



Publisher

<http://jssidoi.org/esc/home>



QUALITY MANAGEMENT SYSTEM FOR IMPROVEMENT OF QUALITY AND EFFICIENCY OF FOOD PRODUCTION: CASE OF DAIRY PRODUCTS ENTERPRISE*

Saule Ospandiyarovna Akhmetova¹, Mariya Shayahmetovna Suleimenova²

^{1,2} Almaty Technological University, Tole bi street 100, Almaty 050012, Republic of Kazakhstan

E-mails:¹ sunrise_kz@mail.ru; ² s.mariyash@mail.ru

Received 15 March 2018; accepted 10 July 2018; published 30 September 2018

Abstract. On the basis of the conducted researches the strategic directions of development of the enterprise are scientifically based. The conceptual principles of creation and functioning of processes at Fudmaster Company JSC are formulated and the structural model of network of processes is created. The functional model and the mechanism of creation of process including its identification, formation, management and improvement are developed. The possibility of use of scientific methodology of FMEA analysis in technology of preparation of production "Kefir from Fudmaster" is shown. On the basis of the offered scientific and methodical approach the process of the production of fermented milk product "Kefir from Fudmaster" is structured. The standard of the organization for formation of processes of dairy production is developed and evidence-based.

Keywords: quality management system; process; process approach; milk and dairy products; verification; measuring tools; monitoring; controlling

Reference to this paper should be made as follows: Akhmetova, S. O.; Suleimenova, M.S. 2018. Quality management system for improvement of quality and efficiency of food production: case of dairy products enterprise, *Entrepreneurship and Sustainability Issues* 6(1): 289-310. [http://doi.org/10.9770/jesi.2018.6.1\(18\)](http://doi.org/10.9770/jesi.2018.6.1(18))

JEL Classifications: L15, L23, L66, M11, Q01, Q13, Q18

Additional disciplines (besides field of economics reflected in JEL classifications): Chemical Engineering and Ecology.

1. Introduction

With creation of the Eurasian Customs Union for the Kazakhstan food industry enterprises the most relevant has become a question of increase in competitiveness of production. Nowadays the high competition of the foreign

* This research was supported by the project, which has received funding from the Ministry of Education and Science of the Republic of Kazakhstan, the Grant of a Scientific Project on the theme "Monitoring and optimization of food safety based on innovative nanotechnologies" (2015-2017, state registration number is 0115RK01777)

companies, delivering food products to Kazakhstan market and low competitiveness of domestic production in foreign market create serious economic and social problems. That is why our domestic manufacturers have to make use the best international and domestic practices on improvement of the organization of production and introduce the international systems of management.

The dairy industry - one of the most dynamically developing food branches of the Republic of Kazakhstan which is continuously introducing advanced technologies and the equipment, methods and control devices. However in the conditions of increase of competition it is necessary to improve first of all the mechanism of management, to reduce expenses and prime cost, using modern methods of quality management.

The perspective direction when making solution of a problem of improvement of quality and competitiveness of dairy products is creation, introduction and improvement of a quality management system according to requirements of the ST RK ISO 9001-2016 standard. The system allows to exercise quality management at all stages, beginning from business-to-business marketing research and establishment of requirements to quality, including development of dairy products, production and logistic processes, preparation of production, and finishing with shipment and delivery it to the consumers.

Not at all systems of quality management introduced at the enterprises for production of dairy products in a due measure there is a key element - the process focused approach. Advantage of use of the process model is the continuity of management on joints of separate functions, constant measurement of key parameters in control points of a subsystem of monitoring, assessment of effectiveness of the process and efficiency of use of resources.

The relevant and perspective direction in dairy branch is creation of scientific methods of improvement of quality and efficiency of production on the basis of basic principle of management system - the process focused approach.

The purpose of the work is increase in efficiency of dairy production by introducing of the process focused approach, monitoring and controlling, SWOT analysis, FMEA analysis. For achievement of the purpose the following objectives have been set:

- To carry out the analysis of information sources and, using SWOT analysis, to define the strategic directions of development of the dairy enterprise;
- To investigate activity of the dairy enterprise and to reveal a supply line of the main processes providing quality of finished goods;
- To investigate the main production of the dairy enterprise, to define indicators, to create subsystems of monitoring and controlling;
- To reveal efficiency of application of the FMEA analysis for improvement of quality of processes in the dairy industry.

2. Literary Review. The Process Approach is the Basis of a Quality Management System of Dairy Enterprise

Success of the dairy enterprise is based on high and reliable quality of products. However, to meet the requirements put by consumers it is necessary to organize quality of all activity of the company. This quality has to be checked not only at the end of production process, but to be the planned, systematic link of all activity of the enterprise (ST RK ISO 9004-2010 (IDT, ISO 9004-2009); Evans James R., 2007; Costa A.I.A., Dekker M., Jongen W.M.F., 2001; Akhmetova, S.O., Fuschi, D. L., Vasiliūnaitė, R., 2017).

System approach in the work on ensuring quality will give the chance to develop the new mechanisms of interaction of processes meeting requirements of the ISO international standards of a series 9000. It means that the products which are turned out by the dairy enterprise will correspond to necessary levels of quality and safety (Avstriyevsky A.N., Kantare V.M., Surkov I.V., 2007; Bart T.V., 2007). Introduction of the process approach and therefore, creation of network of processes is the requirement of ST of RK ISO 9001-2016. Process approach is a basis of this standard (ST RK ISO 9001-2016; Repin V.V., Eliferov V.G., 2006; Shadrin A., 2006; Sharipov S.V., 2004).

The management of the enterprise for production of dairy products has to have the regular processed information on activity of QMS, responsibility for which is born by service of quality which provides the sequence of transactions of the analysis of QMS by the top management of the enterprise (fig. 1) (Lafta J.K., 2007; Tereshchenko N.V., Yashin H.C. 2006; Akhmetova S.O., Aliyeva G.B., 2013).

What gives to the enterprise introduction of QMS? Here that V.Ya. Belobragin in the book "Quality: lessons of the past and present" about it writes (Belobragin V.Ya., 2003): "First, the trust of consumers increases, the competitiveness of production increases and its entry into foreign market is facilitated. Secondly, conditions for successful participation in competitions on the conclusion of government contracts, in tenders for receiving investments, for receiving an award and an award in the field of quality are facilitated (E. Deming, M. Boldridzh, European, national, etc.). Thirdly, there is a possibility of marking of production the Mark of conformity, and it is additional advertizing of production. Fourthly, safety of work of production personnel due to its qualification and competence, the culture of production, stable operation of the equipment and technical processes increases. Fifthly, economic losses from application in production of the faulty equipment, equipment, measuring instruments, from realization of substandard production, claims decrease".

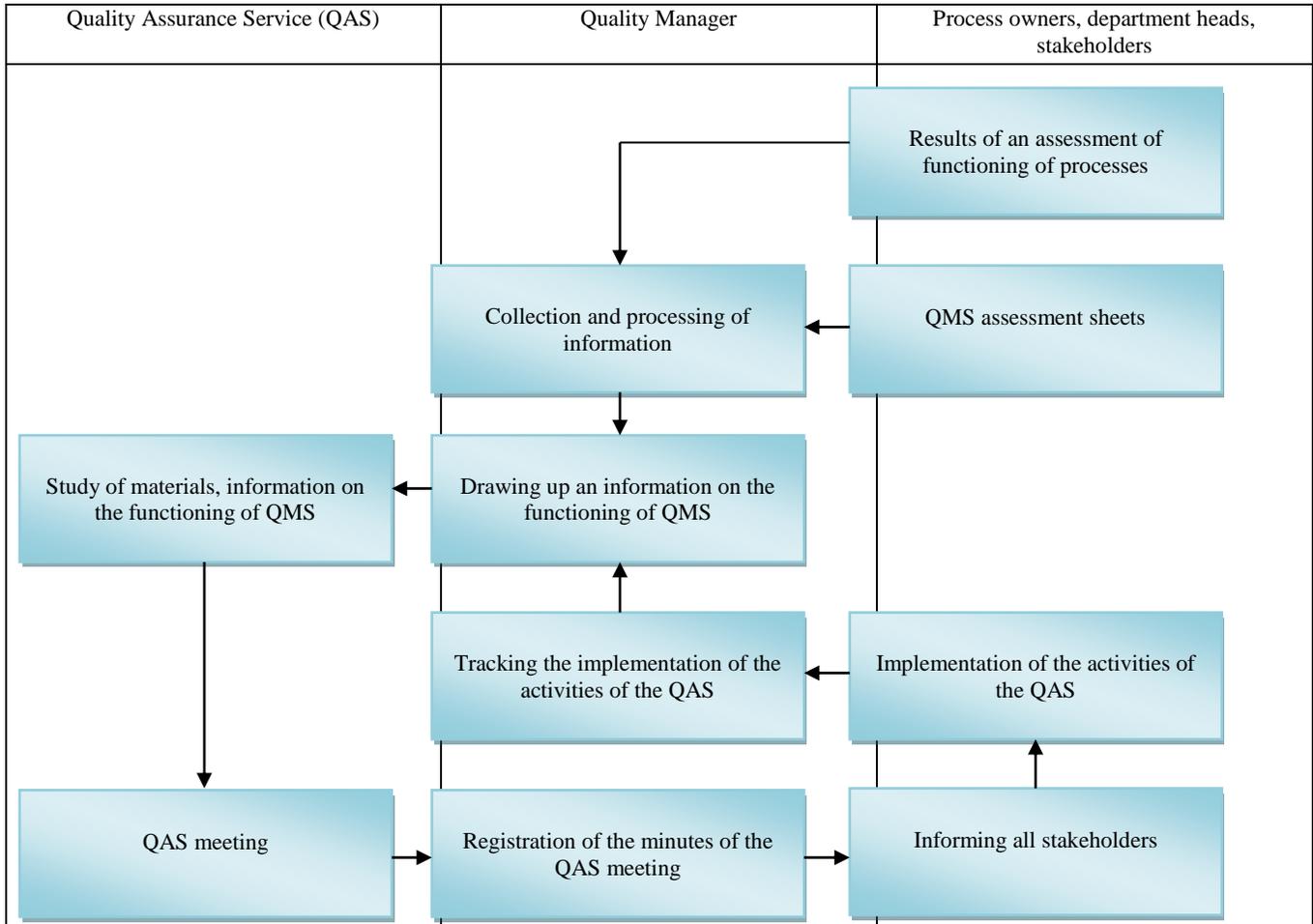


Fig.1. Scheme of the sequence of transactions on the analysis of QMS by the management

Source: Lafta J.K. (2007)

Activity of any organization consists of numerous processes. Therefore effectively to function, the organizations have to define and operate the numerous interconnected and interacting processes (Goryacheva E.D., Maximova N.V., 2008; Akhmetova S.O., Kulazhanova A.M., 2013; Tvaronavičienė M., Tarkhanova E., Durglishvili N., 2018). Approach as a process promotes ability of the organization to define and realize the kinds of activity, degree of their interrelations and independence. It allows to operate these kinds of activity more effectively.

