

Development of Methodology of Identification of the Quality Management System Processes

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Abstract

The contemporary economical environment requires from companies continuous improvement the quality of their products. The background of enterprises' capability to produce qualitative product is provided by effective quality management system (QMS). The rapidly changing consumer demand and increasing competition require continuous improvement of enterprises' quality management system. The managers of many national companies understand that a well-designed QMS is an opportunity to improve product quality and optimize business processes. Quality management consists of interrelated processes called the QMS processes. The application of process approach in quality management is a necessary demand of contemporary standards such ISO 9001, ISO 9004.

The article observes the issue of development of the methodology of the QMS processes' identification. The article presents different approaches to processes classification and the results of studying of the QMS process models of Russian companies. The authors have elaborated their own approach which complements the previous studies. The authors highlight the role of the specific processes providing the high performance of the whole quality management system.

The presented approach is based on the requirements of ISO 9001:2015 Standard and can be adaptively implied in practice.

Keywords: processes, business-processes, process approach, quality management system, QMS.

1. Introduction

The effectiveness of using the process approach in the industrial company management is widely recognized. Implementation of process management is a mandatory requirement of modern standards based on the quality management system (QMS), which includes: ISO 9001:2015 (the general international standard), GOST RV 0015-002-2012 (standard for organizations of military-industrial complex – MIC), 9100:2011 (standard for organizations from aviation, space and defense industries) and other industry standards.

In accordance with the updated version of ISO 9001 standard on the basis of which all industry standards are formed the organizations have the right to determine the composition of the QMS processes by themselves [6]. Despite the fact that the standard ISO 9001 (version 2008) have been allocated the necessary groups of QMS processes there are still hot disputes concerning the composition of the processes.

At the present time, when some carte blanche appeared in the choice of QMS processes, many specialists are at a loss, which is caused by a lack of understanding of the essence of the process approach to management. Nowadays when we have a carte blanche in QMS processes to be chosen many experts are at a loss because they don't understand the essence of the process approach to management.

Many domestic industrial enterprises, in particular, MIC enterprises still use desktop-oriented approach to the application of the process approach and the main goal for them remains to obtain a certificate confirming compliance of the company's

QMS with modern standards [10]. The most tangible benefits of good business process management are increasing effectiveness and efficiency which formed the quality of products. The applied approach to distinguishing the QMS processes by domestic enterprises of MIC is still a matter of debate. For example, process models presented in the QMS documents of MIC enterprises do not reflect their actual interconnection of processes. QMS processes have been singled out according to the principle of its correspondence to the names of the similar sections of ISO 9001 standard.

The desktop-oriented approach to the application of the process approach is also evidenced by the fact that enterprises do not decompose processes into subprocesses. It is impossible to ensure the quality industrial management highlighting only top-level processes. Each subprocess also requires regulation and management based on the Shuharta-Deming cycle PDCA. As a result all industrial business-processes must be transformed into a network of processes that ensure the creation of value for the final consumer.

The process approach model is individual but for enterprises of the same scope the processes can be the same. However standards and regulations for these processes should be developed in accordance with the circumstances of particular enterprise.

The goal of this paper is to build the conceptual model of QMS processes. With regard to the general objective outlined above, the following general questions were stated as: to review existing approaches to the allocation of processes; to study the process models of industrial enterprises, to clarify the principles

of the classification of QMS processes; to highlight the upper level QMS processes and their interrelations; to form a basic conceptual model of QMS processes.

2. The “process” category content

To identify industrial business-processes we need to understand the content of the business process, as well as principles of its classification. The main definitions of the “process” category are presented in *Table 1*.

