DOI: 10.25515/PMI.2017.4.497

UDC 338.246.2

CHALLENGES AND TRENDS OF QUALITY MANAGEMENT IN THE CONTEXT OF INDUSTRIAL AND MINERAL RESOURCES ECONOMY

Viktor P. SEMENOV, Yuri I. MIKHAILOV
Saint-Petersburg State Electrotechnical University «LETI» them. V.I.Ulyanov (Lenin), Saint-Petersburg, Russia

The paper reviews key challenges and trends of quality management in the context of industrial and mineral resources economy, from the beginning of research on quality to organization of modern systems, based on principals of total quality management. Attention is given to relevant issues, associated with the application of process and project approaches to quality management and with international management system standards. The authors present a list of key modern methods, instruments and concepts of quality management in the context of industrial and mineral resources economy. The paper reviews modern trends in the development of quality management, including formation and development of integrated management systems, control over the reproduction of intellectual capital under the conditions of global market and development of innovation economy.

Key words: quality management, organization management, industrial and mineral resources economy, innovation economy, quality management system, total quality management

How to cite this article: Semenov V.P., Mikhailov Yu.I. Challenges and Trends of Quality Management in the Context of Industrial and Mineral Resources Economy. Zapiski Gornogo instituta. 2017. Vol. 226, p. 497-502. DOI: 10.25515/PMI.2017.4.497

Introduction. Currently quality management as a science and methodology makes much headway both in international companies and in Russian organizations. Practical application of its methods and tools shows that under competent management in this area any organization can achieve significant results and great respect from customers.

Quality management originated from theory and practice of general management, but for quite a long time followed its separate path of development. It is only recently that two concepts – management and quality management – started to be perceived as inseparable, requiring concurrent examination as sciences on how to achieve and enhance performance efficiency [1].

In the context of increasing competition, uncertainty and complexity of external environment, quality management becomes the leading type of management in the organization [2, 3, 6]. The last decade of 20th century was marked with significant changes in the understanding of management theory and practice, and today one of the biggest challenges is seen in providing sustainable and balanced development for all types of business organizations (companies).

Currently the most vibrant research field is management under the impact of intense competition [6]. Key distinctive features of modern global economy include sharp increase in the rates of scientific progress and constantly growing intellectualization of labour and production processes. In this context quality management is regarded as a new interdisciplinary trend in management theory and practice, which combines methods of organizational theory and behavior**,** reengeneering of business processes, strategic, corporate, anti-crisis and innovation management [7].

Tools and methods. In the process of its evolution, quality management has passed all the stages from simplest methods of product screening to quality control and assurance and has finally transformed into the methodology of constant improvement of goods and services – Total Quality Management (TQM). The main driver of this development is the customer. Managers of western companies regard continuous improvement, process approach, involvement and engagement of personnel, corporate social responsibility as essential TQM principles [1]. Today quality management is seen as a certain strategy and tactics of welfare and prosperity for the community as a whole, as well as for individual companies and each person. Now its principles, tools and methods are used in almost every type of human activity.

DOI: 10.25515/PMI.2017.4.497

Market processes lead to the development of various quality management systems, based on TQM principles. The repertoire of modern methods and tools of business improvement, which is already sufficiently large, keeps growing due to the following new approaches [2, 3]:

• project management;

• benchmarking – the method of comparable evaluations;

• balanced scorecard system, offering analysis in four key headings of the company performance: finance, customer, internal business processes and personnel;

• quality function deployment;

• six sigma concept, which started as a method of improving processes by minimizing their variability;

• model of business excellence, used in the mechanisms of quality bonuses;

• models of organizational self-assessment by T.Conti, J.Dalgaard, D.Clemmer;

• TPM (Total Productive Maintenance) system, which provides quality through the efficient maintenance of production facilities, or overall equipment effectiveness.

Quality-focused development strategy implies creation and implementation of approaches that are aimed at finding a balance between the interests of producers, consumers, partners, owners, personnel and the community as a whole; it serves as a certain guarantee of progressive advancement and constant improvement of company performance under the conditions of a dynamic and competitive world.

One of the most popular approaches in the field of quality management, widely applied by companies in various sectors, is development and implementation of quality management systems (QMS), meeting the requirements of international standard ISO 9001 «Quality Management Systems. Requirements». Currently there are more than a million of such systems in the world [7].

International standard ISO 9001 (today – ISO 9001:2015) offers a minimal set of requirements that the organization has to meet in order to embark on the course of attaining total quality management. Not only commercial organizations apply the international standard, it is also widely used in non-profit organizations, state and municipal institutions, medical and educational facilities, and numerous other organizations, where there are specific or typical distinctions of how the object properties are perceived under specific or typical conditions of the object's quality assessment.

