

Quality Management System at an Enterprise in the Radio Electronic Industry

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Abstract – In the article there's presented the necessity, external and internal preconditions of building a quality management system (QMS) at the enterprises in the radio electronic industry. There're identified and substantiated industry-specific manufacturing and organizational peculiarities that should be taken into account while designing a QMS.

Keywords – quality management system; radio electronic industry; ISO 9001; building a quality management system

INTRODUCTION

Under modern economic conditions the effectiveness of planning, realization and progressive advance of the activity of organizations in any branch of economics directly depends on the systematic character, openness and transparency of the applied methods and mechanisms of management. Moreover, the success is mainly achieved by means of introducing and maintaining a QMS by which there's understood a part of an enterprise management system in terms of quality. For Russian enterprises in the radio electronic industry the given task is one of the key ones.

The radio electronic industry is one of the key areas of focus of modern industry, the basis of high-technology products of many branches of industry. In any end-products there are either electronic components or radio electronic assemblies, units, modules, devices, systems.

The main technological tendencies in the market of electronic and radio electronic products can be considered microminiaturization, the increase in productivity, the microcircuit density, expanding the functional capabilities, the integration of different electronic and radio electronic products (ERPs) in one product, and the transition to new advanced materials. Together with these tendencies there can also be noted increasing requirements to the ERP qualitative characteristics, first of all to reliability, technological and

operational capabilities, as well as service life and no-failure operation. The products of the electronic and radio electronic industry refer to high-technology, that's why there're placed high demands on their quality.

Radio electronics is the most rapidly-growing branch of industry in the world in which there're realized a great number of innovative projects; the growth rate of the industry for the past 30 years has been on the average about 8 per cent per year.

For today Russia's radio electronic industry comprises more than 1800 organizations occupied with the development and manufacturing of radio electronic equipment, radio electronic systems and devices of industrial, military, household and any other use. At present Russia's radio electronic industry provides 275 thousand working places and makes a great contribution into the country's gross domestic product (GDP).

According to the Russian Federation's State program "Development of the Electronic and Radio Electronic Industry, 2013-2025" (approved by the Decree of the Government of the Russian Federation dated December 15, 2012, No.2396-p) the main aim of the state policy in the sphere of the radio electronic industry is improving competitiveness of the radio electronic industry by means of creating the infrastructure for the development of the priority guidelines, integration into the international market and realization of innovative capacity.

In this regard, an important focal point in the state policy in this branch is the distribution in Russia of the world quality and effectiveness standards. In this case, one of the key mechanisms of managing (reducing) the risk of maintaining inefficiency and low entrepreneurial activity of the companies in the branch is introducing modern quality systems. This measure is aimed at increasing the companies' effectiveness as part of the product quality – one of the most important key

success factors in the product priorities of the branch development.

MATERIALS AND METHODS

The analysis of the peculiarities, advantages and problems of building and perfecting a QMS is presented in the following papers: Dahlgaard-Park, & Dahlgaard [1], Oakland [2], Salgado, Silva, Mello, & Silva [3]; Jain, & Ahuja [4]; Alič [5]; Cagnazzo, Taticchi, & Fuiano [6]; Chatzoglou, Chatzoudes, & Kipraios [7], Salimova [8] and others.

The enterprises in the electronic industry all over the world actively implement and certify the QMS. In 2015 the share of the certificates given to the enterprises in the electronic industry was 9.5 per cent. According to ISO statistics, this branch is the second on the number of ISO 9001 certificates.

In all branches of economics by the beginning of 2016 there had been given more than 1.03 million certificates of conformity to ISO 9001 requirements in 197 countries in the world. There was observed an annual increase in the number of the given certificates; during the period from 1994 to 2015 the growth rate was from 2 to 81 per cent a year (with the exception of 2003 and 2011, that is during the late years of the transition to the new versions of the standard). The leading countries on the number of the given certificates are China, Italy, Germany, Japan and Great Britain (Table 1).

Table 1. The leading countries on the number of the given certificates in ISO 9001

Leading countries	Number of certificates
1. China	292514
2. Italy	131718
3. Germany	52347
4. Japan	46983
5. Great Britain	39950
6. India	36236
7. USA	33051
8. Spain	32526
9. France	27598
10. Romania	20504
Total	713427
Percentage of the total number	69 per cent

Source: ISO statistics: <https://iso.org>

The first ten countries accounted for 69 per cent of all the given certificates. Among the post-Soviet countries the obvious leader is Russia with the number of certificates about 9000, the rest countries have a far smaller number of certificates.

RESULTS

We have found out the prerequisites of building a QMS at the enterprises in radio electronic industry. The necessity of building a QMS at an enterprise in radio electronic industry arises under the influence of a great number of factors and prerequisites which are commonly divided into two groups: external and internal [9].

