

# Data Analysis Model of High Self-Organization Processes

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**Abstract.** The article is devoted to the development of quality management systems in terms of the growth of process self-organization. Formulas for calculating the share and level of self-organization of processes are given based on the transaction expenses, compliance, and non-compliance costs. Forms of maps and schemes for monitoring processes of quality management systems with a high degree of self-organization are proposed.

## 1 Introduction

Nowadays, the share of process self-organization of the quality management system grows in enterprises of the machine-building industry, because of the increase in the complexity of the technical and organizational components of production, a hidden consumer. In other words, the growth of the share of self-organization is an objective reason for the development of quality management dictated by modern market trends.

Since self-regulatory processes can have both positive and negative directions for an enterprise, adequate ways should be found to assess, analyze, respond and create conditions for such processes that ensure the competitive development of the enterprise [2-4].

## 2 Key research findings

To assess and analyze the share of self-organization, the ratio of intra-process organizational and transaction costs is used. If transaction expenses are higher than organizational costs, the role of self-organization is high [1].

Transaction and organizational costs are interrelated concepts, an increase in some leads to a decrease in others and vice versa.

The transaction expenses of the business process of the quality management system should include:

1. Search for information about clients, suppliers, and outsourcers;
2. Measurement and analysis of the level of quality of manufactured products;

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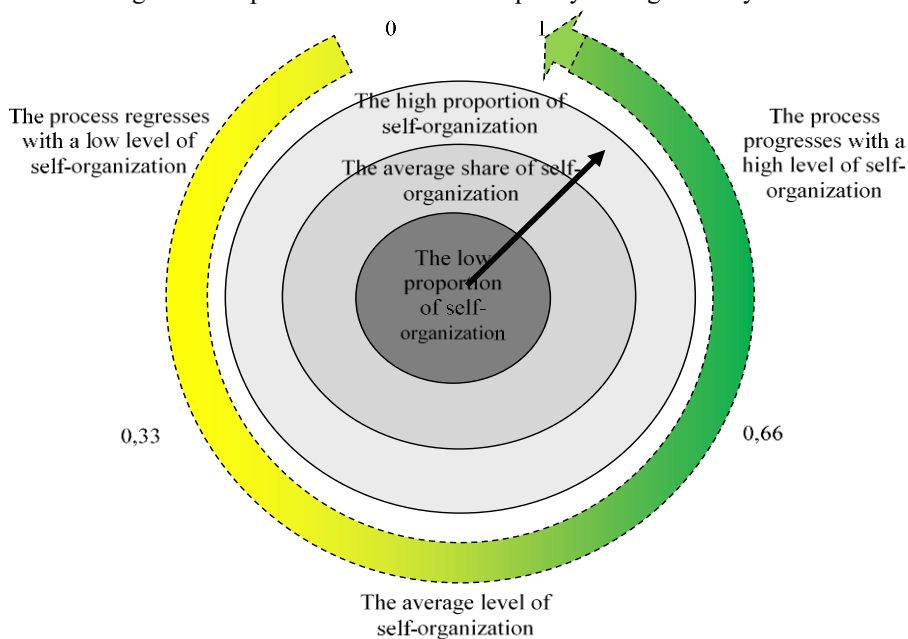
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3. Decision-making and their consequences;
4. Development of new means and production technologies;
5. Process optimization

The organizational costs of the quality management system business process should involve:

1. Development and maintenance of standards;
2. Certification of production;
3. Personnel certification;
4. Identification and traceability of products.

If self-organization is evaluated as a vector value, the value of the vector will define the share of self-organization, depending on objective circumstances, such as the development of design and technology, the emergence of a hidden consumer, and others. The direction of the vector will characterize the level of self-organization, which depends on subjective factors, such as the development of the organization's quality management system, the level of standardization, and others (Fig. 1). In other words, the share of self-organization is a value that is formed independently of the enterprise management, and the level of self-organization is ensured through the competent construction of a quality management system.



