni metody zabezpechennya yakosti; Pereklad z angliyskoyi Grygorenko R., Pivtorak A., Yablonsky S., K.: Vydavnychiy tsentr KNEU*, 254 s.
- Vakulenko, A.V., 2006. *Upravlinnya yakisty: Navchalno-metodychny posibnyk dlya samostiynogo vyvchennya dystsyplyny. Vydannyya druge, bez zmin*, K.: KNEU, 167 s.
- Ekonomichy slovnyk-dovidnyk, 1995. *Za redaktsiyeyu doktora ekonomichnykh nauk, profesora Mochernogo S.V.*, K.: Femina, 368 s.
- Materialisticheskaya dialektika, 1981. *Pod redaktsiyeyu F.V. Konstantinova (obshchaya redaktsiya), V.G. Marakhova (obshchaya redaktsiya): v 5 tomakh*, M.: Mysl, T.1, 385 s.