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**EMPIRICAL MODEL FOR EVALUATING THE QUALITY OF
ORGANIZATION MANAGEMENT**

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Abstract

The paper considers the main stages of development of quality management concepts. Diagnostics of the organization's management system was performed. It is economically confirmed that the growth rate of losses outstrips the growth of the organization's profit. A terminological analysis of Russian-language and foreign resources on the definition of "personnel involvement" is carried out. Based on the integration of approaches, the concept of "personnel involvement" is clarified. A brief description of the organization's personnel is considered. The main factors influencing the value of the organization's profit are identified. With the help of economic and mathematical modeling, an adequate regression model of the dependence of the organization's profit on internal and external factors is constructed. We have determined that the involvement of staff directly affects the effectiveness of the organization. This model can be further considered as an agent-based approach in simulation modeling. The forecast of indicators and the level of reduction of losses of the organization of the fat and oil industry is made.

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1. Introduction

The search for approaches to assessing the quality of organization management is a paramount task in a multitasking economy and environmental uncertainty. The problems of most organizations according to the results of a study conducted by American Center for Productivity and Quality (Holly & Morgan, 2018) are associated with the creation of criteria for evaluating, analyzing and monitoring the organization's activities. Moreover, as noted in the report, the main difficulties in the development of assessment models arise due to: the presence of a large number of factors of the internal and external environment; difficult to measure parameters such as employee engagement and satisfaction; the need to revise indicators in connection with the equalization of flows and the regulation of labor productivity in the framework of a process. The existing many approaches to the definition and assessment of the quality of organization management poses an urgent task to clarify this concept and develop integrated assessment indicators. And the lack of methods for measuring the economic effect of an increase in the level of involvement in the implementation of integrated management systems emphasizes the relevance of this work.

2. Problem Statement

Despite the existence of published economic benefits from the implementation of standards for management systems, which is estimated in the range of 0.15% and 5% of annual sales revenue and the proven applicability of standards in any industries and fields of activity (Economic benefits of standards, 2017), the relationship between the financial result of the organization and the presence of certificates issued for compliance with the requirements of the standards. The mechanism determining the receipt of declared economic benefits requires clarification in specific practical conditions.

Although the search for the relationship between efficiency and the availability of quality certificates can be found in the works of Troshkova (2013). The main criterion for evaluating performance is the degree of satisfaction of end users. In modern literature, there is no convincing scientific position on the existence of a relationship between the degree of satisfaction of end consumers, labor productivity and employee involvement. Over the past three years, obtaining economic advantages has been associated with the "implementation of measures to develop personnel; the introduction of modern management methods based on information technology; with corporate knowledge management systems" (Levshina & Troshkova, 2017, p.13). Belyakov and Sokolov (2019) developed an index designed to measure employee engagement. The growth of labor productivity as a result of improving the process of staff involvement based on the application of international standards was noted by the authors of this article (Abakumova & Troshkova, 2017).

According to clauses 7.3. ISO 9001:2015 and GOST R 56404-2015 for the effective functioning of the organization, employees should be aware of their contribution to the effectiveness of the quality management system and lean production, including the benefits of improvement. In accordance with clause 7.1.4 of GOST R 56404-2015, the socio-psychological environment should be considered as the basis for involving employees of the organization in the search for and reduction of real and potential losses, the process of continuous improvement of value stream. In accordance with clause 9.1.2 of GOST R 56404-2015, monitoring and measurement should be carried

out in the following parts: achieving goals, involving staff, continuous improvement. The indicators characterizing the effectiveness of the functioning of the quality management system and lean production and their processes depend on the degree of involvement of employees and on how well employees with the appropriate level of competence are adequately involved and effectively integrated into the organization's processes. The role of the leader in planning the goals of the organization and ensuring their achievement according to environmental conditions and distributed opportunities is clear to everyone. And the need for active actions to involve workers in the implementation of the goals and the place of the results of these actions in the growth of the organization's profit and reduction of losses needs mathematical confirmation.