Table 1. Definitions of process

Authors	Definitions of process
M. Hammer and J. Champy (1993)	A collection of activities that takes one or more kinds of input and creates an output that is of value to the customer [9].
Ericsson (1993)	A chain of logically connected, repetitive activities that utilizes the organization's resources to refine an object (physical or mental) for the purpose of achieving specified and measurable results/products for internal or external customers [1].
T. Davenport (1993)	A process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action [3].
J. Harrington (1993)	Any activity or group of activities that takes an input, adds value to it, and provides an output to an internal or external customer [5].
D. Garvin (1998)	Sequences of tasks and activities – that provides an integrated, dynamic picture of organizations and managerial behavior. Collections of tasks and activities that together – and only together – transform inputs into outputs [4].
ISO 9000:2015	Set of interrelated or interacting activities that use inputs to deliver an intended result [7].

The definitions of process presented above suggest general conclusions on studied category:

1. Processes create a valuable result, add value for clients.
2. Processes are set of interrelated, ordered actions that have the beginning and the end.
3. Process inputs and outputs may be tangible (e.g. materials, components or equipment) or intangible (e.g. data, information or knowledge).
4. The purpose of process is to satisfy the customer requirements. Customers can be external or internal to the organization, but they are always external to the process. They are outside of the process and receive secondary outputs.
5. Processes determine inter-related branches of activities and control measures to ensure planned outputs. Any organization should carry out the detailed process planning and define management tools in accordance with the context of the organization.

3. Classifications of processes

There are different classifications of the approaches to business-process defining (*Table 2*). In these classifications, we have chosen to stress classifications developed by Michael Porter, David Garvin, Donald Harrington, European Foundation for Quality Management (EFQM) and American Center for Productivity and Quality (APQS).

Comparative analysis of the process classifications shows that the in core of the organization's process model are the primary, supporting (secondary) and development (managerial) processes. The composition of these groups of processes differs in the studied approaches. In particular this concerns the primary processes. It is the authors' opinion that the lists of primary processes identified by the American Center for Productivity and Quality (APQC) and the European Network for the Study of Prospective Indicators (ENAPS) can be successfully applied in the QMS process model of industrial enterprise.

Table 2. Classifications of processes

Process types	Process context
<i>M. Porter</i>	
Primary activities	- related directly to the physical creation, sale, maintenance and support of a product or service. Processes: 1) Inbound Logistics; 2) Operations 3) Outbound Logistics 4) Marketing and Sales 5) Service [8].
Support activities	- support the primary functions above. Processes: 1) Procurement; 2) Human Resource management 3) Technological Development 4) Infrastructure [8].
<i>D. Garvin</i>	
Work processes	- the sequences of activities that transform inputs into outputs. Processes: 1. <i>Operational processes</i> that create, produce, and deliver products and services that customers want. 2. <i>Administrative processes</i> that do not produce outputs that customers want, but that are still necessary for running the business [4].
Behavioral Processes	- the sequences of steps used for accomplishing the cognitive and interpersonal aspects of work. They affect the form, substance, and character of work processes by shaping how they are carried out. Processes: decision-making processes; communication processes; organizational learning processes [4].
Change Processes	- the sequences of events over time. Processes: 1. <i>Autonomous processes</i> have a life of their own; they proceed because of an internal dynamic. The entity or organism evolves naturally and of its own course. 2. <i>Induced processes</i> do not occur naturally but must be created. All planned change efforts therefore fall into this category [4].
Managerial Processes	- a series of actions that lead to the accomplishment of objectives; orchestrating of activities and events and engaging others in tasks so that desired ends are realized. Processes: 1. <i>Direction-setting processes</i> that establish organizational direction and goals/ 2. <i>Negotiation and selling processes</i> that obtain needed support and resources 3. <i>Monitoring and control processes</i> that track ongoing activities and performance [4].
<i>Norwegian TOPP (Productivity Program of the Technology Industry)</i>	
Primary processes	- the central and value-creating processes of the enterprise. They run straight through the company, from receiving supplies from vendors to activities on the customer side [1].
Support processes	- not value-creating processes directly, but rather activities needed to support the primary processes [1].