Process transforms an entrance to an exit by means of use of mechanisms (resources) regulated by means of management. The entrance, management (procedure) and exit can be material or non-material. The corresponding tools can be applied to collection of information and data for the analysis of the process work and characteristics of input and output. (Aksenov N.M., 2005). The main benefit at application of process approach is the solution of interfunctional problems (destruction of invisible barriers) between divisions. (Repin V.V., Eliferov V.G., 2006).

Improvement of the process - constants, cyclically repeating actions directed to increase in its effectiveness and efficiency. These actions include, first of all performance of stages of a cycle PDCA (Deming Cycle): planning of the improvements, implementation of measures for improvement, check of the results, widespread introduction of the positive experience and gained knowledge.

The basic model of the process is used for emphasis of an attention on requirements imposed to the process and the measurements necessary for assessment of an extent of implementation of these requirements (fig. 2).

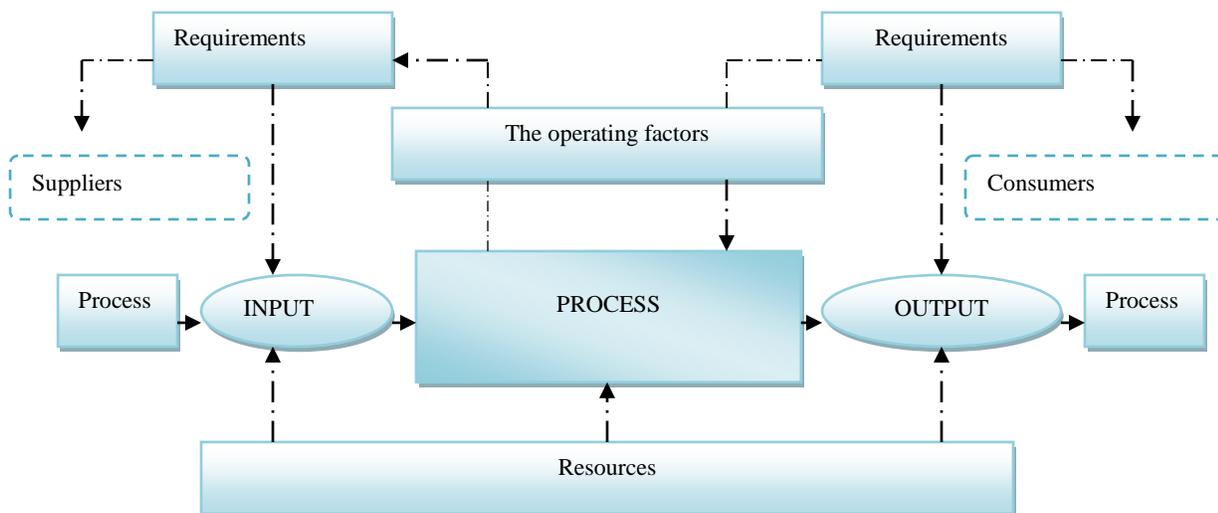


Fig.2. Model of the process of QMS

Source: John Holah, Domagoj Gabric (2016)

In the process all those actions which are necessary for performance of the purpose of the process, obtaining its result are carried out. Often such actions represent the strict sequence which can be represented in the form of a process algorithm. Such model is also used for identification of areas where it is possible to bring improvement in the process and its result (H.L.M. Lelieveld, John Holah, David Napper, 2014; H.L.M. Lelieveld, John Holah, Domagoj Gabric, 2016).

It is told about advantages of the process approach in (Schuster M.M., 2006): "among the primary benefits of such approach it is possible to select simplicity of carrying out optimization as the processes, from the point of view of their organization, synchronization, interconsistency, and also resources consumed by the processes.

The main advantages of process approach:

- Processes of the enterprise are beyond the functions which are carried out by structural divisions. Therefore the process scheme of management is more effective, than functional as it isn't limited to a framework of structure;
- Processes are subject to the description and are tightly regulated. Thereof it is much easier to exercise control, verification and validation of processes, than structural divisions.

3. Research methods and objectives. Analysis of efficiency of the operating Quality Management System of “Fudmaster Company” JSC

2.1 Ensuring of production and processes quality at the “Fudmaster Company” JSC.

The Fudmaster Company is the leader in production of dairy products in the market of Kazakhstan. It is the first Kazakhstan food company which in 2001 has begun to introduce a quality management system of ISO and has received the certificate in 2004 of the Body for Certification of TUV CERT of technical supervising society TUV NORD CERT GmbH & Co. KG No. 78 100 6181 from 12/20/2014. Since 2004 the Fudmaster Company is included into the international Laktalic group (France) - the leader in production of high-quality dairy products in the world uniting over 200 enterprises in the different countries of the world (<http://www.foodmaster.kz>; Quality manual. “Fudmaster Company” JSC, 2016). At the dairy plant work the certified sanitary and chemical and microbiological laboratories of internal control. To achieve desirable result, the company fully works according to the international ISO 9001:2000 standard.

Quality Management System of the “Fudmaster Company” JSC has to have a confirmed ability of the processes to reach of the planned results. The products have to meet the requirements of normative documents and wishes of consumers. The solution of this problem is carried out by means of creation of a subsystem of monitoring and measurement of processes (Rodionova Yu.A., 2013). The flowchart of a subsystem is provided on fig. 3.

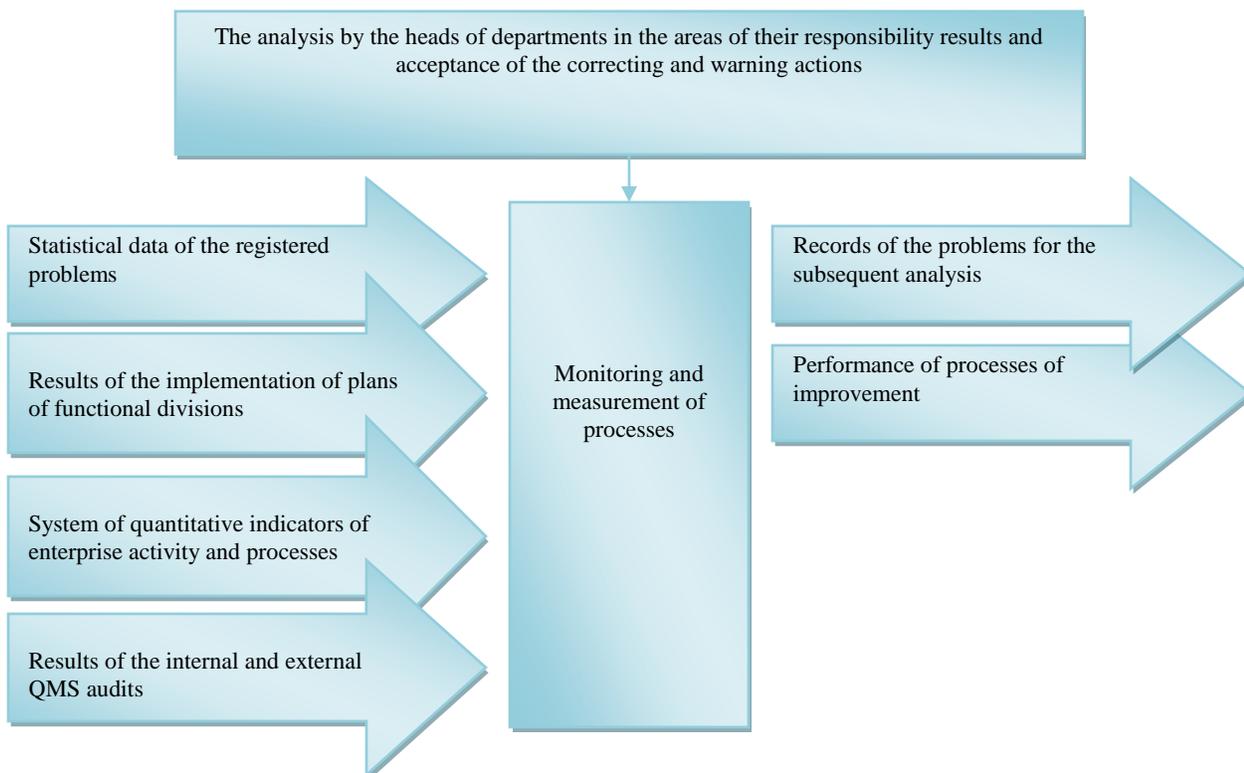


Fig. 3. Flowchart of a subsystem of monitoring and measurement of processes

Source: composed by the authors

At the enterprises for production of milk and dairy products monitoring of production (from the entrance control of raw materials to quality control of finished goods), raw materials and materials, processes of production of dairy products and semi-finished products, the measuring equipment used by production, tests of dairy products and entrance control of raw materials is carried out. (ST RK 1733-2015; ST RK 1734-2007; Technical Regulations of the Customs Union 021/2011; SanPiN No. 611 8/6/2010; Matison V.A., Tikhimirov I.A., 2007; Akhmetova S.O., Aliyeva G.B., 2013).

