

# **The analysis of decision making conceptions in the framework of quality management system conforming to the 9000 ISO standards: a general survey and the experience of the Republic of Belarus**

Pavel S. Serenkov and Vasili M. Ramanchak  
Belarusian State Polytechnic Academy (BSPA)  
65-17 Fr. Skaryna Ave., Minsk, 220027, the Republic of Belarus  
**Fax: +375 17 2313617**

**ABSTRACT:** It is determined that the quality of production has become the dominating factor of supplying companies prosperity in the world market. For the Republic of Belarus it is a matter of life and death. The concept of consumption community prescribes for suppliers of products to establish quality management systems that conform to the 9000 ISO standards.

There is a rather hard skew in this direction in the Republic of Belarus. Being certificated, quality management system is an entrance ticket to the world market for the enterprises - exporters. The top management of many organizations hastens to deploy quality system at themselves first of all with the purpose of certificate obtaining. Consequences of it might be tragic. The quality management under the conditions of our country manifests itself as a rather complex cognition object that has national specific features.

**There are lobbying of varies quality management information technologies (QFD, FMEA, QLF, VE, DOE of Taguchi etc.) in the Belarusian market. The analysis of this market has shown that, as a rule, they are " know - how " technologies and run into money. The idea of topicality of the universal methodology development of a complex system of quality management is grounded in the present article.**

During the last two years BSPA runs the project, which purpose is the increase of efficiency of quality management systems conforming to the 9000 ISO standards. The main project aim is the creation of the unified methodology of decision making approach based on procedures of planning, assurance, control and improvement of production life cycle processes quality and development of the rational effective managing solutions.

Key words: quality management systems, 9000 ISO standards, effective top management decision making, unified methodology, integrated science approach

# **The analysis of decision making conceptions in the framework of quality management system conforming to the 9000 ISO standards: a general survey and the experience of the Republic of Belarus**

Pavel S. Serenkov and Vasili M. Ramanchak  
Belarusian State Polytechnic Academy  
The Republic of Belarus

It is known that the global economy develops in leaps. As a rule, periods of leaps are associated with discoveries in various fields of science and technology. In these periods new companies – the so-called “gazelles” – are born and a lot of old companies and corporations disappear. As a matter of fact, the market of the companies-manufacturers is formed anew. Those who are the first to adopt and introduce new technologies and new forms and methods of management are far ahead to the others. Such periods are characterized by the absence of a total competition. There is a big gap between a comparatively small group of the leading companies and other manufacturers. The next rather a long period is the period of overtaking, equalization and, as a result, of the competition growth. During the last decades a relative stagnation in revolutionary discoveries in the field of new technologies is being observed. And as a consequence, the world market of the end of the 20th century is characterized by a highest degree of a competition, high manufacture concentration and selling over. The basic, life-proved strategy of survival and prosperity for a Company in the modern conditions is based first of all on production and services quality’, which it can offer to its consumers.

By the end of the century the concept of consumption community that had been founded in the sixties as the concept of the state consumers' rights protection was finally established in the world. Nowadays the process of legislative registration of the consumption community concept is intensively developing. In Europe it was reflected in “The Global Concept of Legislative Assurance of Goods and Services Quality in European Market”. “The Global Concept...” generalizes the historic stages of quality management in the world and is based on the following principles:

- a production control being fulfilled by test laboratories;
- unified evaluation of quality conformity (called “certification”);
- a supplier’s quality management system [1].

For today the top of consumption community requirements is the instruction to production suppliers to establish quality management systems that conform to the requirements of the 9000 ISO standards. Moreover, next tops of these requirements, such as the instruction to establish more rigid quality systems conforming to the requirements of the 9000 QS standards, ecological management systems conforming to the requirements of the 14000 ISO standards, social management systems are visible.

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<sup>1</sup> “Quality is totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs (ISO8402)” [6]

Nowadays the statement of J. Karrington, one of the outstanding American experts in quality management, that the eighties-nineties are an arena of struggle for quality and that the economic catastrophe is the price for this struggle, became a common knowledge. It is necessary to stress, that everybody in the world knows nowadays that the quality management became the most prospective target of investment in order to strengthen the positions of companies in the world market. The unprecedented growth of attention to quality management is observed worldwide. The problems, associated with the search of the optimum methods of quality management of production and processes are the subject of the utmost care of industrial companies' top management. Some three or four years ago, when the second 9000 ISO standards edition has appeared, there was the official point of view in the Republic of Belarus that implementation of quality systems at the industrial enterprises of the country is untimely. However, during the last years, foreign trade activities experience has shown, that for the exporting enterprises the certificated quality management system is an entrance ticket to the world market. On signing the contract, the customer more and more often wishes to have the proofs from the supplier that the latter works in accordance with the 9000 ISO standards. A lot of really impressive examples of economic efficiency resulted from implementation of quality management systems appeared [2]. The main cause of this efficiency is the complex approach to quality problem: decreasing of production costs and increasing of the value of production for the customer. Moreover, the additional economic profit occurs from the priorities of the contracts conclusion, obtaining the preferential bank credits, insurance, solution of legal character problems etc.