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Table 2. Classifications of processes (continuation)

Process types	Process context
Development processes	- are supposed to take the value chain and its primary and support processes to a higher level of performance [1].
<i>ENAPS (European Network for Advanced Performance Studies)</i>	
Business processes	1. Product development: product research; product engineering and design; process engineering and design; co-engineering. 2. Obtaining customer commitment: market development; marketing and sales; tendering. 3. Order fulfillment: procurement and inbound logistics; production planning & control; manufacturing and assembly; distribution and outbound logistics; order processing. 4. Customer service: after-sales service; product take-back [1].
Secondary processes	1. Support: financial management; human resource management; information management; maintenance; internal control of health, environment, and safety. 2. Evolution: continuous business process improvement; product research; production technology research; human resource development; supplier base development; development of external relations; strategic planning [1].
<i>APQC (American Productivity & Quality Center) – Process Classification Framework (PCF)</i>	
Operating processes	1. Develop Vision and Strategy 2. Develop and Manage Products and Services. 3. Market and Sell Products and Services 4. Deliver Physical Products 5. Deliver Services Manage 6. Customer Service [2].
Management and support services	1. Develop and Manage Human Capital 2. Manage Information Technology (IT). 3. Manage Financial Resources 4. Acquire, Construct, and Manage Assets 5. Manage Enterprise Risk, Compliance, Remediation, and Resiliency 6. Manage External Relationships 7. Develop and Manage Business Capabilities [2].

The groups of QMS processes were identified in standard ISO 9001:2008. They include processes of management, resources, operations, measurement, analysis and improvement.

Many experts have a question how the QMS processes differ from the business processes of the enterprise. QMS process is a set of interrelated activities that use inputs to deliver an intended result. Quality is achieved not only through actions that support the qualitative performance of other business processes such as business processes monitoring, conducting audits and etc. Improvement in the quality of production is possible only through the improving of the processes that create value as well as through improving the managerial and supporting processes which aid development of primary processes. On the one hand, QMS process model emphasizes the role of single processes which are referred to the achievement of the company's objectives in the field of quality. On the other hand, it shows the role and the place of processes which are referred to the implementation of quality management system in all enterprise processes such as planning, provision, control and quality improvement. The group of QMS processes "Measurement, Evaluation and Improvement" of ISO 9001:2008 standard refers to the authors' selected group of processes that support the implementation of quality management in all enterprise processes.

4. Case-study of defining QMS processes on industrial enterprises

The authors studied the QMS processes of 20 industrial enterprises of the Saratov region with the number of personnel from 40 to 4100 people. All QMS processes were amalgamated and classified into following groups: primary processes, supporting processes, managerial processes and processes for implementation of quality management. The composition of the process groups and their documentation on studied enterprises is shown on Figures 1-3.

The minimum number of processes (5 processes) is allocated at enterprises of chemical sector with number of personnel about 1 000 people. The maximum number of processes (21 processes) is presented at enterprises of electronic engineering industry with 1 000 employees. On average, about 10 QMS processes are documented at the studied enterprises. According to the results of research the size of the enterprise does not affect the number of allocated QMS processes. But in case of

supporting processes it depends on the size of the enterprise. Most of enterprises with fewer than 200 employees allocate only one QMS supporting process the Resource management. It was found that in the case of defense industry enterprises more QMS processes could be defined comparing with other industries. On the average, 17 QMS processes were recorded at the defense industry enterprises.

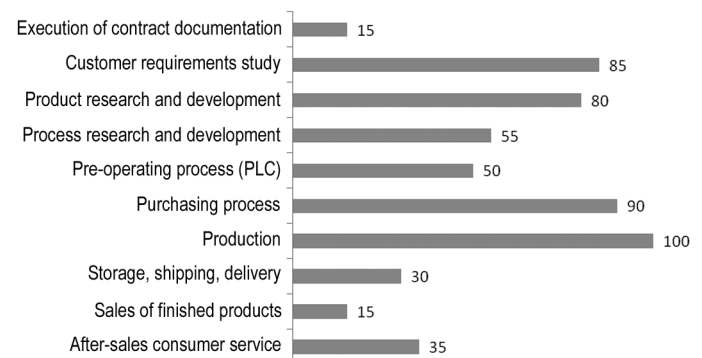


Figure 1. Primary processes of studied organizations

According to the results of research (Figure 1) all studied enterprises identify the production process. It is interesting that three studied enterprises combined production process with other primary processes. The authors see it no rational to combine primary processes as it reduces the ability of enterprise to achieve efficiency and effectiveness process management. It was found that not enough attention is paid to the processes "Process research and development" and "Pre-operating process (PLC)" Only 55 percent of enterprises identified these processes. Also insufficient attention is paid to the process of after-sales consumers services.