Quality control covers all stages of life cycle of production and at its carrying out all necessary parameters are controlled. In this regard on dairy production different types of quality control are used: entrance, operational and acceptance control (Hoyle, David, 2007; Bettina, Warzecha, 2017).

In fig. 4 the flowchart of acceptance of milk raw materials on “Fudmaster Company” JSC is presented.

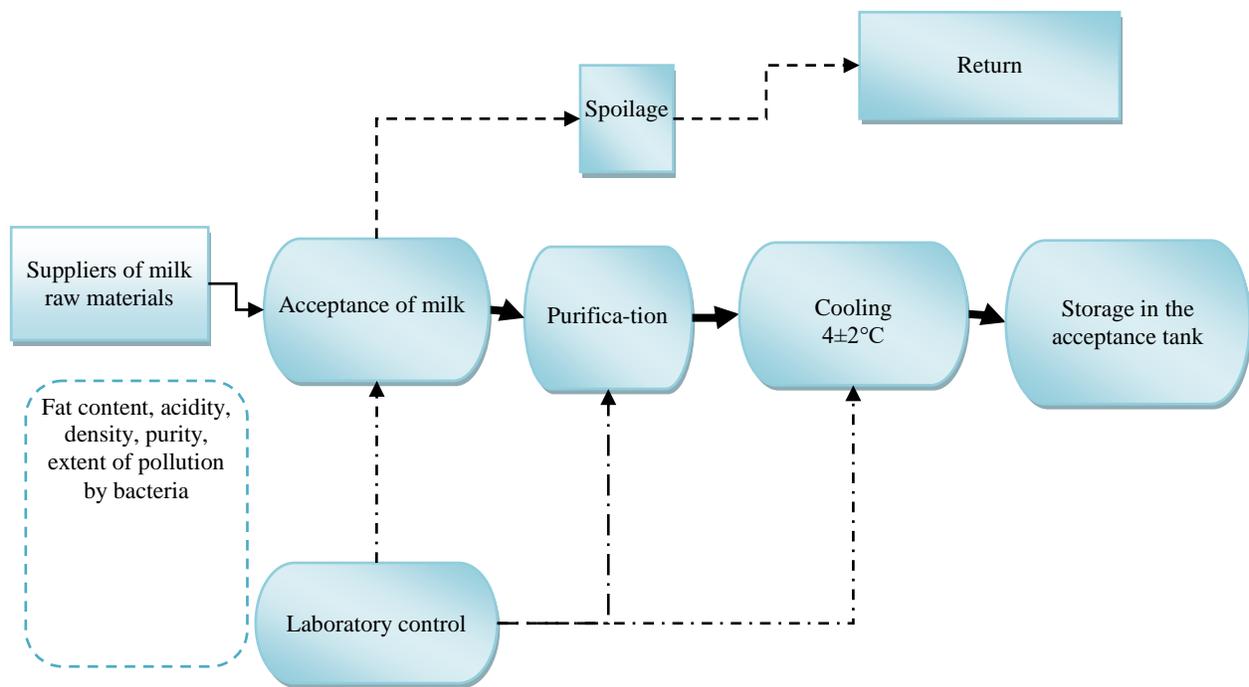


Fig. 4. Flowchart of acceptance of milk raw materials

Source: composed by the authors

The second type of control which is carried out at the milk production is operational. Control during the course of production includes quality control of semi-finished products and product at production stages and also control of observance of technological parameters and formulas for the purpose of prevention of inadvertent transfer to the subsequent stages of production of inappropriate product and prevention of deviations which can lead to production of inappropriate finished product.

Acceptance control of finished dairy products is carried out for the purpose to exclude receipt by the consumer of inappropriate production. Each consignment of raw materials arriving to the enterprise is exposed to the analysis. Organoleptic indicators and the most important physical and chemical properties of raw materials are defined constantly, according to the requirements of the working procedure (Yefimov V.V., 2009; ST RK 1732-2007).

Having analysed the provided data of information sources, it is possible to draw a conclusion that quality control of production is a component of the quality management system which, in turn, is a part of the management system of the dairy enterprise in general. Quality management, as well as management of the organization, has to be effective and productive and lead to continuous improvement of quality of production, increase in satisfaction of consumers and other interested persons of the enterprise (Salimova T.A., 2008; Rozhkov N.N., 2005; Rodionova Yu.A., 2013).

2.2 Methods of improvement of a quality management system of processes and production of the enterprise for production of dairy products

The efficiency and effectiveness of processes management can be provided with application of statistical methods which give the chance with the set degree of accuracy and reliability to judge a condition of the studied objects and processes and on the basis of it to develop optimal solutions on further actions (Rozno M.I., 2008). As a result of the carried-out analysis it is especially necessary to stop on use in a model for processes management such tools of quality as SWOT analysis allowing to reveal the strengths and weaknesses of processes, and FMEA analysis allowing to define the potential reasons of a defect and to develop the correcting actions at implementation of processes.

SWOT analysis is the tool for the preliminary quality estimation of the process. The data obtained on its basis can be used for obtaining the structured information on each of the directions - forces, weaknesses, opportunities, threats which are important for the enterprise. In the SWOT analysis matrix these characteristics are specified (Kuzmin A.M., 2006). In SWOT analysis not only threats and opportunities are opened, but also assessment of that how important for the enterprise account in the strategy of each of the revealed threats and opportunities is carried out.

The FMEA analysis is one of standard technologies of the analysis of products and processes quality. The methodology of FMEA allows to exclude mistakes at early stage of creation of production and processes, to establish potential discrepancies, their reasons and consequences, to carry out specification and accounting of the executed functions, to estimate risk and to take measures for elimination or decrease in dangers (Godlevsky V.E., Dmitriyev A.Ya., Izyumenko G.N., Litvinov A.V., Yunak G.L., 2002; Analysis of types and consequences of refusals. FMEA, 2003. Under edition. M: Priority).

Thus, the analysis of information sources has revealed the main directions of the researches allowing to solve the problems set in the work directed to development of the procedure of a formation of the dairy enterprise processes including subprocesses of identification, description, management and improvement of the making elements and also monitoring and controlling.

4. Results and discussions

3.1 The analysis of structural components of quality management of the dairy enterprise (on the example of “Fudmaster Company” JSC)

According to methodology of Total Quality Management activity of “Fudmaster Company” JSC in the field of quality is based on four main components: planning, management, providing and improvement of quality (fig. 5).

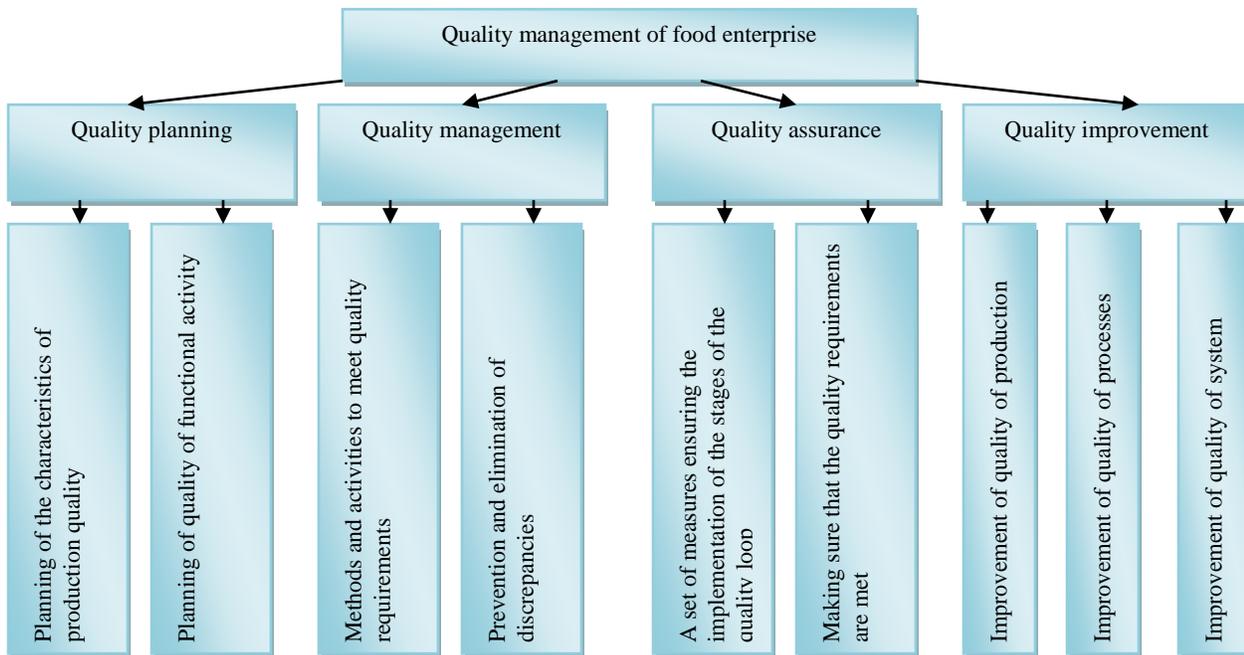


Fig. 5. The Structural Components of Quality Management

Source: composed by the authors

The analysis which is carried out at “Fudmaster Company” JSC has shown that all components of quality management are presented and their normal functioning is provided (Akhmetova S.O., Aliyeva G.B., 2013).