In the Republic of Belarus production quality is regulated by a lot of the decrees of the Council of Ministers and of the State Standard Department. The decree N 268 of the President of the Republic of Belarus of 20.05.98 "On increase of domestic production competitiveness ..." puts the quality management systems implementation in a rank of state politics at first.

An ideal quality management system as a part of a Company overall top management system under the modern conditions of our Republic is one of the major effective levers for enhancement of one's own competitiveness. This lever has been not really involved yet.

The system developed and deployed in accordance with the requirements of the 9000 ISO standards is the effective tool for realization of an effective manual of Company by top management [3;4;5].

Unfortunately, nowadays there is a rather hard skew in this direction of activity in our country. The top management of many enterprises hastens to apply in industry the quality management systems with the purpose just of obtaining the certificate of quality. They suppose that it is enough to gain a worthy place in the world market. As a result, the formation of the quality management system at enterprises of a similar kind is reduced to installation of some formal elements: elaboration of an organizational structure, documented procedures as a "Quality manual" and internal standards, instructions etc. As a rule, it is enough for a positive outcome of the quality system certification procedure that conforms to the 9000 ISO standards and for obtaining the certificate of quality. The international 9000 ISO standards are the "soft" standards that put a problem in a form of requirements, but not regulate its solution. Therefore, a procedure of quality system certification in conformity with the international 9000 ISO standards is rather formalized. In our country some experience of quality system

certification is already accumulated by the National bodies on certification as well as by the international ones (KEMA, TÜV) [2].

The modern concept of quality management assumes first of all a complex solution of the problems of quality planning, quality assurance, quality control and quality improvement of the production and processes within the quality system (ISO 8402) [6]. Integrated approach is the main principle of creation the quality management systems, within the framework of which it is possible to execute effective quality management at a Company. The integrated approach enables one to perform continuous procedures of planning, assurance, control and improvement that form together the so-called classic management "plan-do-check-act" (*p-d-c-a*) cycle within the framework of the whole network of processes that effect the quality of production. In its turn, each stage of a *p-d-c-a* cycle, as a rule, also may be considered as a cycle including such stages as obtaining the adequate information, its analysis, decision making, organization of corrective and preventive actions, control of their efficiency. As a result, the strategic concept of quality management within the framework of the Company processes network is a rather complex system of the interconnected procedures. From this viewpoint the management of organization under the conditions of a rigid market competitiveness outside the country, on the one hand, and conditions of dominant state regulation inside the country, on the other hand, manifests itself as rather a complex research object that has some national specific features. As a complex cognition object, the effective quality management has its own distinctive features and, therefore, its own regularities of its manifestation. Therefore, a complex study of this object is required.

It is proved that the majority portion of the "quality" is being formed just during the first stages of production life cycle, viz. marketing and designing (ISO 9004-1) [5]. It corresponds to one of the major mottoes of quality management, viz. "Defects are more profitable to be prevented than to be corrected".

It is possible to present the effective quality management conditionally as combination of two elements:

- steadily performed procedures of quality planning, quality assurance, quality control and quality improvement of each process within the framework of a network of processes that is implemented in an organization;
- well-structured quality system, as a combination of an organizational structure, procedures, processes and resources (ISO 8402) [6].

Thereby the quality system acts as the basis, but the steadily performed procedures of planning, assurance, control and improvement of the quality of basic processes act as a superstructure that supports active competitiveness of a Company. Accordingly, all scientific and practical efforts in the field of quality management conditionally can be divided into two directions:

- research aimed at the development of the new forms of quality management systems through an organizational structure, redistribution of the responsibilities and authorities, redistribution of the resources as well as the

communication channels between subdivisions of an organization, the methods for personal motivation etc.;

- research aimed at the development of new methods and information technologies for supporting procedure of planning, assurance, control and improvement of both the processes network, and individual processes of production life cycle.