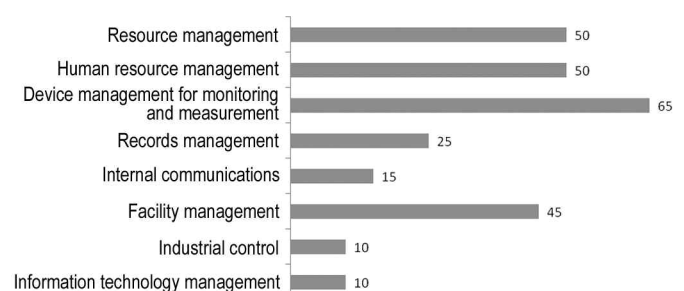


Figure 2. Supporting processes of studied organizations

The study of the composition of the QMS supporting processes (Figure 2) of studied enterprises demonstrated that no one of them has been identifying the process "Knowledge management". The process "Industrial control" is also has a lack of attention from the side of company management. The management is focused on such processes as "Devise management for monitoring and measurement", "Human resource management" and "Facility management".

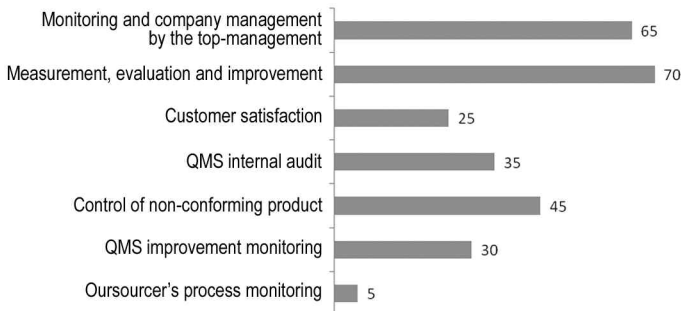


Figure 3. QMS managerial processes and processes for implementation of quality management

Under this research we have studied managerial processes and processes for implementation of quality management (Figure 3). The process "Monitoring, evaluation and improvement" was identified in 70% of studied companies. The process which contains in the title the word "improvement" was found in 65% of enterprises. Lack attention is paid to the process "QMS internal audit" (only 35% of companies are identify this process) as well as to the process "Outsourcer's process monitoring". At the enterprises under investigation activities related to the development of QMS suppliers are practically not implemented. At studied enterprises there are no processes connected with quality planning and risk management.

According to the results of research QMS processes of domestic industrial enterprises shows lack of attention of management to a number of supporting and managerial processes, as well as to the processes for implementation of quality management.

5. The conceptual approach to QMS processes classification

The authors propose the following classification of QMS processes:

- primary processes (P);
- supporting processes (S);
- managerial processes (M);
- processes for implementation of quality management (QM).

The primary processes are related to business operations, their combination depends on the value chain at the enterprise. This group of processes corresponds to the category of business operations according to APQC classification, as well as to the primary processes identified in the EFQM model.

Supporting processes maintain the implementation of the main processes of the enterprise. They do not create value to customer, but they effect on quality of the implementation of the main processes. Basically these processes provide the necessary resources for the implementation of the primary processes.

Managerial processes are focused on the perspective development of the enterprise and formation of the dynamic capabilities of the enterprise.