It should be noted that in the last several decades approaches to quality management have lost their exclusively technical orientation and now they affect all the processes, taking place in organizations and in the community as a whole. The focus has shifted from technical to socio-economic aspects and their rational coordination [5, 8, 13, 16]. In these days one of the most relevant tasks is to put into practice the idea of quality as a strategy to enhance efficiency of the economy in the context of international integration processes.

Quality assurance is associated with additional quality costs, which serve as an internal economic basis of QMS and allow to identify economic consequences of business decisions. Calculation and analysis of quality costs reveal the actual state of affairs in the field of product quality not only to the management and employees of the company, but also to its shareholders and external consumers of works and services. As a result, information on quality costs creates opportunities to make strategic, tactical and operational decisions taking into account interests of all stakeholders, which promotes increasing performance efficiency and competitiveness. Assessment of quality costs is one of the key elements in the QMS economic analysis [6, 7].

Social technologies can play a crucial role in the processes of social development [16]. Technologies related to the quality of living (e.g., TQM) allow communities to construct social reality in accordance with their understanding; and taking into account new rules of the coming era of information society, they become the most important tool of our times.

DOI: 10.25515/PMI.2017.4.497

One has to agree with the authors of the following publications [2, 3] that the trend for process reengineering has passed. These days from a destructive force it has turned into a practice of restructuring the company. As for the application frequency of these approaches, it is more often that company managers use various methods of analysis and problem solving, which stimulate development and utilization of creative potential – as compared to statistical methods and six sigma approach that have not succeeded in winning the minds of managers. Benchmarking has maintained its positions and successfully continues to assist companies in their desire to improve. The process approach, which allows to create a flexible organization focused on horizontal communications, develops not as quickly as one would wish. Among other approaches, which will undoubtedly advance and actively influence the situation, one can highlight the balanced scorecard system and knowledge management, as personnel training is becoming the foundation of company's sustainable development.

Evolution of quality management systems brought about changes in their object, subject and aims. Nowadays there is a whole variety of quality management concepts which characterize different stages of its development: from Total Quality Control (TQC) and Total Quality Management (TQM) to Total Quality Transformation (TQT).

Each of them reflects the essence of a different method, used in TQM practice to solve a certain type of quality problems. Among the most widely-used tools one can distinguish Quality Circles (QC) and Quality Function Deployment (QFD).

It should be noted that nowadays competitiveness of the enterprise primarily depends on the quality of its management. One has to agree with the authors of publications [3, 4, 6] that quality management is currently becoming the leading type of company management, i.e. 4th generation management. Its key modern achievements include:

• ISO 9000, quality management standards which have undergone four revisions; ISO 14000, a family of environmental management standards; a fully compliant with the latter series of standards OHSAS 18000, related to occupational health and safety, and a scope of other universal and industrial management system standards – there is intensive growth in this area, with a tendency for implementation of integrated systems;

• international organizations: International Accreditation Forum (IAF) and International Personnel Certification Association (IPC), formulating principles and criteria for the accreditation of bodies certifying management systems and professionals;

• international requirements to the procedures of management system certification, applied by accredited certification bodies; international network of partner certification bodies (IQNet);

• International Register of Certified Auditors (IRCA);

• currently established practice of management system audit;

• world's leading companies with certified corporate systems of quality management (over 600,000);

• quality bonuses of various levels.

Millions of enterprises and organizations from almost every country are involved into the implementation of ISO 9000. A great number of professionals across the world master these standards and carry out organizational and methodological work to implement them in their companies. The subjects in this field are numerous certification bodies and consulting organizations. This is a big business and it controls significant financial and material resources [4]. An ideologist and coordinator of this global project is the International Organization for Standardization (ISO) and its Technical Committee (TC 176).

Hence, by the end of 20th century a transition has been made from conventional mass production to lean production, which was defined by Tom Peters as «mass production on demand» [3]. At the beginning of 21st century the profile of coming changes is already outlined, and the transition towards new type of production, so called agile manufacturing, has started. Its main distinction

DOI: 10.25515/PMI.2017.4.497

from lean production lies in the fact that the latter functions under relatively stable conditions, whereas agile manufacturing can adapt even to a highly unpredictable and rapidly changing environment. Summarizing the above, the following situation is observed: both lean production and agile manufacturing, as well as mere consecutive application of the process approach in accordance with ISO 9000 standards can result in the elimination of boundaries in product manufacturing – first across organizations and then across countries.