The external prerequisites of building a QMS include the following:

1) the availability of the state system of compulsory licensing certain operations, productions, products and services. For today, the presence of a QMS corresponding to the requirements of the industrial standards of management or its individual elements is necessary to get a license for the development, production, testing, storage, sales and recycling of ammunition and explosives;

2) taking part in tenders and other tendering procedures for the product supply both on the domestic and foreign market:

a) getting a state order in compliance with the requirements of the Federal Law No. 44 of 05.04.2013 "On contract systems in the sphere of procurement of goods, works and services for provisioning governmental and municipal needs" is in many respects connected with the presence at an enterprise a certified QMS:

b) providing supplies to the enterprises the procurement activities of which are regulated by the requirements of the Federal Law No. 223 of 18.07.2011 "On procurement of goods, works and services by different kinds of legal bodies". For example, in the procurement documentation of the Public Joint-Stock Company "Gasprom", the Public Joint-Stock Company "Russian Railways", the Public Joint-Stock Company "Rostelecom" and so on, a potential supplier having a QMS is welcomed;

c) getting by an enterprise of subcontracts both from foreign customers and Russian export companies often depends on a company having a QMS;

3) the legislation of a series of countries, and since 2000 also Russian, in all disputable situations related to the quality and safety of products and services requires the confirmation of compliance of the product supplied to the market with the current scientific and technical level; in this case the availability of a certified QMS is considered as such a confirmation;

4) an enterprise-supplier having a certified QMS allows it without any extra financial, time and organizing costs clear a number of the set non-tariff (technical) barriers in trade. This practical activity is captured in the agreements developed at the level of the WTO, the Eurasian Economic Union and the international and regional organizations focusing on the issues of technical regulation in foreign trade;

5) The International Electrotechnical Commission (IEC) recommends implementing a QMS at the enterprises of the electronic industry. The ISO together with the IEC developed a number of standards and specifications containing recommendations and requirements to a QMS of the organizations of this branch and the procedures of the evaluation of a QMS;

6) the QMS certification gives an enterprise a necessary level of trust on the market and enhances its business

reputation because a conformity certificate is a generally accepted quality guarantee;

7) the opportunities for insurance, factoring, crediting and some other kinds of the support by the financial institutions of transactions on the product supply to both the foreign and domestic markets require the confirmation of the firm's stability, first of all as related to the risks connected with the quality and safety of products that to a certain extent can be confirmed by the availability of a certified QMS;

8) the prospects of establishing enterprises with foreign capital also depend on the partner enterprises having a certified QMS. In the prospective investors' opinion, the absence of a QMS questions investments security and the possibility of the expansion into new sales markets.

In their turn, the internal prerequisites of the development and implementation of a QMS at the enterprises in the radio electronic industry may include the following:

1) establishing a modern system of management as in the ISO standards of 9000 series there's accumulated the best for the moment management practice based on the Deming cycle of continuous improvements (PDCA), TQM principles and providing the basis for creating the integrated management systems;

2) the availability of a QMS upgrades the quality of an enterprise management on the whole. An optimal combination of managerial functions and the scope of the delegated authority, the responsibility matrix and other tools offered by the ISO standards of 9000 series allow considerable improving the management quality and changing the role of the top management focusing their attention mainly on strategic management;

3) a QMS functioning presupposes the involvement of all the staff in quality assurance at all stages of the product life-cycle – from the demand analysis to the maintenance of the finished products that considerably increases responsibility for the labour quality;

4) a QMS allows considerable reducing rework costs and respectively reducing product costs. Being consumer- and other stakeholders-oriented, a QMS allows anticipating consumers' claims and complaints due to forming a precise mechanism of preventive and corrective measures in the sphere of the quality of the output products and provided services.

5) the QMS availability at an enterprise encourages the growth of its assets: a) intangible assets including good will may increase due to the value enhancement of the trademark of the producer consistently turning out high quality products; b) financial assets may increase due to the income capitalization resulted from the increase in working capital (rise in the prices of high quality products, capturing new sales markets and so on).

No matter which of the given above prerequisites will the key one when making a strategic decision on the development and implementation in a QMS, its basis must become the

leadership approach of a company's management team and careful scheduling of all the project's measures on building a QMS.

DISCUSSION AND CONCLUSIONS

A QMS development is rather a labour-taking and long process. According to the requirements of the international standards ISO 9001, establishing a QMS requires an organization's strategic decision the making of which can be influenced by a company's internal and external environment, risks related to this environment, changing business needs, the status of the output products, employed operations, an organization's size, structure as well as particular goals and reasons for building a QMS. Success is achieved due to the observance of the key TQM principles: a) consumer orientation; b) leadership; c) the workers' cooperation; d) the process approach; e) improvement; f) evidence based decision-making; g) mutually beneficial relations with partners or relationships management.

