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The prospects of modern quality management approaches integration (on the example of the Republic of Tatarstan)

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Abstract. In the research basing on the quality management modern approaches and the practice of the Republic of Tatarstan leading industrial enterprises are estimated the possibilities of energy management systems improving (with intensive introduction of modern industrial equipment) through the integration of the quality management system. In our study is made an analysis of present energy management systems functioning indicators and demonstrated the further need for these two systems integration in the modern management.

1. Introduction

Recently it's possible to see the widespread introduction of robotic systems at the modern industrial enterprises for the purpose of productivity and quality increase in and cost cutting. The wide scales of implementation lead to the growth of power losses that is fraught for the ecology [1, 2] and development of the enterprise, resulting in need of the qualitative organization of work and technical equipment maintenance. The enterprises aim at balance of customers' satisfaction and systematic operation when asking to quality management. The existing approaches to quality management can be divided into three units: statistic methods, verbal directivity tools and the complex methods integrating the two previous units. In the research is analyzed the complex methods as the methodology of the integrated quality improvement like the most effective variant in the most real industry cases.

2. The problem definition

The Quality Management System (QMS) in the current business often could be defined like the firm stability and success guarantor and here it is necessary to determine the QMS [3] model. The QMS model is the set of the principles, methods, requirements to different aspects and processes of activities, the criteria determining the level of perfection of these processes and methods of their assessment which in total define all processes of organization activity directed to achievement of the required results on quality.



The modern quality management methods are the FMEA, QFD, "6 sigma", kaizen, "Lean production", "5C", CRM, TRM, benchmarking, "20 keys" [4]; the suitable choice depending on the firm purposes and the management strategy could propose to produce the high-quality services production. Quality policy is one of the key organizing methods for the company goals achievement. The variant of some noted above complex methods realisation and the current major quality policy tools could be presented in such management instrument like the energy management. An experience of the industrial organizations and firms from the such countries like the Netherlands, the USA, etc. which earlier implemented the energy management systems demonstrate the average annual growth of energy efficiency at least in 2-3% per year, the compatible results are in the agriculture sector [5], etc. Actually in the case of energy management methodology using is realized the systems approach to energy control in the organizations, but for many Russian companies the energy management implementation is mostly a trendy factor or it is concerned with the legislation requirements and in less degree based on the readiness to increase energy efficiency [6].

The GOST R ISO (national) standard 50001 sets the requirements for the energy management system development and improving [7], but the real application of the standard could be ineffective without its quality management system implementation. Obviously, the most effective way here could be concerned with the integrated QMS using. The basis for the integration with the ISO 9001:2015 standard requirements could be the such additions in the quality model elements like the "organizational knowledge" and "knowledge management" as the cumulative knowledge and abilities of all firm staff which could be practically used like the complex concerned with the knowledge and abilities of certain experts and knowledge in the organization information funds, i.e. the certain level of knowledge allowing to create the most qualitative product in shorter periods. The application of risks estimation methods according to the 9001:2015 standard requirements here also could be analysed as the way of the preventive actions efficiency increasing [8], etc. Moreover, the novelties above in the standard version exclude the necessity for the special "system approach" [9] term marking and multiply its using in the text.

The energy management (EM) realising as the integral system made for the specific firm needs and conditions usually allows to gain the multiplicative effect and to increase energy efficiency [10]. According to the Strategy of development for the Republic of Tatarstan (one of the leading Russian Federation regions) before the 2030 the one of the major purposes is "the "smart economy" improving"; the implementation and commercialization of new materials, products and technologies [11], [12], etc. Basing on the previous analysis we could note that the local large firms often spend the resources (and power) with the small profit [13], [14]; then managers employ the experts to develop saving measures like the energy production with trigeneration technologies, or use some alternative sources, etc. [15]. The energy management implementation is a labor-consuming process but the known practice demonstrates certain results in the total productivity growth. Looking on the statements noted above it is necessary to analyse the possibilities of such approach using.

3. Problem solving

Let's look at the leading firms and enterprises results and available characteristics of its quality systems and policies analyzing the Republic of Tatarstan practice. PJSC «Nizhnekamskneftekhim» is the one of the Europe and the Commonwealth of Independent States petro chemistry production leaders [16]. As it is noted in its open documents the energy saving is the one of its most advantageous activity directions. The important management instruments here are the operations on certification for compliance with the international standards requirements and the enhancement of integrated quality control system. Three energy management programs spared 350 million kWh; the total energy capacity of production is reduced more than on 43%.

JSC «Kazanorgsintez» is the one of the largest Russian Federation chemical firms [17]. At the heart of quality work are the principles of the maximum directivity on the supplier and the special attention to the ecology issues. In 2015 it was signed the program of reliability augmentation lines with the

electro-and heat supplies and the WTF equipment for 2016-2020; also are implemented the projects basing on the increasing efficiency of secondary production using methods, etc.