Integration of management systems. Due to the development of systems meeting requirements of several international standards for management systems, implementation of integrated management systems (IMS) is drawing increasing attention in the recent years [4]. Among such standards are: ISO 9000 standards for quality management systems, ISO 14000 standards related to environmental management, OHSAS 18000 standards in the area of occupational health and safety, SA 8000 standard on social and ethical compliance. They also include standards based on ISO 9000 and designed for specific industries (automobile production, aerospace industry, telecommunications, oil and gas, forestry, health care, construction, food industry, agriculture, railway transportation etc.) Alongside this, worldwide recognition has been gained by international standards for typical computer systems aimed at process modelling, planning and management of production (MRP, MRP-II, MRP-III, ERP, CSRP, CALS, IDEF, ARIS, Business studio etc.)

Advantages of IMS development and implementation include:

• enhanced feasibility in the process of development, implementation and operation of the management system;

• a unified and harmonized management structure;

• reduced costs of development, operation and certification;

• a possibility to combine several processes within ISM framework (planning, management analysis, document control, personnel training, instruction, internal audits etc.);

• increased mobility and adaptability to changing environment;

• greater appeal to customers, stakeholders, investors.

Key distinctive features of modern global economy include sharp increase in the rates of scientific progress and constantly growing intellectualization of labour and production processes [14]. These factors serve as a foundation of the new economy, among other things distinguished by a rapidly growing share of research-intensive production in the overall output of the industry.

Papers [13, 16] offer a detailed overview of the challenges and distinctive characteristics of industrial and mineral resources economy and its modern development. One has to agree with the authors of publication [11], stating that today oil and gas industry of Russia has entered a new stage of development, when its reserves have a high level of depletion (more than 80 %), the majority of hydrocarbon fields are mature and new deposits brought into production tend to contain hard-to-recover reserves. It should also be noted that for Russian oil and gas companies the days of low-cost oil extraction are more or less over. For new deposits, extraction costs are 2-3 times higher than for conventional ones.

At present, Russian oil sector has a very low level of innovations related to management and technological development of the industry. Without large-scale implementation of innovations, further maintenance of oil extraction rates will be impossible. Innovative technology and management solutions are also needed for the development of new promising regions – e.g. deposits in the continental shelf area, in East Siberia and unconventional hydrocarbon resources in West Siberia. World's leading oil and gas companies invest into research-intensive technologies of field development, which allows to substantiate economically efficient methods of recovering problematic hydrocarbon reserves. Innovations in oil and gas sector also facilitate rational subsoil use, provide sustainable functioning of the environment and increase company's profits. Active innovative efforts

DOI: 10.25515/PMI.2017.4.497

have to be combined with efficient utilization of the company's innovative potential. Under current conditions, Russian oil and gas companies need to create a system of strategic management, which will be focused on innovative development and facilitate better realization of the company's innovative potential.

Ongoing transition from industrial to intellectual labour takes place in the context of a grave crisis, unprecedented in its reach over all spheres of financial and economic activity. By sheer nature of capitalism, financial sector tends to detach itself from production and real economy, which is the source of money in the first place. According to various estimates [5], in the modern world only 2-3 % of all financial operations are associated with material production. All the remaining money, tens of trillions of dollars, circulates for its own sake. E.g. in the US, the share of real economy does not exceed 15-18 %. All the rest is service sector, including banking system, insurance etc. Notably, these sectors do not even have adequate state supervision.

Moreover, modern market has created a new type of competition – international competition over the quality of intellectual resources. By some accounts [6], about 60 % of the increment in US national income is provided due to advancing rates of scientific development, i.e. due to knowledge increment. Import of technologies is by an order of magnitude more efficient than import of products, whereas import of intellectual resources is by several orders of magnitude more efficient than import of technologies. That is the reason behind US state policy of importing intellectual resources of high qualification and professionalism. Two opposite processes occur simultaneously – capitalization of knowledge and intellect and intellectualization of capital.

Modern quality management definitely can be categorized as intellectual activity. It is proved by the character of its objectives, covering most diverse processes of the product lifecycle, as well as by the multitude of methods, technologies and approaches, encompassing various techniques of modelling, analysis and forecasting.

Conclusions. The quality of products and services has become an indicator of high labour efficiency and a well-developed economy, a source of national wealth and a sign of decent living standards. 21st century is sometimes called the century of quality.

For Russia the problem of quality in the context of industrial and mineral resources economy has a special significance [10, 12, 13]. Defending the quality standards of Russian products and services as compared to its competitors has a substantial impact on the economy, employment, social and cultural life.

Historical experience shows that in many countries increased attention to quality initiated crisis recovery. Governmental policies focused on quality improvement helped to deal with large-scale crises in Japan and Germany, on US and Europe markets [15, 16].