At present a great attention is being paid in the world to theoretical and practical developments in the field of quality management. It is determined by the fact that the production quality has become the dominating factor of production competitiveness and organization prosperity in the world market. The European concept of business management on the basis of quality policy accepted by the EC indicates that the quality policy must be on the top of the overall organization policy so to determine it.

Since the fifties quality problems found the solution in theoretical and practical research and projects of such known scientists as W.E. Deming, P.W. Messing, B. Crosby, A.V. Feigenbaum, K. Ishikawa, J.M. Juran, D.C. Montgomery, G. Taguchi etc. The USSR also was one of the leaders in the development of system methods of production quality grade increase, of maintenance of its stability. In fifties-nineties a number of various quality management systems were developed, tested and passed theoretical and practical approbation in the USSR. The unified complex control quality system developed in the sixties and known as CS PQC has become the top of these systems [1]. It became the prototype of quality systems conforming to the 9000 ISO standards.

The most popular for today is the methodology of quality management known as the "total quality management" (TQM). In Japan the TQM strategy has been developed in the most systematized and integrated way as the strategy of general quality management within the framework of the whole enterprise. This strategy is known as the Company-Wide Quality Control (CWQC)[2]. The main ideologist of CWQC is Dr. G. Taguchi.

There are two directions of the Company-Wide Quality Control, viz.:

- 1) On-Line Quality Control;
- 2) Off-Line Quality Control.

On-Line Quality Control is an approach oriented to the problems of manufacturing process quality and finished product quality. It is based on the monitoring of manufacturing processes and finished product with the aid of various techniques. The main role is played by the statistical control methods for solving different quality problems during and after manufacturing process and for analysis of non-conformities and their consequences as well as for developing the effective ways of their correction. The most popular are the methods of histograms, control charts and other instruments of basic statistics, analysis of variances (ANOVA), development of effective corrective actions by means of designing industrial experiment - DOE) etc.

Other techniques, such as Foolproofing, Auditing and Problem Solving also play an important role in the On-line Quality Control. The potential of this approach is limited by maintaining already planned and ensured quality levels.

Off-Line Quality Control is rather a more integrated approach which goal is the achievement of minimum overall financial loss and maximum profit. With this regard, Off-Line Quality Control is oriented to the whole production life cycle (design, manufacturing, sales and service). Moreover, this approach takes into account such aspects as demands of customers and society, product costs, human factors (change the way of thinking of all employees by education and training), process and finished product quality control. It assumes first of all the careful study of production and processes up to the stage of manufacturing. To prevent losses with the aid of planning and ensuring of processes is more profitable than to correct ones with the aid of control. Thereby the main efforts of quality engineering are concentrated on the design stage of production life cycle and cover the three basic phases: 1) system design; 2) parameter design; 3) tolerance design. The most wide-spread tools of the Off-Line Quality Control are the technique of the development and analysis of quality function called the Quality Function Deployment (QFD), the technique of evaluation of decision making at design stage with the use of quality loss function (QLF), designing of industrial experiment (DOE). Off-Line Quality Control includes On-Line Quality Control and its techniques.

Being more rigid than the 9000 ISO standards, the standard of the American automobile manufacturers QS 9000, requires an implementation, within the framework of the quality system, besides the above-stated methods and tools, such techniques as the engineering of value (VE), Failure Mode and Effect Analysis (FMEA), methods of mathematical and physical simulation, analysis of final elements (FEA), computer methods of engineering (CAE) etc.

The analysis of the market of quality management information technologies has demonstrated that, as a rule, they are "know-how" technologies. In order to conduct a successful business, modern organizations are compelled to purchase and to use the existing theoretical and practical techniques of the leading companies, and also to initiate the creation of new technologies that run into money. For our country it is very essential.

The lobbying of above-stated quality management information technologies (QFD, FMEA, QLF, VE etc.) in the market of the Republic of Belarus makes very often the top management and the company quality services to be nonplused: they are not sure if they should purchase or should not purchase a specific technology, and, if they should, so what way of instillation ought to be chosen. Also, the expected effect from such single measures will be hardly reached. It reminds patching up tears. Taking into account the national specific features of strategic concept of quality management (see above), the comprehensive complex approach is necessary for the effective solution of problems of quality management. Therefore, the problems of the development of a universal methodology of a complex system of quality planning, quality assurance, quality control and quality improvement

of each process of a Company processes network with the purpose of effectiveness increase of quality management systems remain topical.