3. Research Questions

Issues in the field of quality management, the formation of quality management systems, their integration and implementation were considered in the scientific works of many foreign and domestic researchers: U.E. Deming, J. Juran, K. Ishikawa, T. Conti, F. Crosby, G. Taguchi, A. Feigenbaum, J. Harrington, V. Shukhart, Yu. P. Adler, V. Ya. Belobragin, B. V. Boytsova, E. A. Gorbashko, O. A. Gorlenko, V. V. Efimova, G. N. Ivanova, N. D. Ilyenkova, E. A. Kazimirovsky, V. A. Lapidus, D. S. Lviv, I. I. Mazur, V. D. Matsuta, S. V. Ponomarev, T. A. Salimova, M. Z. Svitkin, V. M. Sitchenko and others.

4. Purpose of the Study

Currently, the established approaches to the quality management of organizations are quite diverse. First of all, this is explained by the difference in prevailing views, applied strategies and tools.

The main stages in the development of quality management concepts are related: 1970-1980. The concept of universal quality management (TQM) - organizations must deal not only with issues in improving product quality, but also in improving management quality; 1980-1990 The concept of universal quality management (UQM) - is the total coverage of quality management; 1990 to present time The concept of management based on quality (MBQ) - management based on: international standards; certification systems; audit of quality systems; 2010 to present time - The concept of quality based on information technology (QIT) - the use of information technology and the transition to digitalization of management systems; 2018 to present time - The concept of lean manufacturing - increasing productivity through tools of lean manufacturing (Terebkin, 2012).

The aim of this work is to develop an empirical model of the dependencies of indicators in the system of assessing the quality of organization management. The object of the study is the organization of the oil and fat industry, located in the East Siberian region, in particular the Krasnoyarsk Territory.

5. Research Methods

The analysis of the activity of the organization of the oil and fat industry showed that the dynamics of the growth rate of losses of the organization exceeds the growth of profit (Figure 01).

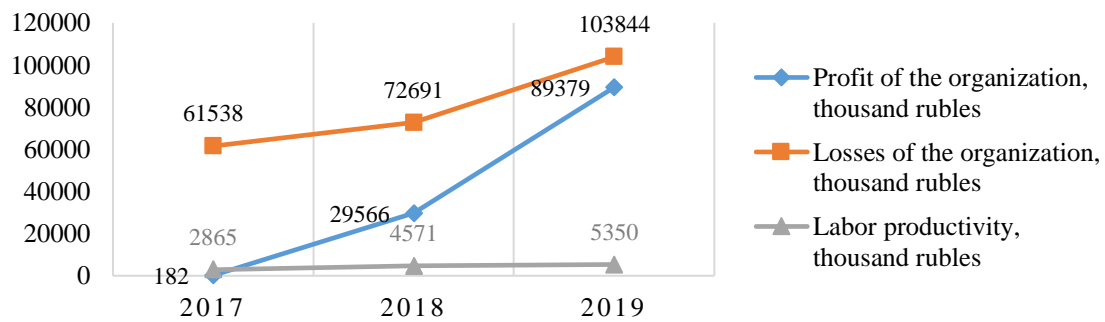


Figure 01. The dynamics of economic indicators of the organization

Thus, the involvement of staff plays an important role in generating profit for the organization and reducing losses that are consistent with strategic goals and are in line with the main priorities and values of the organization. Based on our survey, for employees of the organization of the oil and fat industry, involvement means that they should own issues that are relevant to their work, and have a personal interest in the results of the ongoing process.

We examined approaches to understanding the term “employee engagement”, taken from various sources (Table 01).

Table 01. Basic definitions of the concept of “employee engagement” (fragment)

Authors	Definition
Solomonidina N. L.	Employee engagement is the process of encouraging a person, using internal personal and external factors, to certain activities aimed at achieving individual and common goals;
Tsareva N. A. Chernaya Yu. A. Shamakhova Yu. V.	Employee engagement is a physical, emotional, and intellectual state that motivates employees to perform their work duties while showing the best results;
Lisoy A. N. Krygina A. Yu.	Staff involvement is a qualitative feature of the staff, which is expressed in the understanding of the significance of their contribution to the company's activities and development, the desire to grow through initiative and innovation;
Chulanova O. L. Pripasaeva O. I.	Employee engagement is the degree to which an employee's values match those of the organization.