The «KAMAZ» Group of Companies is the largest country autocorporation in the Russian Federation. The company notes that the quality management system is an instrument of competitive production and service achievement satisfying the customers waiting and providing the basis for the stable financial position. It was established the creation by the all company's subdivisions the medium-term program "Actions for the cost cutting on energy carriers of rather adopted annual budget", reducing the expenses to 5% annually [18], etc.

Analyzing the possible mathematical approaches for the task solving here we could propose that choosing among the possible calculation methods [19, 20] or the well-distributed in the quality management different variants of diagrams and the block diagram [21] etc. we could conclude that in this case in will be better to use firstly the such available decisions like the simple expert rating estimation basing on the noted firms open data sources.

See below the results of quality management policy status analysis for all these cases (Table 1).

TABLE 1 - AN ANALYSIS OF THE MODERN QUALITY MANAGEMENT APPROACHES USING

№	An analysis of the modern quality management approaches using			
	Methodology	«Nizhnekamskneftekhim»	«KAMAZ »	«Kazanorgsintez»
1	FMEA	5	1	5
2	QFD	4	1	4
3	«6 sigma»	3	3	5
4	«Lean production»	1	1	1
5	Kaizen	2	1	4
6	«5 C»	1	2	4
7	CRM	4	1	4
8	TRM	1	1	4
9	Benchmarking	1	1	1
10	"20 keys"	3	3	4
Total		25	15	36

The quality management instruments using on these firms basing on its open documents, etc. is estimated in 5 scores scale: "1" - the system is implemented, "2" - implementation result is neutral, "3" - implementation will not bring big changes, "4" - it is recommended, "5" - implementation is necessary. It's possible to make the next conclusions here: JSC «KAMAZ» actively uses the modern approaches of quality management, the policy of activities and quality is effective; JSC «Nizhnekamskneftekhim» successfully uses the modern quality tools; JSC «Kazanorgsintez» needs the using of suitable SMK. The next step is the analysis of the ISO 50001 standard (national version) using in these organizations in the table below, basing on the possible companies open data sources.

TABLE 2 - GOST R ISO 50001 "ENERGY MANAGEMENT SYSTEMS" STANDARD USING

Status	GOST R ISO 50001 "Energy management systems" standard using		
	«Nizhnekamskneftekhim»	«KAMAZ»	«Kazanorgsintez»
Used	+		

Status	GOST R ISO 50001 "Energy management systems" standard using		
	«Nizhnekamskneftekhim»	«KAMAZ»	«Kazanorgsintez»
Not used			+
Planning		+	
Remarks	Implemented and used standard GOST R ISO 50001:2011	GOST R ISO 50001 implementation was planned for 2015	The GOST R ISO 50001 implementation is recommended

From these tables it is visible that the JSC «Kazanorgsintez» rather needs the ISO 50001 standards implementation; «KAMAZ» PTC not fully adheres to the ISO 50001 standard and only some of its subsidiaries implemented this standard; PJSC «Nizhnekamskneftekhim» successfully uses the standard. Thus, here it is almost clear that the JSC «Kazanorgsintez» needs an implementation of the modern integrated quality management approaches and the acceptance of the ISO 50001 standard. The «Nizhnekamskneftekhim» company successfully uses the most of all modern methods of quality policy, energy systems and resource-saving. «KAMAZ» PTC Group of Companies is the company which adhering the successful quality policy respectively the using of the "Systems of Energetic Management" standards is quite expedient.

4. The conclusions and the further researches directions

The using of the most famous energy-saving innovative technologies at the moment is obviously technically and economically profitable. The prospects of the energy management integrated system implementation and the modern quality management approaches are predetermined by the existence and effective interaction of the harmony subsystems. Such integrated system assumes the existence of a competitive quality policy with the aspects of technical elements maintenance due to the environment threats.

Looking at the attractive markets and industry sectors with the speedy growth in the Russian Federation we could note that based on the signed and realised wide government policy, etc. the growth of industrial electrotechnics production and using in the case of current business challenges raises an issue about the new requirements for the high-quality control and production management. As we have seen above the integrated quality management systems and energy management implementation in the Russian conditions could give the completest spanning of production control and due to this also an increase in the productivity growth which is the one of the main task of modern management [22].