The fourth category of QMS processes consist of processes for implementation of quality management. The composition of this group of processes was based on the Shewhart-Deming cycle PDCA:

- quality planning (PLAN): QMS processes focused on setting quality objectives and plans for their implementation;
- quality assurance (DO): QMS processes focused on creating confidence that quality requirements will be met;
- quality control (CHECK): processes related to the assessment and analysis of the implementation of QMS objectives and their results;
- quality improvement (ACT): processes focused on improving the company's QMS.

Quality planning intends for defining QMS's objectives and processes, as well as working-out of plans for their achievement. The process of quality planning includes the development of policies and objectives in the field of quality. The starting point of QMS planning is the enterprise strategy. Policies and objectives in the field of quality should be established in connection with business plan as well as its internal and external environment. Quality objectives are formed on strategic benchmarks which are decomposed to the objectives of specific QMS processes.

Quality assurance contemplates the implementation of plans, ensuring the implementation of processes in accordance with established requirements. This process contemplates the implementation of process plans in accordance with established standards, process monitoring, measurement and process management. The main task of this process is to ensure the implementation of QMS objectives. The process of quality assurance includes QMS audit for compliance with established requirements; analysis of enterprise processes; QMS audit of external suppliers and analysis of their processes; management of inconsistent process results.

Quality control focused on QMS's results monitoring, evaluation and analysis. The main task is to analyze the correspondence between the results and planned indicators in order to identify the processes and procedures for development.

The quality control's sub-processes include:

- QMS's efficiency and effectiveness analysis and evaluation;
- measurement and analysis of QMS processes' effectiveness;
- customer satisfaction measuring and analyzing;
- evaluation and analysis of the degree of compliance with the expectations of stakeholders;
- evaluation and analysis of products and services compliance with the established requirements;
- external suppliers' products and services evaluation and analysis of compliance with the established process requirements.

The output of this process is the information which is necessary to develop proposals for introduction of amendments to QMS.

Quality improvement process allows making changes in QMS and its processes in order to achieve planned results in the future. Improvements should be aimed at increasing the efficiency and effectiveness of the QMS and its processes. The process of quality improvement includes:

- Analysis of the needs and opportunities to improve QMS's efficiency and effectiveness;
- Analysis of the needs and opportunities for improving

products / services / processes;

- Analysis of the needs and opportunities for improving the products / services / processes of external suppliers.

The role of the developed model is to identify important processes for the implementation of quality management and which has a lack of attention from the side of company management.

The processes for implementation of quality management are divided into sub-processes in accordance with the PDCA cycle. We consider to it is necessary to identify the processes of leadership and risk management. Risk management should be implemented within the frameworks of each processes of the enterprise to enhance process stability through the advance preparation in relation to potential events that may occur and have a negative or positive impact on the process.

Also it is important to integrate QMS processes with company strategy. The latest version of the ISO 9001 standard focuses on ensuring the QMS complex of the company's strategy. The one of main problems for defense industry enterprises is to ensure that objectives in the field of quality are in compliance with company strategy. As these companies work with government orders they give insufficient priority to the issues of strategic development. They are to pay more attention to the role of strategy in the QMS. And managerial processes should be identified in accordance with the type and scale of the enterprise in its further practical application. The presented approach to the classification of processes provides further insight into the location of the QMS in the general model of the business processes of the enterprise.

Further practical application of the QMS's processes model developed requires its adaptation to the enterprise's context including the internal and external environmental factors.

6. Conclusion

It is possible to develop QMS if the specialists understand the content of the process management and realize the role of QMS in the general management system.

Managers of modern industrial enterprises strive to improve the product's quality and reliability and enhance the efficiency of the whole enterprise. As international and national practices show the efficient and effective quality management system is

the foundation of successful enterprises' development. The QMS of each enterprise consists of the set of processes. Well designed model of QMS processes contributes to the company's ability to cope with external and internal challenges creating a sustainable quality of products and increasing the enterprise's competitiveness.

The main aim of the theoretical material reviewed, practical experience presented, authors' QMS processes' classification given is to provide the better understanding by specialists of the content of QMS's processes for further development of the whole quality management system.

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