By staff involvement, we will understand how efficiently the working time is used by the employees of the organization, how quickly the loss of working time was detected and their true cause was established. We reviewed a brief description of the personnel of the organization of the oil and fat industry. Today the total number is 135 people. Basically, the prevailing staff with higher education (food industry, trade), their share is more than 44% of the total. The results of the analysis of the personnel movement show that the turnover rate increased by 4.1% and amounted to 7.1%, which indicates the retirement of employees for various reasons. Using economic and mathematical modeling, an adequate regression model is built for the dependence of the organization's profit on internal and external factors. At the first stage, the hypothesis of the correspondence of the organization's profit to the normal distribution was checked (Alexandrovskaia & Kirillin, 2017) (Table 02).

Table 02. Criteria for checking the normal distribution (fragment)

Criterion	Criterion value	Conclusion
Modified Kolmogorov criterion	0.088	The normality hypothesis is not rejected
Modified Smirnov criterion	0.079	The normality hypothesis is not rejected
Cramer-Mises criterion	0.045	The normality hypothesis is not rejected
Anderson-Darling criterion	0.371	The normality hypothesis is not rejected

With a 95% probability, the hypothesis of a normal distribution of the organization's profit is accepted. This conclusion is supported by a graphical representation of the profit distribution and theoretical frequencies of the normal distribution (Figure 02).

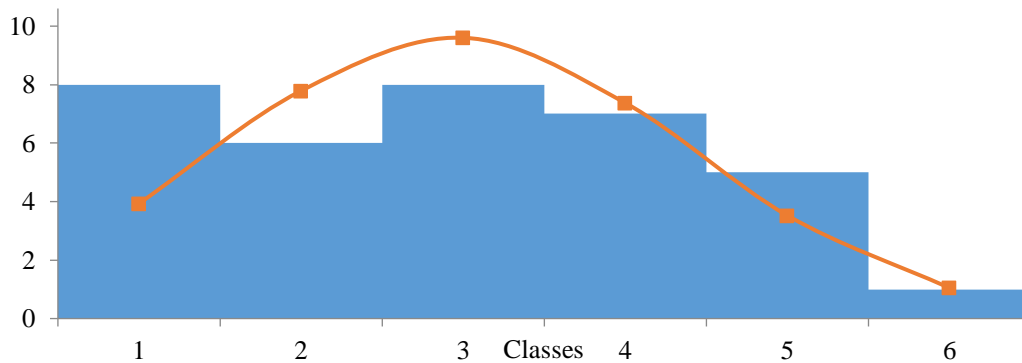


Figure 02. Histogram of normal profit distribution

As factors affecting the profit of the organization, were selected:

x1 - loss of organization (defective products; shortages of inventory; non-compliance with incoming control requirements; downtime, etc.), thousand rubles;

x2 - product safety (number of poisonings), times;

x3 - involvement of the organization's personnel, %

The involvement of the staff was evaluated on a scale (Pushkina, 2016; Vorontsova & Chumachenko, 2017) (Table 03).

Table 03. Scale for assessing staff engagement

Name of indicators	Value
Destruction zone	< -0,4
Zone of uncertainty	-0,4 до -0,1
Zone of indifference	-0,1 до 0,3
Performance area	0,3-0,6
Effective Development Zone	> 0,6

At the second stage, a multiple regression linear model was built:

$$y = -7666,745 - 1,17x_1 + 336,47x_2 - 86,64 x_3,$$

At the third stage, the statistical significance of the regression coefficients was checked (Table 04). The significance was assessed using the student's criterion (Popov, 2016).