At “Fudmaster Company” JSC quality management is exercised constantly and includes a number of elements which normal functioning allows to achieve the set goals. Special attention is paid to management of inappropriate production. For ensuring quality the set of the actions providing performance of all stages of life cycle of production is defined (Jacobus Johannes Oschman, 2017). The analysis of activity of “Fudmaster Company” JSC also has allowed to define the strategic directions of innovative development and to create the structurally functional scheme presented in fig. 6.

Four major directions of strategic innovations of the dairy enterprise at the present stage are formulated (Vasilyeva L.N., Muravyeva E.A., 2005; Jacobus Johannes Oschman, 2017):

- improvement of quality and competitiveness of dairy products;
- introduction of innovative technologies and high-performance equipment;
- improvement of the process focused approach to activity of the dairy enterprise;
- introduction of the mechanism of processes validation and verification.

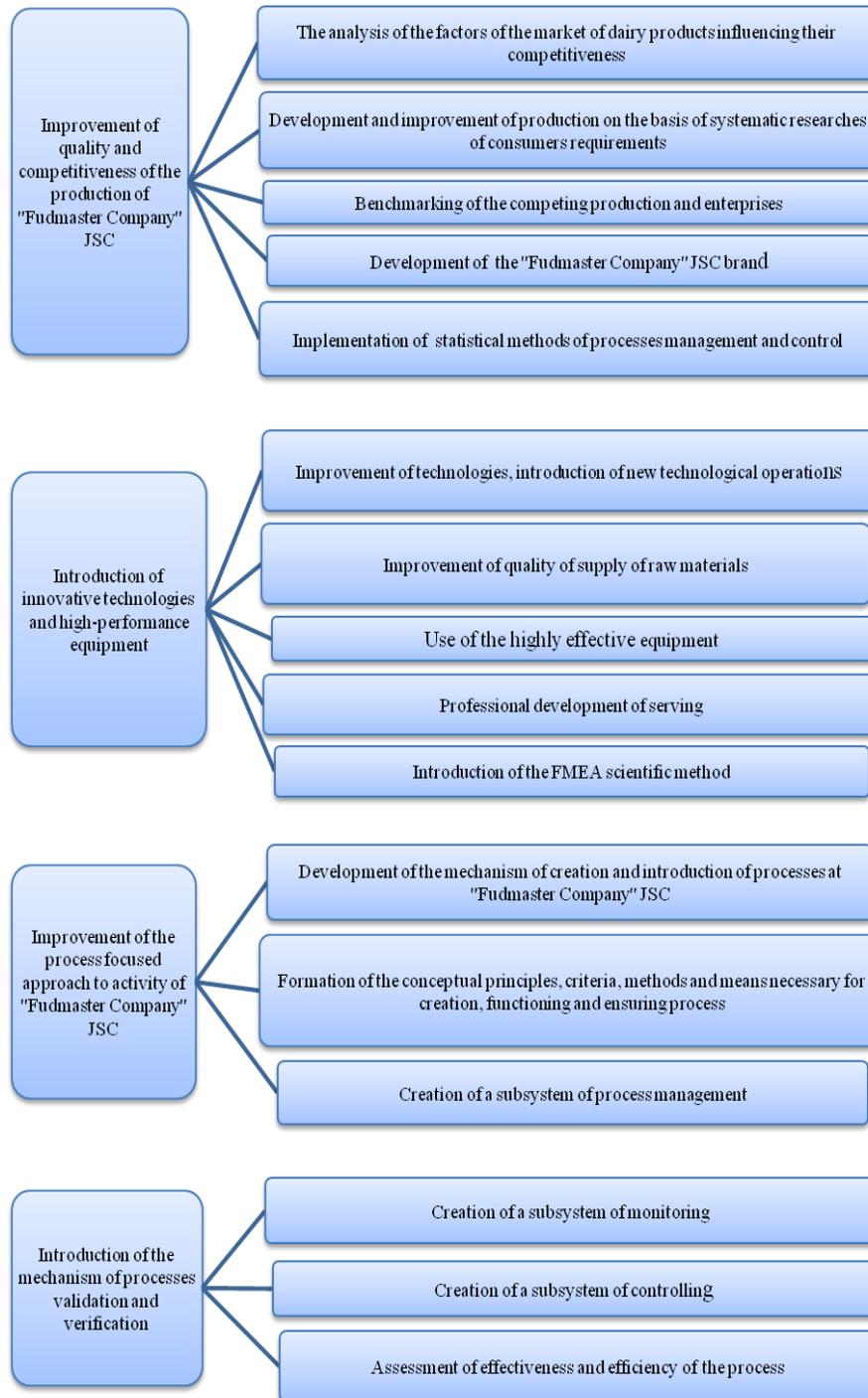


Fig. 6. Structural-functional scheme of innovative and strategic development of "Fudmaster Company" JSC

Source: composed by the authors

For increase in efficiency of activity of “Fudmaster Company” JSC improvement of process approach to quality management on the basis of system management of the interconnected processes is carried out. Thereof there was a need of creation of methodology of the dairy enterprise processes formation for the purpose of increase in their effectiveness and efficiency. (Maximova N.V., 2009; Akhmetova S.O., Kulazhanova A.M., 2013). The conducted research has allowed to reveal the strategic directions of the dairy enterprise development at the present stage. SWOT analysis and Isikava's chart have been applied to a further specification and improvement of strategy of the enterprise.

3.2 Study of opportunities of the “Fudmaster Company” JSC activity improvement when using the analysis and ensuring quality tools

For identification of opportunities of production and processes quality improvement of the enterprise for production of dairy products quality management tools have been used (Gerasimov B.N., 2005). For the purpose of identification of the causes causing instability of activity of “Fudmaster Company” JSC the chart "cause-effect" of Isikava has been constructed. The chart has allowed to divide the problem required the solution, on separate fragments, to reveal and group the conditions and factors influencing a problem and to carry out the cause and effect analysis. A specific place on Isikava's chart is held by the elements "Monitoring, Measurements and Controlling".

The developed cause and effect chart has given the chance to reveal the major factors influencing quality of dairy products that has allowed to make a complete picture of activity of the enterprise when carrying out SWOT analysis, its weaknesses and strengths, opportunities and dangers which can develop into uncontrollable risks.

The SWOT analysis which is the most convenient scientific instrument of strategic planning (Gerasimova G.E., 2002) is applied to more in-depth study of the strategic directions of development of the dairy enterprise and also assessment strengths and weaknesses. The key directions of strategic management of “Fudmaster Company” JSC revealed as a result of the analysis are confirmed with researches with use of SWOT analysis which has allowed to identify strengths and weaknesses, opportunities of the enterprise, potential threats.

Assessment of the indicators referred to strengths was carried out on a serial scale of 0-0,5 points. It was accepted that the indicator which has got less than 0,1 points doesn't enter an initial matrix of SWOT analysis.

At discussion of the weaknesses characterizing activity of the enterprise, the commission has selected for assessment the following indicators:

- high concentration of the enterprises for production of dairy products in Almaty and Almaty region;
- relative difficulty of set of shots of an average control link;
- special requirements to storage conditions of dairy products;
- high costs for high-quality raw materials;
- strong dependence on a wholesale link.

By the results of the assessment the last indicator has got less than 0,1 points and has been excluded from the SWOT matrix.

In the analysis of opportunities of the enterprise below-mentioned indicators have been revealed:

- expansion of the range of the lower price segment on the basis of the developed strategy;
- expansion of regional sales markets;
- increase in efficiency of activity of the enterprise at introduction of process approach;
- decrease in prime cost by reduction of production costs.

At assessment of the presented indicators all of them have received points higher than 0,1 and have entered the SWOT matrix.

Discussion and selection of the indicators on the choice and assessment of indicators characterizing threats for the enterprise for creation of SWOT matrix was a final stage of the research. To them have been referred:

- strengthening of promotion to Kazakhstan market of cheap Russian and Kyrgyz production;
- increase in prices for raw materials;
- decrease in level of income of a part of potential consumers and their transition to purchase of cheaper production.

At assessment of the indicators characterizing dangers, the commission of experts has come to a conclusion that the last indicator on points hasn't entered a total SWOT matrix.

By results of the conducted researches the matrix of SWOT analysis of the dairy enterprise given in the table 1 below has been constructed.

Table 1. SWOT-analysis matrix of “Fudmaster Company” JSC

1 STRENGTHS:	2 WEAKNESSES:
1.1 High quality of product and production (0,4 points); 1.2 Popularity of a brand of “Fudmaster Company” JSC (0,3 points); 1.3 Management efficiency on the basis of the certified QMS (0,2 points); 1.4 Existence of a modern logistics system (0,1 points).	2.1 High concentration of the enterprises for production of dairy products in Almaty and Almaty region (0,2 points); 2.2 Relative difficulty of set of shots of an average control link (0,1 points); 2.3 Special requirements to storage conditions of dairy products (0,1 points); 2.4 High costs for high-quality raw materials (0,1 points).
3 OPPORTUNITIES:	4 THREATS:
3.1 Expansion of the range of the lower price segment on the basis of the developed strategy (0,3 points); 3.2 Expansion of regional sales markets (0,4 points); 3.3 Increase in efficiency of activity of the enterprise at introduction of process approach (0,3 points); 3.4 Decrease in prime cost by reduction of production costs (0,1 points).	4.1 Strengthening of promotion to Kazakhstan market of cheap Russian and Kyrgyz production (0,2 points); 4.2 Decrease in demand for high-quality production (0,3 points); 4.3 Increase in prices for raw materials (0,1 points).