The analysis of development and deployment of various information technologies at the enterprises of the Republic of Belarus within the framework of the top management quality decision making system has demonstrated the following regularities (that seem to be interesting, according to the authors' viewpoint):

- The majority of the top management believes that the multimillion investments and, in particular, cardinal updating of production hardware are the necessary condition for the achievement and maintenance a "world" quality grade of goods. To a great extent, that is determined by misunderstanding of the main principles of modern quality management philosophy and, in particular, of the problems of an economic efficiency. It may be explained also just by misunderstanding of the modern concept of the "quality" itself. Belarusians have not as yet enough experience of tasting close interrelations of the "quality" concept with the cost concept, of structuring "quality" concept on grades (categories, ranks, classes) in accordance with the needs of various categories of purchasers. In our country we just begin to understand that it is possible to struggle successfully for a quality of production that belongs to a certain grade determined by the real potential resources of a Company and that it is possible to survive and to compete successfully in an appropriate market sector.

- In contrast with the classic manufacturers world market, the majority of top management of the industrial enterprises of the Republic of Belarus has technical education of various levels. This is a stimulating factor for promotion the installation of new progressive quality management information technologies. Moreover, the effective top management decision making is possible without generalization and detailing of experimental quality data or results of audit because of sufficiency of managers' competence. The relatively high technical competence of the managers also makes it possible to suspend the tendency of duplicating of detached primitive information technologies aimed at the "not advanced" in technical regard top management. It gives one the opportunity to lay emphasis on science intensive information technologies for the quality management with elements of computer aid engineering.

- The absence of economic, financial and juridical independence for a long time, as well as the fear to be punished for any miserable shortcoming have suppressed any kind of initiative of management personnel at all levels of the organization structure. Even now we still have the following unofficial mottoes for surviving that have been kept since the time of the "planned economics": "The initiative is punishable" and "Any quality failure is never the chief's fault but a subordinate employee is always guilty of it". The absence of any initiative - even under conditions of authorities redistribution today - results in the impossibility of the quick extensive deployment of quality management technologies and tools at enterprises. E.g. we can often observe the following

typical situation at an industrial enterprises: there is a quality problem of detached technological process that was successfully solved with the help of outside specialists by means of the elementary control charts and ANOVA methods. But the transfer of these methods even to the similar technological processes (not to speak of processes on principle divergent) by own personnel causes extreme difficulties.

The Belarusian State Polytechnic Academy is the leading research organization in the Republic of Belarus in the field of development and deployment of effective quality management information technologies at the national industrial enterprises. The long-term researches are harmonized with the policy of the State Standard Department and the State Science and Technologies Committee. At present there are rather impressive examples of development and deployment of various techniques of planning, assurance, control and improvement of life cycle processes aimed at the increase of the efficiency of production and improvement of the goods quality of the whole series of enterprises. The various developed and tested techniques are based on the multilevel system of the quality data registration and analysis that has been structured in accordance with functions and objectives. They are also based on mathematical methods of design of industrial experiments, statistical methods of various levels of complexity, accelerated quality evaluation methods, quality management expert methods, Taguchi philosophy etc.

During the last two years the Belarusian State Polytechnic Academy runs the project which purpose is the increase of efficiency of operation of quality management systems conforming to the 9000 ISO standards. The main project objectives are the creation of the unified methodology of decision making approach based on procedures of planning, assurance, control and improvement of quality of the production life cycle processes as well as the development of the rational effective managing solutions.

The Belarusian State Polytechnic Academy development team is planning to create a scientifically generalized model of a methodology of the quality management of production and processes (procedures of planning, assurance, control and improvement) at all stages of production life cycle as an "information pyramid " based on the following principles:

- being structured in accordance with functions and objectives;
- being created on the basis of functional decomposition approach;
- requesting the sequence of activities, but not limiting the use of various methods and tools;
- actuating a complex of the following algorithms and techniques:
  1. detection of process (production) quality affecting factors,
  2. evaluation of their affecting coefficients,
  3. integration,
  4. development of the rational managing solution.

The research is based on the principles and postulates of the linear accuracy theory, the quality control, the probability theory and mathematical statistics, the theory of an objects classification, numerical methods of a



mathematical analysis and simulation and etc. To the authors' opinion, the original point in the project being fulfilled is the universality of the methodology of quality decision making. The unified procedures realization algorithm may be transferred to the main stages of production life cycle (designing, manufacturing, control and tests).

The project will be realized also with the use of above-listed and well-known techniques as Taguchi methods, Failure Mode and Effect Analysis (FMEA), analysis of variances (ANOVA), the basic statistical methods, the technique of quality function deployment QFD, designing of industrial experiment (DOE)etc.

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