Table 04. T- statistics

	Odds	Standard error	t- statistics
Y-intersection	-7666.45	1027.429	-7.462
Losses of an enterprise, thousand rubles (x1)	-1.170	0.077	15.235
Product safety, (number of poisonings) (x2)	336.473	202.985	1.658
The involvement of staff,% (x3)	-86.642	14.401	6.016

To check the adequacy of the model, the Fischer criterion was calculated (Eliseeva, 2018) and it was concluded that the relationship between the variables is significant, and the equation is adequate to empirical data.

The absolute values of the t-statistics of the coefficients are compared with the critical value of the Student criterion, determined for the significance level $\alpha = 0.05$ and degrees of freedom $v = n - m - 1 = 35 - 3 - 1$ $t_{crit.} = 2.04$. Table 4 shows that “product safety” with a probability of 95% is not a statistically significant variable, since the calculated value of t-statistics ($t_{x3} = 1.658$) is lower than the critical student criterion of 2.04. Thus, it was revealed that the loss of the organization and the involvement of personnel has a significant impact on the profit of the organization.

Figure 03 shows a direct linear relationship between profit and percent involvement. Obviously, with increasing interest, the value of profit also increases.

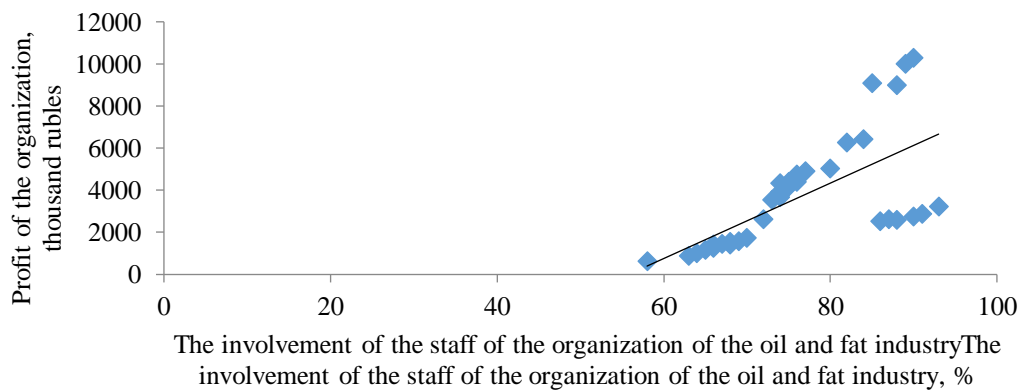


Figure 03. Linear relationship of profit and employee engagement

6. Findings

Consider the involvement of staff in the current and future state of the organization (Table 05).

Table 05. The involvement of the organization's staff (V_p , %)

Organization Current Status					Prognosis	
Shift time, min	Losses of working time, min	V_p , %	Reasons for unnecessary expenses of working time	Projected activities	2021	2022
					possible reduction of losses on	
480	137	71.4	Cause 1 Cause 2 Cause 3	Event 1 Event 2 Event 3	52%	75%

We have compiled a forecast for reducing losses in the organization of the oil and fat industry (Table 06).

Table 06. Forecast of performance indicators of the organization of the oil and fat industry

Indicators	Option		
	Base	Design	
	2019	2022	2021
1. Losses of organization, thousand rubles	103844.4	51922.2	25961.1
2. Personnel productivity, thousand rubles	5349.6	5734.2	5926.6

7. Conclusion

As a result of the study, it was found that the most serious influence on the value of the profit of the organization of the oil and fat industry is affected by the involvement of personnel and the loss of the organization associated with product quality and management quality. The constructed adequate regression linear model showed that with the help of it is possible to build a reliable forecast of the organization's profit behavior with known values of indicators.

In the future, it is planned to create information support for improving the accuracy of the forecast, it is also possible to create simulation models that will allow you to visually observe the involvement of personnel and losses of the organization. These models can act as a tool for making a forecast with known values of indicators, in the future you can consider aspects of the agent approach in the simulation modeling.

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