Source: composed by the authors

At the following stage the comparative analysis of indicators of SWOT matrix has been carried out. Comparison of strengths-opportunities, strengths-threats, weaknesses-opportunities and weaknesses- threats is carried out. The strategic directions of development of the enterprise and, first of all, providing high quality production due to introduction of methodology of creation of processes of the dairy enterprise and decrease in costs for production and reduction of prime cost and selling price were the result of the researches conducted at this stage (Ivanov V. A., Shilov V.M., Oborin A.V., 2004).

3.3 Study of opportunities of the process approach application at “Fudmaster Company” JSC

As have shown the results of researches of “Fudmaster Company” JSC activity, one of the most important strategic directions of the enterprise development is transition from the function scheme of management to functional and process and, according to an objective, development of a technique of formation of processes of the dairy enterprise.

Correction of the strategic directions of development of “Fudmaster Company” JSC and development of an adequate technique of process approach at the enterprise was result of the carried-out analysis. For improvement of controllability of the enterprise all parties of its activity are analysed and modeling of structure and nature of interaction between the processes is carried out (Jacobus Johannes Oschman, 2017; Bojkovska K., Tomovska J., Mohammad Ali Shariati, 2014; George Alukal, Anthony Manos, 2006).

On the basis of the analysis of network of processes of the dairy enterprise and the developed conceptual principles the functional model of process of production (fig. 7) is created. The functional model of process, unlike mathematical, logical, structural, contains all basic elements and reflects their interrelation and interaction, at the same time factors of management and resource expenses are especially noted. (Maximova N.V., 2009; Antony, J. and Preece, D., 2002; Kondo Iosio, 2002).

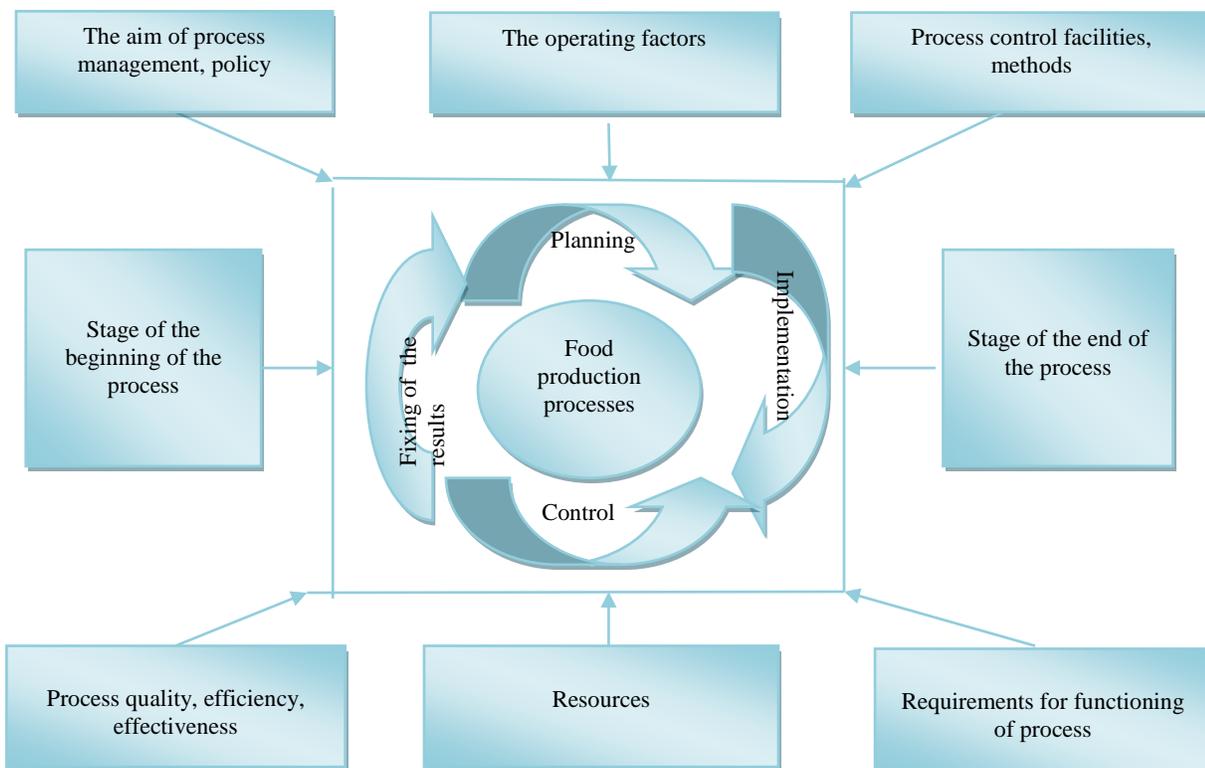


Fig. 7. Functional model of process

Source: composed by the authors

The cycle P-D-C-A offered by E. Deming is the cornerstone of functioning of each process. In the developed functional model of process of the dairy enterprise, besides traditional managing directors of factors and security with resources, the elements providing its functioning are considered.

3.4 Improvement of processes quality at “Fudmaster Company” JSC when application of methodology of FMEA analysis on the example of a production “Kefir from Fudmaster”

For the purpose of realization at “Fudmaster Company” JSC of the process focused approach production of “Kefir from Fudmaster” (fig. 8) has been chosen. This type of production is made at the plant in bigger volume

and is the main one. For the process of production of the specified product the research of a possibility of potential appearance of defects has been conducted.

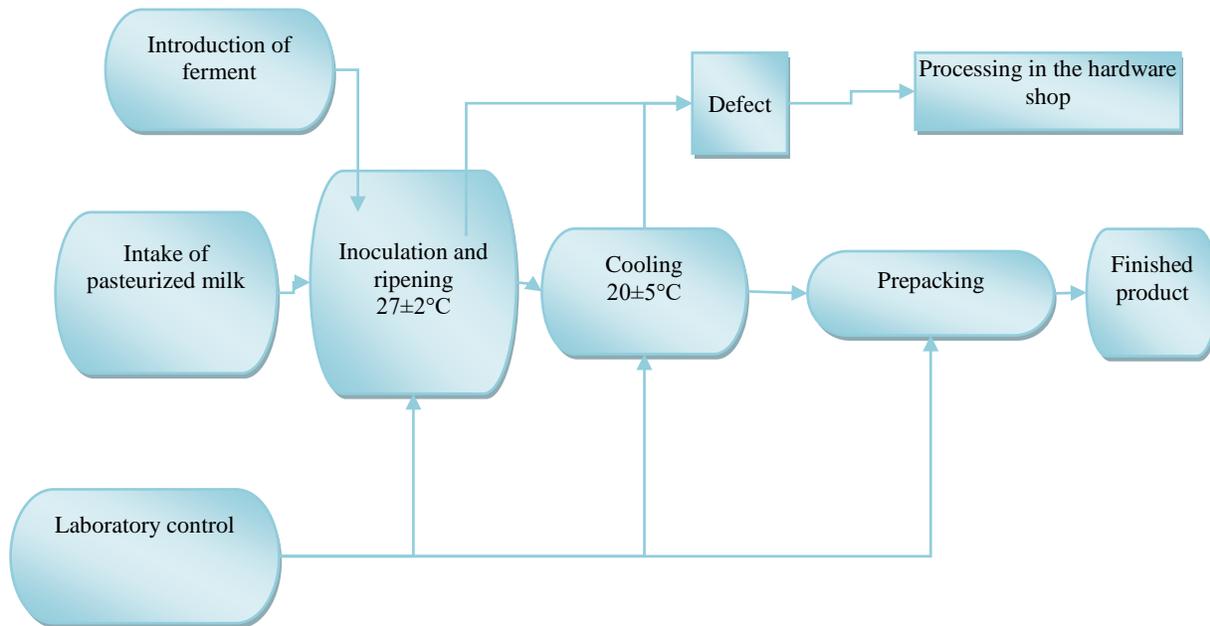


Fig. 8. Flowchart of production "Kefir from Fudmaster"

Source: composed by the authors

For decrease in probability of appearance of defects by production of "Kefir from Fudmaster" the FMEA methods in relation to technology of preparation of production have been considered. During the work analysis of the offered designs and technologies from different positions has been carried out and actions for process improvement are developed. Work was carried out in common with specialists of the following services of "Fudmaster Company" JSC: department of production planning, service of quality, laboratory, department of the chief technologist and department of the chief mechanical engineer.

The conducted researches have allowed to reveal potential defects and failures of the equipment and also failures in technological process, their causes and consequences. Quantitative assessment with use of a serial ten-mark scale is carried out, defects were estimated by three criteria: probability of occurrence of a defect (Po), gravity of a potential risk (S), possibility of identification of a defect (Pd). At high mark assessment of probability of occurrence of the defect technological process was improved that as a result has yielded positive results on effectiveness and efficiency of the process (Rozno M.I., 2008; Godlevsky V.E., Dmitriyev A.Ya., Izyumenko G.N., Litvinov A.V., Yunak G.L., 2002).

The FMEA analysis of the process was carried out at a stage of technical training of production and mounting of the production equipment. By results of the research the assessment by criteria of FMEA provided in fig. 9 are obtained.