The policy of Russian companies has to be aimed at high quality and implementation of quality management systems. Modern principles of quality management serve as a cornerstone of international standards ISO 9000, closely related to TQM. TQM concept has refreshed an interest in integration processes of quality management and in solution of management problems in the area of «human capital» reproduction.

REFERENCES

1. Adler Yu.P. Eight Principles That Change the World. *Standarty i kachestvo*. 2001. N 5-6, p. 49-61 (in Russian).

2. Vasil'ev V.A., Odinokov S.A., Borisova E.V. Methods of Quality Management for Innovative Technological Processes. *Kachestvo. Innovatsii. Obrazovanie*. 2016. N 8-10, p. 56-60 (in Russian).

3. Zaika I.T., Smolentsev V.M., Fedulov Yu.P. Systematic Management of Quality and Environmental Aspects. Moscow: INFRA-M, 2014, p. 384 (in Russian).

4. Martsinkovskii D.A., Vladimirtsev A.V., Martsinkovskii O.A. Methodological Aspects of Management System Integration. St. Petersburg: Beresta, 2011, p. 68 (in Russian).

DOI: 10.25515/PMI.2017.4.497

5. Semenov V.P. Interaction of Scientific, Technical and Economic Factors in Quality Management. *Inzhenernoe obrazovanie*. 2016. Iss. 20, p.154-159 (in Russian).

6. Semenov V.P., Mikhailov Yu.I., Men'shakova V.A. Modern Market and Quality Management. *Kachestvo. Innovatsii. Obrazovanie*. 2016. N 8-10, p. 61-66 (in Russian).

7. Semenov V.P., Miroslavskaya M.V. Control over Innovative Business Processes in Quality Management Systems. St. Petersburg: Izd-vo SPbGETU «LETI», 2016, p. 144 (in Russian).

8. Khaikin M.M. Branch Approach to Training of Specialists in the Field of the Public and Municipal Administration for Resource-Extraction Regions. *Zapiski Gornogo instituta*. 2014. Vol. 208, p. 81-86 (in Russian).

9. Khaikin M.M. Subsoil Use within the Context of the Modern Economic Theory Development. *Zapiski Gornogo instituta*. 2015. Vol. 213, p. 100-109 (in Russian).

10. Khaikin M.M. Improvement of Natural Monopoly Regulation in Modern Russian Economy. *Sovremennye aspekty ekonomiki*. 2016. N 5, p. 35-39 (in Russian).

11. Cherepovitsyn A.E., Kraslavski A. Research into the Innovative Potential of an Oil and Gas Company at Different Stages of Field Development. *Zapiski Gornogo instituta*. 2016. Vol. 222, p. 892-902. DOI: 10.18454/PMI.2016.6.892 (in Russian).

12. Cherepovitsyn A.E. Socio-Economic Potential of Large-Scale Projects to Develop Offshore Oil and Gas: Risks and Stakeholder Expectation. *Zapiski Gornogo instituta*. 2015. Vol. 215, p. 140-149 (in Russian).

13. Carayannis E.G., Cherepovitsyn A.E., Ilinova A.A. Technology Commercialization in Entrepreneurial Universities: the US and Russian Experience. The Journal of Technology Transfer, April 2015, Springer Science+Business Media, New York, 2015. DOI 10.1007/s10961-015-9406-y.

14. Semenov V. Methods of Complex Evaluation of the Level of Competitiveness. *Economics and Management*. 2013. Vol. 18 (4), p. 715-720. DOI: 10.5755/j01.em.18.4.4258.

15. Sultani A. Role of Competitiveness' Clusters in Innovation Development of Oil and Gas Complex. Scientific Reports on Resource Issues, TU Berg akademie Freiberg. 2011, p. 239-241.

16. Cherepovitsyn A.E., Ilinova A.A. Ecological, Economic and Social Issues of Implementing Carbon Dioxide Sequestration Technologies in the Oil and Gas Industry in Russia. *Journal of Ecological Engineering*. 2016. Vol. 17. Iss. 2, p. 19-23.

Authors: **Viktor P. Semenov**, *Doctor of Economics*, *Professor*, *Head of Department*, *vps@etu.ru* (*Saint-Petersburg State Electrotechnical University «LETI» them. V.I.Ulyanov* (*Lenin*), *Saint-Petersburg, Russia*), **Yuri I. Mikhailov**, *Doctor of Economics*, *Professor*, *yuim@yandex.ru* (*Saint-Petersburg State Electrotechnical University «LETI» them. V.I.Ulyanov* (*Lenin*), *Saint-Petersburg, Russia*).

The paper was accepted for publication on 14 March, 2017.