**Fig. 1.** Self-organization vector.

The share of self-organization (vector value) is proposed to be estimated based on the theories of transaction and organizational costs [2]. The level of self-organization (direction of the vector) is suggested to be assessed based on the theories of transaction expenses and economics of quality.

The share of self-organization in the processes of quality management systems is evaluated using the following criterion:

$$K = Itr / (Io + Itr) \tag{1}$$

where  $Io$  – organizational costs;  
 $Itr$  – transaction expenses.

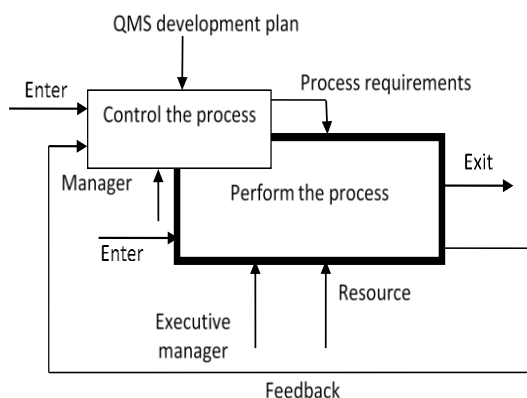
The closer the K index to zero, the lower the share of self-management. The self-management level of quality management processes is estimated by the following criterion:

$$Km = Ic / (In + Ic) \tag{2}$$

where In – business process costs for non-conformance;  
 Ic – business process costs of conformance.

The closer the value of the Km index to zero, the lower the efficiency of self-management. Consequently, in the case when the share of self-organization in the quality management processes based on the results of calculations is high, the criteria for assessing the effectiveness of the process (clause 4.1 of ISO 9001) should be revised and include the results of calculations of Km in the procedure "management review" (clause 5.6 of ISO 9001).

Share gain of self-organization leads to some of the manager's functions are delegated to the performer (Fig. 2). They can be presented in the process map, as a documented procedure that provides personnel with appropriate powers and reflects the areas of responsibility for the process (Table 1).



**Fig. 2.** Integration of production and management processes.

**Table 1.** The example of a process map form with a high share of self-organization.

Process name				Changed №	Date of change	Page
№	Block scheme of the process	Procedures, functions performed in the process		Documents	Note	
		Executive works	Managing works			

The role of self-assessment procedures increases under this development, the audit is aimed at ensuring the integration of a separate process into the quality management system. Moreover, as the practice has shown, the implementation of clause 5.6 of ISO 9001 (the analysis by management) is partially carried out by the process manager. For example, the manager independently analyzes the level of customer satisfaction and forms a product improvement plan.

Monitoring of the quality management system process (clause 4.1 of ISO 9001-2008 requirement) will change in terms of assessing the control of the process. Controllability of the process with the low share of self-organization was evaluated by analyzing the effectiveness of corrective and preventive measures, the changes in performance indicators and audit procedures. In turn, the high share of self-organization assesses controllability not



organization, and secondly, specific performers not only clarify the wording but also guarantee intra-company development (Table 2).

**Table 2.** Planning for the quality management system.

Quality policy statement	Quality management system objectives		Activities of structural divisions				
	Name	Indicators	Name	Belonging to the business process	Executor	Period	Status
1	2	3	4	5	6	7	8

To fulfill the ISO 9001 requirements in terms of proof of integrity (clause 5.4.2) when planning the quality management system, the following requirement is suggested to be indicated next to the signatures, in addition to the mandatory signing of this document by all heads of structural divisions: «By signing this document, you expertly confirm that the goals of the organization are consistent with the Quality Policy, are achievable through the listed activities, and also do not contradict the corporate culture of the enterprise».

### 3 Conclusion

For higher educational institutions, the activities of the structural divisions will be the plans of the departments, in which the state dictates the regulations on the mandatory advanced training for the academic staff, the improvement of training courses, the work with lagging students, etc. Thus, the department plan will become one of the tools for assessing the compliance of the quality policy. For large enterprises, including universities, it is too burdensome to draw up an organization plan annually in the form of table 2. Therefore, they should form a matrix of communication between the provisions of the policy, goals, and plans of departments.

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