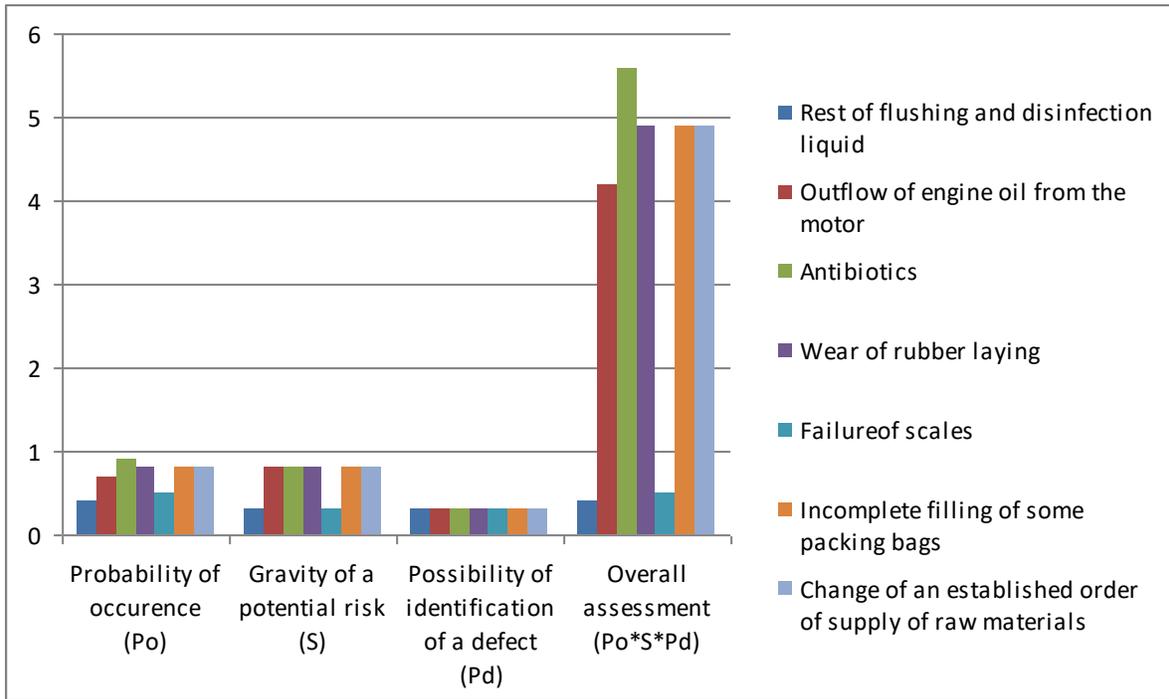


Fig. 9. Assessment by criteria of FMEA before process completion

Source: composed by the authors

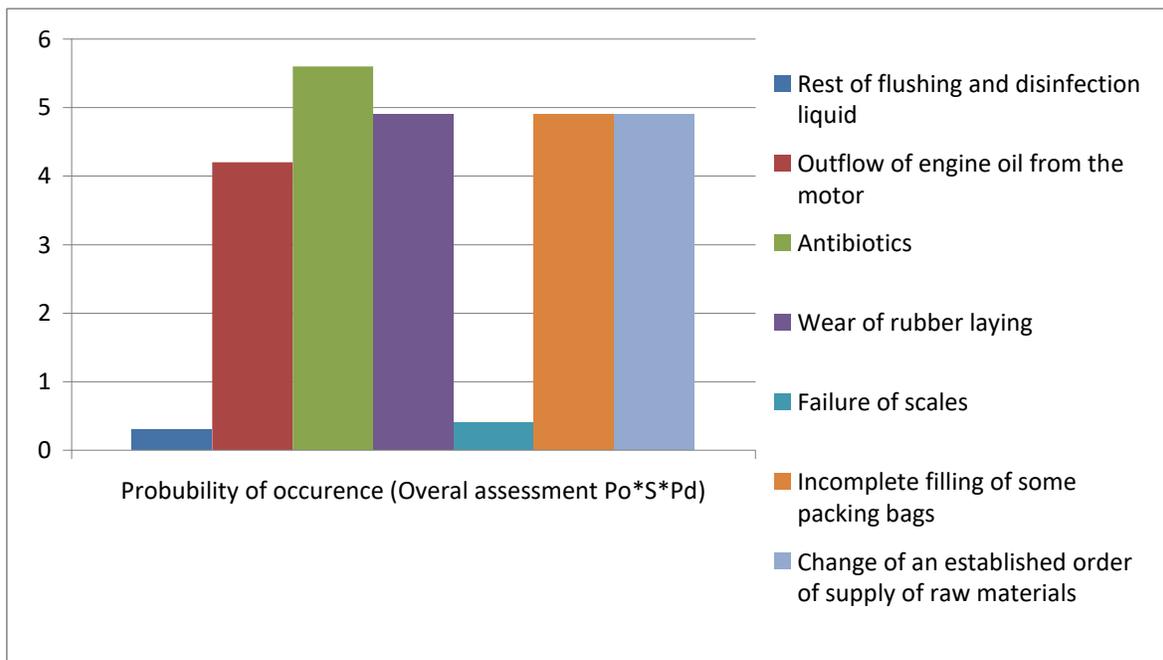


Fig.10. The overall assessment of probability of occurrence of defect before "Kefir from Fudmaster" production process completion

Source: composed by the authors

In the figure 10 the overall assessment of probability of defect before "Kefir from Fudmaster" production process completion is presented.

After modification of the equipment and technology risks of occurrence of defects, stated above have considerably decreased. In the figure 11 results of assessment on criteria of FMEA after "Kefir from Fudmaster" production process completion are presented.

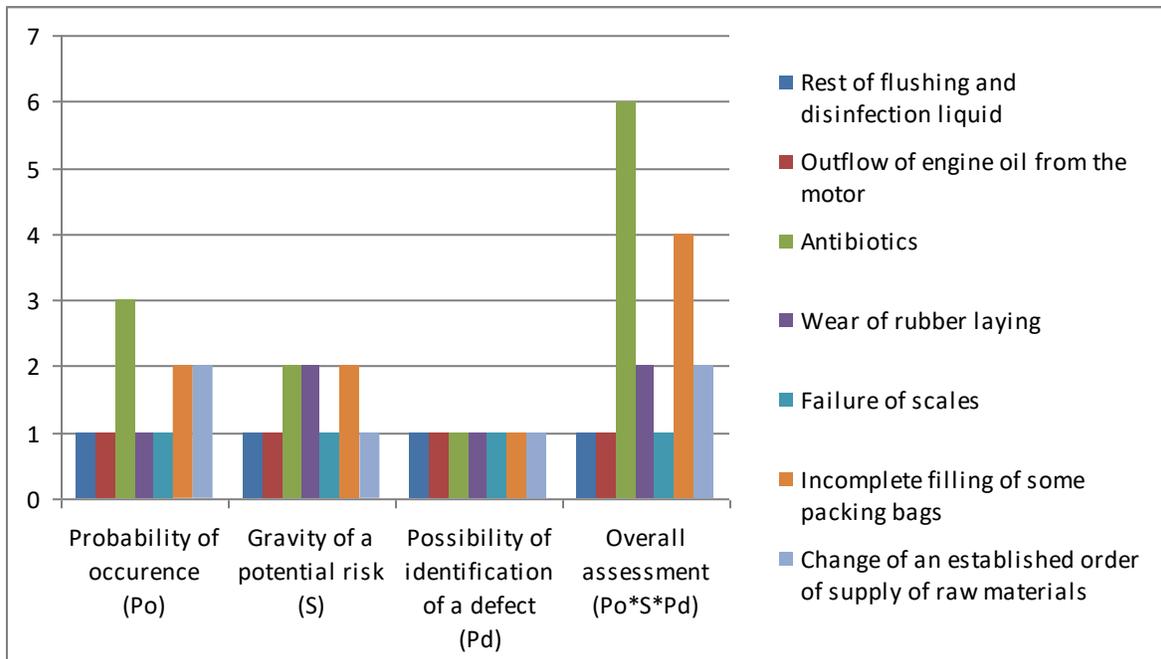


Fig. 11. Assessment by criteria of FMEA after "Kefir from Fudmaster" production process completion

Source: composed by the authors

In the figure 12 results of overall assessment of probability of occurrence of defects after "Kefir from Fudmaster" production process completion are presented.

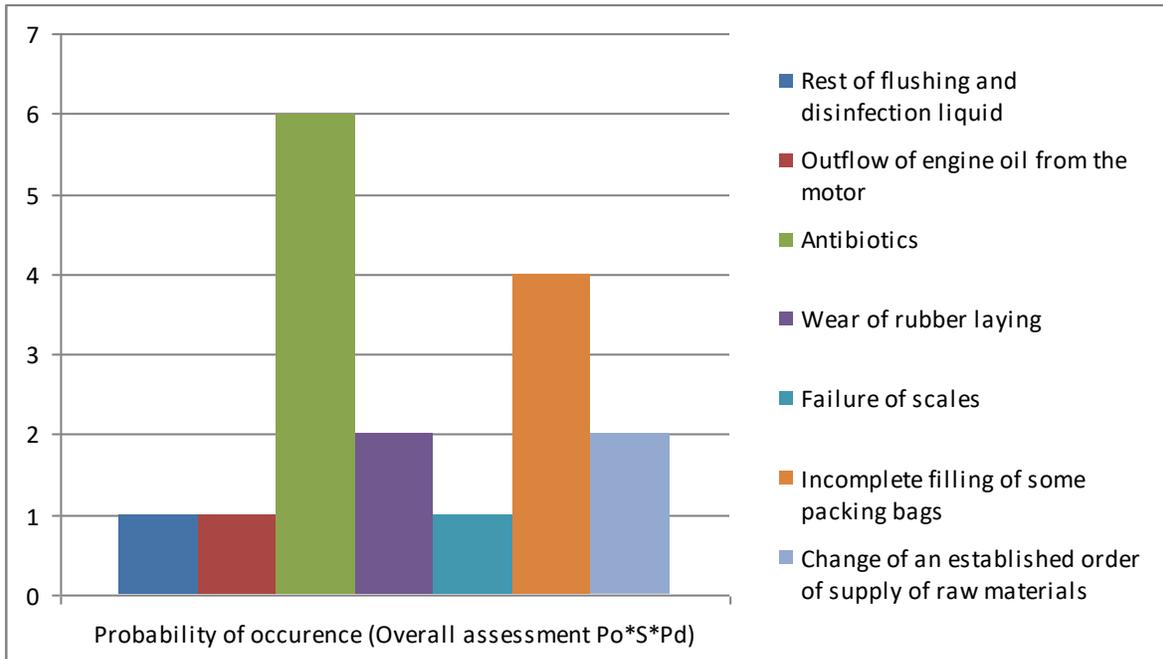


Fig. 12. The overall assessment of probability of occurrence of a defect after "Kefir from Fudmaster" process production completion

Source: composed by the authors

In the figure 13 comparison of the overall assessment of FMEA before and after "Kefir from Fudmaster" production process completion is presented.