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References

- [1] Kashapov N F, Gilmanshin I R, Gilmanshina S I and Galeeva A I 2016 Landfill energy complex based on the renewable energy installations *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 134** DOI: 10.1088/1757-899X/134/1/012007 p 1
- [2] Kashapov N F, Gilmanshin I R, Gilmanshina S I and Galeeva A I 2017 Instrumental research

method of qualitative composition of landfill gas in the surface layer of landfills *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 240** DOI: 10.1088/1757-899X/240/1/012021 p 1

[3] Milova V M 2014 *Total Quality Management* (St. Petersburg: Publishing House GUAP) p 213

[4] Gorbunova O I and Guseva I K 2016 *The instruments and methods of quality management* (Irkutsk: BSU Publishing House) pp 47-73

[5] Kashapov N F, Nafikov M M, Gilmanshin I R, Gazetdinov M Kh, Nafikova M M and Nigmatzyanov A R 2017 Energy-saving technologies of cultivation of sugar sorghum *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 240** DOI: 10.1088/1757-899X/240/1/012032, p 1

[6] Tretyakova M V 2015 The energy management system as a tool for improving energy efficiency of the organisation energy complex Russia, *Vestnik Universiteta* **vol 13** (Moscow: The State University of Management Publishing) pp 60-65

[7] GOST R ISO 50001:2012 "Energy management systems" URL: eitus.bstu.ru/shared/attachments/124979/ (available at 11.02.2019)

[8] Chaika I I 2014 The ISO 9000:2015 family standards *The continuous improvement of the organizations' activities seminar materials* (Moscow: The Scientific Training Center of quality management systems and certification, National University of Science and Technology MISIS Publishing) pp 1-5

[9] Kashapov N F, Konahina I A, Gil'manshin I R and Fahreev N N 2014 Mini-Central heating and Power Plant (CHP): the choice of the optimal structure and modes of operation *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 69** DOI: 10.1088/1757-899X/69/1/012008 p 5

[10] Russian companies experience in energy management implementation, State information system URL: https://gisee.ru/articles/energy_management/59822/ (available at 19.02.2019)

[11] The Republic of Tatarstan Strategy of social-economic development before 2030, Ministry of Economy of the Republic of Tatarstan URL: <http://mert.tatarstan.ru/eng/strategiya-sotsialno-ekonomicheskogo-razvitiya.htm> (available at 12.02.2019)

[12] Vorontsov D P, Shikhalev A M, Mingafina R Ia, Ialalina V A and Rozhko O N 2018 Interregional logistic centers in the modern regional development: an estimation of needs and prospects (on the example of the Sviyazhsk interregional multimodal logistics center) *Sec. Intern. Conf. of Social Sc. Proc. NORDSCI*, Book 2 **vol 1** DOI 10.32008/NORDSCI2018/B2/V1/29 pp 277-85

[13] Shikhalev A M, Vorontsov D P and Akhmetova I A 2014 The creation of the estimation of internal and external resources ratio in the management of the extensive and intensive firm development *Proc. of Int. Multidis. Sc. Conf. on Soc. Sc. and Ar. SGEM 2014* Book 2 **vol 4** (Sofia: STEF92 Technology Ltd) DOI: 10.5593/sgemsocial2014B24 p 706

[14] Shikhalev A M, Vorontsov D P, Akhmetova I A and Khamidullina G R 2015 "Advanced firms in the regional development: real situation and the possibilities of growth (on the example of the JSC "TATNEFT" oil company)," *Proceedings of International Multidisciplinary Scientific Conference on Social Sciences and Arts SGEM 2015*. Bulgaria, book 2, **vol 3**, pp 1023-1030

[15] Shugoreva E The main consumed resources and energy saving technologies URL: <http://altenergiya.ru/energoberezhenie/energoberegayushhie-texnologii.html> (available at 12.02.2019).

[16] The energy saving PJSC "Nizhnekamskneftekhim" URL: https://www.nknh.ru/about/energy/energy_saving/ (available at 04.02.2019)

[17] PJSC "Kazanorgsintez" URL: <https://www.kazanorgsintez.ru/index.php> (available at 21.01.2019)

[18] PTC "KAMAZ" Group of Companies URL: <https://www.kamaz.ru> (available at 23.01.2019)

[19] Kashapov N F, Konahina I A, Gil'manshin I R and Fahreev N N 2014 Mini-Central heating and

Power Plant (CHP): the choice of the optimal structure and modes of operation *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 69** DOI: 10.1088/1757-

899X/69/1/012008 p 5

[20] Kashapov N F, Fazlyyyakhmatov M G, Khayritonov Kh A, Lazarev D K and Lazarev V K 2015 Practical experience of using ultrasound flowmeters at the measurement associated petroleum gas *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 86**, DOI:

10.1088/1757-899X/86/1/012020 p 2

[21] Kashapov N F, Sagdiev R K, Denisov E S, Evdokimov Yu K and Fazlyyyakhmatov M G 2014 Phased array based ultrasound scanning system development *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 69**, DOI: 10.1088/1757-899X/69/1/012012 p 4

[22] Kashapov N F, Khafizov I I, Nurullin I G and Z B Sadykov 2018 Influence of introduction of robotics on increase in efficiency of electrochemical production *IOP Conference Series: Mat. Sc. and Engin.* (Bristol: IOP Publishing) **vol 412**, Is 1 Art № 0120345 DOI: 10.1088/1757-

899X/412/1/012034 p 1