The process of building a QMS at the enterprises of the radio electronic industry presupposes implementing a number of measures and works that can be conventionally broken into the following stages: set-up, principal, final, improvement. This variant of structuring a project corresponds to the Deming cycle of continuous improvements (PDCA) (Fig.1).

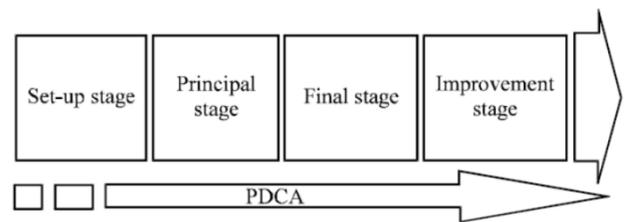


Figure 1. The project's structure on building a QMS of a corporation

At the first stage of the project an enterprise determines the demands and expectations of consumers, the owner and other stakeholders. At the second stage there're developed the strategies and policy in the sphere of quality management. Then there're determined necessary for the strategy implementation business processes as well as the methods and tools of the evaluation of their effectiveness and efficiency. Based on the results of monitoring and measuring the functioning of separate elements and a QMS of an enterprise on the whole there're developed and implemented the measures on the optimization of the organizational structure, business processes, their document support and resources' provision.

In the process of the development and implementation of a QMS it's necessary to take into account the peculiarities of a branch of industry. The peculiarities of building a QMS in the electronic and radio electronic industry follow from the specific character of the branch of industry; they can be divided into organizational and technological. The following technological peculiarities can be referred to the electronic and radio electronic industry:

The electronic and radio electronic branch of industry is the most science-intensive. It brings about a number of requirements: a high level of expenses on the Research and Development to the production output; a great staff number engaged in science and scientific services in relation to the production personnel; the usage of science-intensive products at the initial stage can be inefficient for a long time.

A sophisticated and in some cases unique technology to be developed partly guarantees that the competitors won't be able to copy easily a product and that a great number of the competitors won't enter the market in the nearest time. But on the other hand, if the rework of an article requires some time, it'll considerably increase costs while generating any profit will be delayed.

Scientific-technological progress leads to the quick moral ageing of production. Every year there are developed about 20 per cent new products that requires a quick rearrangement of production and the implementation of a new nomenclature in a relatively short time and with minimum expenses.

In this regard, the increase in the stakeholders' requirements to the product quality as well as the increased competition and scientific-technological progress require building such a QMS that responds to the changing external conditions as quickly as possible and allows ensuring a high level of customer satisfaction.

The following peculiarities can be referred to the organizational ones:

The branch is noted for a wide range of nomenclature including the products of the space industry; those designed for the military application; those for industrial and household use.

One enterprise can produce up to two thousand product names that requires a clear organization of the major and auxiliary processes with the focus on the unproductive expenditures optimization.

The branch embraces different types of production; the articles of the electronic and radio electronic industry can be both made in a single copy and mass-produced. The single-item production narrows down the potentialities of using standard constructions and technological decisions. At the production of unique articles there arises a need to use a large number of the original details, that's why technological processes are developed broadly. The same producing department has to be specialized in executing different manufacturing operations.

The greatest competitive power in the electronic and radio electronic industry is revealed by large enterprises. Almost half of the enterprises in the branch have the number of employees more than 1000 people. On the whole, the share of large and medium-sized (more than 200 employees) enterprises in the electronic and radio electronic industry exceeds 80 per cent of their total number. It brings about an intensive development of

vertically integrated systems. In Russia there're built up enterprises according to the vertical type of integration (according to the cycle: research – development – production). At present there work five large integrated structures (OJSC "Air and Space Defense Concern "Almaz-Antey", JSC "Radio Engineering Concern "Vega", JSC "Concern "Sozvezdie", OJSC "Concern "Avtomatika", JSC "Concern "Control Systems" and three large holding companies within the state corporation "Rostec": JSC "Ruselectronics", JSC "Concern "Radio-electronic Technologies" and JSC "United Instrument Manufacturing Corporation".

The corporate structure brings about taking into account its peculiarities while developing a QMS: the presence of a corporate structure and independent business units, multilevel internal corporate communications, a complex system of centralization and decentralization of management functions, a great number and variety of business processes, regional and product diversification and others.

On the whole, a QMS as one of the most widely-spread management tools allows regulating the organizational structure, management mechanisms, optimizing main and secondary processes at the enterprises in radio engineering industry on the whole with a focus on meeting the expectations of the parties concerned that provides in the long run the increase in the competitive capacity of an organization.

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