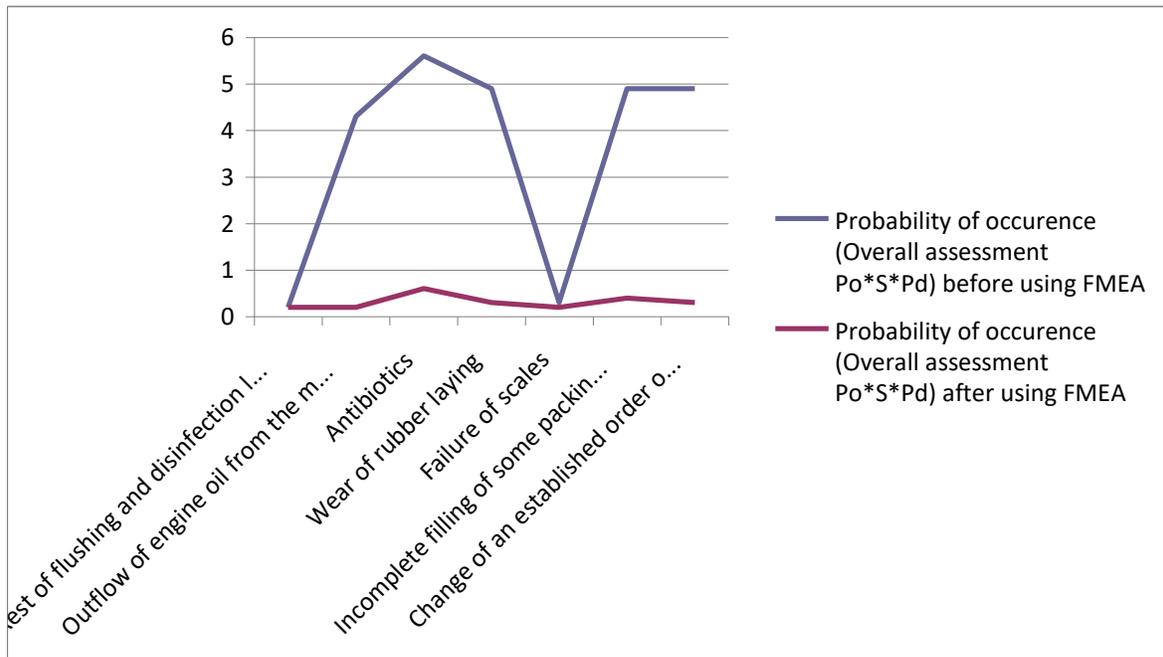


Fig. 13. Comparison of FMEA overall assessment before and after production process completion

Source: composed by the authors

Apparently from drawings, there is a positive effect from application of FMEA methods, the possibility of defects is most reduced. In most cases assessment of criteria of FMEA, such as probability of occurrence of an event (Po), gravity (S) and a possibility of identification (Pd) are brought to a rational ratio, respectively — "occurrence of defect is improbable", "there is no potential risk for a product" and "the defect will be revealed in 100% of cases".

Application of FMEA technique has provided constant quality of product in combination with high flexibility of production. The modified way of production has considerable advantages that pass enough exact masses having the constant temperature and identical tastes turns out. During completion the causes of defects have been excluded. By means of change of a design and technology the possibility of defect and its influence on production have been reduced. Also the reliability of identification of defect has been facilitated and increased.

As a result of the executed complex researches at "Fudmaster Company" JSC the Standard of the organization on formation of processes of the dairy enterprise is created and evidence-based (Ponomarev S.V., Mironov S.V., 2007; Kondrikov V. A., Plotnikov N.V., 2006; Akhmetova S.O., Aliyeva G.B., 2013). The structure of the standard of the organization conforms to the requirements for the documentation established at "Fudmaster Company" JSC. The standard consists of a complex of the mechanisms providing normal functioning of the process. It is the structural-functional scheme and the operational card of the process allowing to open interaction of the inputs and outputs of subprocesses, the operating factors and resource providing. Besides, it is shown how it is possible to identify control points of the process which are determinants of its stability. In control points the owner of the process can determine by rejections of characteristics in the on-line mode a condition of the process and the existing trends. Thanks to it the regular traceability of the process and a possibility of timely intervention for the purpose of reduction into statistically operated state is provided.

The responsibility matrix - a necessary element of each process allows to see and to check visually duties of the personnel providing process functioning. Ensuring the basic principle of quality management system - process improvement - is a fundamental task of the process owner. The algorithm including a number of stages on process improvement is developed for these purposes. In general the standard provides creation and normal functioning of processes at dairy plant (Shichkov N.A., 2005; Evans James R., 2007; Bojkovska K., Tomovska J., Mohammad Ali Shariati, 2014; Advice from ISO/TC 176, 2018).

Conclusions

- On the basis of the studying of information sources and researches conducted by means of SWOT analysis and the cause and effect chart of Isikava the strategic directions of development of the enterprise for production of dairy products including need of structuring and improvement of the process focused approach for quality management are evidence-based;
- As a result of the conducted researches and the scientific analysis the conceptual principles allowing to create, identify and carry out effective functioning of the process of the dairy enterprise are defined;
- The model of the dairy enterprise processes network which is structurally uniting four key groups of the main processes is created;
- The functional model of the dairy enterprise process in which the interrelation between the input and output of the process which is carried out according to the principles of the PDCA is evidence-based is developed. The process is provided with resources and subsystem of management based on statistical methods and means, and functioning under certain conditions set by requirements of production for the purpose of obtaining planned values on effectiveness and efficiency of the indicators;
- On the basis of the offered scientific and methodical approach "Kefir from Fudmaster" production process is structured;

- The possibility of use of FMEA analysis scientific methodology in technology of preparation of production "Kefir from Fudmaster" is shown that has allowed to exclude the causes and to reduce probability of occurrence of defects in production;
- By the results of the conducted complex research the standard of the organization for formation of processes of the enterprise for production of dairy products is created and evidence-based. The procedure of processes creation allowing to perform coding and name, definition of goals and formation of the structure, including the owner's appointment, identification of input, output and resources, construction of responsibility matrix, evaluation of efficiency and effectiveness is developed.

References

- Akhmetova S.O., Aliyeva G.B. (2013). Improvement of quality management system of the Fudmaster LLP company. Proceedings of Intern. Scient. and Pract. Conf. "Processing and Quality Management of Agricultural Production": - Minsk, BGATU, p. 212-216.
- Akhmetova S.O., Kulazhanova A.M. (2013). The mechanism of improvement of the management system of business processes at the Becker and K LLP enterprise, *Journal of ATU*, Almaty, No. 1, p. 33-41. elibrary.ru/contents.asp?issueid=1358039
- Akhmetova, S.O., Fuschi, D. L., Vasiliiūnaitė, R. (2017). Towards food safety: quality management peculiarities, *Journal of Security and Sustainability Issues* 6(3): 513–522. [http://dx.doi.org/10.9770/jssi.2017.6.3\(15\)](http://dx.doi.org/10.9770/jssi.2017.6.3(15))
- Aksenov N.M. (2005). Positive moments of process approach, *Director*, No. 1, p. 13-17. vestnik.osu.ru/2011_13/39.pdf
- Analysis of types and consequences of refusals. FMEA (2003). Under edition. M: Priority. 74 p.
- Antony, J. and Preece, D. (2002). *Understanding, Managing and Implementing Quality*, Routledge, London. <https://www.taylorfrancis.com/books/9780203464083>
- Avstriyevsky A.N., Kantare V.M., Surkov I.V. (2007). Quality management at the enterprises for food and processing industry. Novosibirsk: Sib. Univ. publ. house. 268 pages. <https://www.twirpx.com/file/1710186/>
- Barth T.V. (2007). Quality management. M.: MIENP. 235 p. <https://www.twirpx.com/file/422382/>
- Belobragin V.Ya. (2003). Quality: lessons of the past and present. M.: ASMS. - 273 p.
- Bettina, Warzecha, (2017). Problem with Quality Management Process orientation, controllability and zero-defect processes as modern myths. Walsrode. ISBN 9783981863833. OCLC 992993108. <https://www.amazon.com/>.
- Bojkovska K., Tomovska J., Mohammad Ali Shariati (2014). Contemporary Quality Management System Elements in the Food Industry, *VestnikOrelGAU*, 6(51), p. 48-50.
- Costa A.I.A., Dekker M., Jongen W.M.F. (2001). Quality function deployment in the food industry: a review, *Trends in Food Science and Technology*, 11, 306-314 pp. http://icm.clsbe.lisboa.ucp.pt/docentes/url/anacosta/artigo/Costaetal_TFST2001_QFDRReview.pdf
- Evans James R. (2007). Quality management: manual, M.: UNITY-DANA. 671 p. <https://www.twirpx.com/file/969796/>
- George Alukal, Anthony Manos (2006). *Lean Kaizen. A Simplified Approach to Process Improvements*. 192 p. <https://www.amazon.com/>
- Gerasimov B.N. (2005). Instruments of quality management. Manual. M.: STU. 32 p. <https://www.twirpx.com/file/532211/>
- Gerasimova G.E. (2002). Statistical management of technological process. M.: NTK Track. 232 p.
- Godlevsky V.E., Dmitriyev A.Ya., Izyumenko G.N., Litvinov A.V., Yunak G.L. (2002). Application of a method of the analysis of types, causes and consequences of potential discrepancies (FMEA) at various stages of life cycle of production /Under V.Ya. Kokotov's edition. Samara: GP Prospect. 160 p. magisterjournal.ru/docs/VM56_4.pdf

Goryacheva E.D., Maximova N.V. (2008). Management of food creation process on the basis of the theory of structuring functions of quality // the Collection of the reports of the VI scientific and technical conference with the international participation "Highly effective food technologies, methods and means of their realization: effective use of resources of branch" (Moscow) – M.: MGUPP. – p. 265-266. <http://tekhnosfera.com/>

H. L. M. Lelieveld, John Holah, David Napper (2014). *Hygiene in Food Processing: Principles and Practice*, Edition 2. Elsevier, 640 p. <https://www.elsevier.com/>

H. L. M. Lelieveld, John Holah, Domagoj Gabric (2016). *Handbook of Hygiene Control in the Food Industry*, Edition 2. Woodhead Publishing. 756 p. <https://www.elsevier.com/>

Hoyle, David (2007). *Quality Management Essentials*, Oxford, United Kingdom: Butterworth-Heinemann, p. 200, ISBN 9780750667869, OCLC 72868446, retrieved 2013-10-19. <https://trove.nla.gov.au/version/31318851>

<http://www.foodmaster.kz/>

Isaev S.V. (2006). Introduction of techniques of statistical processes management and analysis of measuring systems, *Methods of quality management* No. 9, p. 39-41. <http://www.icgrp.ru/docs/list/article/?action=showproduct&id=8>

ISO 9001:2015 for Small Enterprises: What to do. Advice from ISO/TC 176. (2018). 188 p. Item Number: T1148E <https://www.iso.org/iso/>

Ivanov V. A., Shilov V.M., Oborin A.V. (2004). Continuous improvement and its place in QMS of the organization, *Quality Management Methods* No. 4, p. 41-45. www.dissercat.com

Jacobus Johannes Oschman (2017). The Role of Strategic Planning in Implementing a Total Quality Management Framework: An Empirical View, *Quality Management Journal* - Volume 24 • Number 2, Issue 4. <https://www.tandfonline.com/.../10686967.2017.11918508>

Kondo Iosio (2002). Quality management in scales of the company: formation and stages of development: translation from English. Nizhny Novgorod: SMTs "priority". 252 p. deming.ru/Books/UpravKach.htm

Kondrikov V.A., Plotnikov N.V. (2006). Effectiveness and efficiency of QMS of the enterprise, *Quality Management Methods* No. 10, p. 27-31. <https://cyberleninka.ru/>

Kuzmin A.M. (2006). Seven instruments of quality management, *Quality Management Methods* No. 5, p. 21-22. https://www.twirpx.com/files/business/periodic/mmk/metody_menedzhmenta_kachestva_200/

Lafta J.K. (2007). Efficiency of management of the organization. Manual. M.: Russian business literature. 237 p. <https://www.twirpx.com/file/549019/>

Matson V. A., Tikhomirov I.A. (2007). Monitoring of overall effectiveness of the equipment, *Food Industry* No. 2, p. 40-42. https://lib.esstu.ru/cgi-bin/irbis64r_12/

Maximova N.V. (2009). Improvement of food enterprise's quality management systems on the basis of analysis and improvement, *Food Industry* No. 4, p. 56-61. www.dissercat.com

Ponomarev S.V., Mironov S.V. (2007). Formation and assessment of indicators of effectiveness and efficiency of QMS processes, *Standards and Quality* No. 8, p. 70-72.

Tvaronavičienė, M., Tarkhanova, E., & Durglishvili, N. (2018). Sustainable economic growth and innovative development of educational systems. *Journal of International Studies* Vol. 11 No. 1, p. 236-244. <https://doi.org/10.14254/2071-8330.2018/11-1/19>

Quality manual. "Foodmaster Company" JSC. (2016), p. 7-16. <http://www.foodmaster.kz/release/>

Repin V.V., Eliferov V.G. (2006). Process approach to management. Modeling of business processes. M.: RIA "Standards and quality". 404 p. <https://www.twirpx.com/file/100807/>

Rodionova Yu.A. (2013). Organization of assessment and monitoring of a quality management system of the enterprise. Abstract of the dissertation, St. Petersburg. 18 p.

Rozhkov N.N. (2005). Statistical methods of quality control: manual. St. Petersburg: IPTsSPGUTD. 145 p. <https://www.kpfu.ru/>

Rozno M.I. (2008). Once again about statistical control and quality control of production in general, *Quality Management Methods* No. 7, p. 50-53. <ria-stk.ru/mmqa/detail.php?ID=9055>

Salimova T.A. (2008). Quality management: the textbook - the 2nd ed. Ster. M.: Omega-L. 414 p. <https://www.twirpx.com/file/869689/>

SanPiN No. 611 8/6/2010 Health Regulations and Norms "Hygienic requirements for food products". https://online.zakon.kz/Document/?doc_id=1043552

Schuster M.M. (2006). Process approach as craft, *Quality Management Methods* No. 7, with. 15-19. <quality.eup.ru/DOCUM4/remeslo.htm>

Shadrin A.D. (2006). Quality management from bases to practice. M.: NTK Track. 360 p. trim.ru/sites/default/files/files/pdf/quality_management_project.pdf

Sharipov S.V. (2004). Quality management system: developed and deploy. on the basis of International ISO 9001:2000 standard / S.V. Sharipov, Yu.V. Tolstova. — SPb.: Peter; Peter Print. — 189 p. https://updoc.site/download/librarypsukz_pdf

Shichkov N.A. (2005). How to measure characteristics of processes of QMS // *Quality Management Methods*. No. 2, p. 14-17.

ST RK 1732-2007 – Milk and Dairy Products. Organoleptic method of determination of indicators of quality. https://online.zakon.kz/document/?doc_id=31070321

ST RK 1733-2015 Milk and Dairy Products. General specifications. https://online.zakon.kz/document/?doc_id=32459980

ST RK 1734-2007 Milk and Dairy Products. Acceptance procedures and test methods. https://online.zakon.kz/document/?doc_id=31683701

ST RK ISO 10001-2009 Quality management. Satisfaction of the consumer. https://online.zakon.kz/Document/?doc_id=31426233

ST RK ISO 19011-2013 (IDT, ISO 19011:2011) Guidelines for auditing management systems. <https://www.belstu.by/Portals/0/userfiles/125/GOST-ISO-19011-2013.docx>

ST RK ISO 9000:2016: Quality management systems - Fundamentals and vocabulary. <https://www.iso.org/standard/45481.html>

ST RK ISO 9004-2010 (IDT, ISO 9004-2009) Managing for the sustained success of an organization. A quality management approach. https://online.zakon.kz/document/?doc_id=31306691#pos=0:0

ST RK ICO 9001-2016 Quality management systems - Requirements. <https://www.iso.org/standard/45481.html>

Technical Regulations of the Customs Union 021/2011 About safety of food products. [webportalsrv.gost.ru/portal/GostNews.nsf/.../\\$FILE/TR_TS_021-2011_text.pdf](webportalsrv.gost.ru/portal/GostNews.nsf/.../$FILE/TR_TS_021-2011_text.pdf)

Tereshchenko N.V., Yashin H.C. (2006). Model of complex assessment of effectiveness of QMS, *Quality Management Methods* No. 4, p. 12-17. <quality.eup.ru/DOCUM4/remeslo.htm>

Vasilyeva L.N., Muravyeva E.A. (2005). Methods of management of innovative activity. M.: KNShchRUS. 130 pp. <http://estud.ru/litra157/>

Yefimov V.V. (2009). Means and methods of quality management: manual. M.: KNORUS. 232 p. <http://www.docplayer.ru/56430230>

Acknowledgements

This research was supported by the project, which has received funding from the Ministry of Education and Science of the Republic of Kazakhstan, the Grant of a Scientific Project on the theme "Monitoring and optimization of food safety based on innovative nanotechnologies" (2015-2017, state registration number is 0115RK01777)†

Short biographical note about the contributors:

Saule Ospandiyarovna, Akhmetova is the Associate Professor in Chemical Engineering of Almaty Technological University, Almaty, Kazakhstan. PhD in Technology of Inorganic Substances. Chartered Engineer-Chemist-Technologist (CEng), Researcher and Academic Staff of Higher Education Institutions with almost 35 year experience, a track record of over 90 publications, including monograph "Processing of low-grade phosphorites", 8 USSR and RK patents, scientific papers and presentations on the conferences, acquisition of 5 projects. A Scholar of the International "Bolashak" Programme of the President of the Republic of Kazakhstan 2013-2014. Research areas: Complex processing of low-quality phosphatic raw materials into important products of economic value; Analysis and improvement of QMS of the enterprises for food industry of RK, Food Security, Ecology.

ORCID ID: orcid.org/0000-0001-7287-766X



Mariya Shayakhmetovna, Suleimenova is the Associate Professor in Chemistry and Head of the department "Chemistry, Chemical Engineering and Ecology" of Almaty Technological University, Almaty, Kazakhstan. PhD in Chemical Kinetics and Catalysis. Her scientific and pedagogical experience is more than 30 years, a track record of 200 publications, including 20 textbooks, 1 monograph, 10 USSR and RK patents, scientific papers and presentations on the conferences. Acquisition and advisor of 10 projects: 1 international and 9 Republican scientific projects funded by RK and IScTechC (the partner program of the USA). Area of scientific interests: catalytic synthesis of dyes and biologically active agents, creation of biomaterials for branches of agro-industrial complex, food security, ecology.

ORCID ID: orcid.org/0000-0001-5455-6475

