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TOWARDS FOOD SAFETY: QUALITY MANAGEMENT PECULIARITIES

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Abstract. By introducing new international standards into management systems, most enterprises obtain recognition by the market participants relative to different aspects of their activity. At the same time, problems with the enterprise units management arise rather often. The primary intent of this research is identifying the technical approaches aimed at creating an integrated Quality Management System (QMS) for the food enterprise, which reflects the branch specificity and is based on international standards ISO 9000 and HACCP principles. The paper presents the possible benefits for the food industry originating by the introduction of an integrated QMS based on the analysis carried-out analysis on modern QMS trends. Additionally we present the generalized results of the researches conducted on the “Process model of Raimbek Agro Company”. Finally, a technique for the assessment of productivity and continuous improvement of QMS is developed. Originality/value: the developed technique for productivity assessment and continuous improvement of QMS allows to establish causal relationships between planned and reached results, thus highlighting the effects. The introduction of an Integrated Quality Management System (IQMS) will enable the enterprise to meet the present-day market requirements and to ensure the competitive goods production.

Keywords: food safety; quality; management; process approach; HACCP (Hazard Analysis and Critical Control Point).

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1. Introduction

In the present market conditions, the stable and successful activity of an enterprise is defined by a number of factors, e.g. the ability to satisfy the needs of the consumer, high-quality products and safe production. A rational use of all modern management potential embedding worldwide experiences, would allow to keep and strengthen the market positions, based on own resources (Conti 2005; Fuschi, Tvaronavičienė 2016; Tvaronavičienė 2016). A variety of management systems and standards are available, constantly growing and covering various fields of the company activity (Gerlitz. 2016; Dalati 2016; Tvaronavičienė et al. 2015; Baronienė, Žirgūtis 2016; Kaźmierczyk, Aptacy 2016; Peleckis et al. 2016; Olaniyi; Reidolf 2015).

Thus, management systems represent an effective tool by means of which organizations can optimally build their activities while adapting to a constantly evolving context and growing competition. Management systems requirements include environmental, personnel, occupational safety and health, industrial safety, information support systems, etc. These systems address various areas of interests of the enterprise and its partners, clients,

additionally, the state and the public are also considered and accounted for. Introducing international standards on management systems, enterprises achieve full understanding on several aspects of the activity and possibly discover inconsistency in management of various objects of the enterprise. Thus, there is a clear need for the integration of available systems in a standardized and uniform system for supporting company management. Such system should aim to maximum achievement of the enterprise objectives and the balanced implementation of all interested parties requirements (Maximov, Papkov 2003).

Nowadays the creation of the integrated management systems comprising quality management, environmental management, health & safety management, corporate social responsibility and ethical management are becoming consolidated practices (Tvaronavičius et al. 2010; Litvaj, Poniščiaková 2014; Mentel et al. 2016; Ignatavičius et al. 2015; Tejkalová et al. 2015; Balkytė, A.; Tvaronavičienė, M. 2010). However these practices lack of uniform conceptual approach, as well as of methodical recommendations that would allow implementing integrated management systems in Kazakhstan enterprises.

A special interest has the development of integrated management systems considering the specific features of the enterprises in particular when focusing on concrete aspects of the production technology and the organization of optimal conditions of production and safety. Nowadays is particularly relevant the creation of such management systems for the food industry enterprises which are characterized by a raising degree of potential risks connected with their products. The creation of devoted integrated management system for food enterprises, based on the ISO9000 standards series and the principles of HACCP, will promote safety of food products.

The main objective of the work consisted in the creation of an IQMS for food enterprise reflecting branch specifics on the basis of the ISO9000 series and the principles of HACCP. For the achievement of the purpose, at this stage of research, it was necessary to complete the following steps:

- analysis of the modern approaches and methods applied for the creation and integration of management systems;
- analysis and assessment of Raimbek Agro Company QMS productivity and functioning as part of the development strategy definition;
- development of a technique for the assessment of productivity and continuous improvement of QMS to be used for the analysis of Raimbek Agro Company QMS functioning and allowing establish relationships of cause and effect between planned and reached results;
- development of productivity processes indicators and methods of their measurement;
- development of the «Raimbek Agro Process model» allowing to realize desired process and system approaches and to formalize the activity of the enterprise.

2. Focus of the research and review of current field trends

Subject of the research are theoretical and practical aspects of the management of the enterprise activities introducing an IQMS on the basis of the modern methods of quality management and with the usage of system analysis, process approach, expert evaluations methods, and the analysis of the work practice developed at the enterprise. Object of the research is the functioning the QMS of the Kazakhstan enterprise for production of dairy products (with specific focus on the Raimbek Agro Company as case of study).

Analyzing the experience of the advanced world companies which constructed effective competitive management systems, it is possible to identify the following main trends:

1. Orientation to the client and the market, understanding of consumer preferences which would allow to win the market. The strategy, focused on the consumer, aims at the satisfaction of consumers' requirements and expectations thanks to interventions that can assure that the activity characteristics and business results will be better than those of the strongest competitors; creativity obtains especial importance in contemporary context (Dlugoborskytė et al. 2015).
2. Transition from an authoritative to a leadership management style (Dalati 2016)
3. Increase the role of strategic planning. The problem of strategic planning becomes extremely important in

case of instability of operating conditions of the enterprises. A strategic program properly developed and realized allows to eliminate temporary difficulties, to retain and strengthen the acquired market positions under any circumstances, leaning generally on own resources.

4. Creation of a system for the general management of the enterprise. It has become widely accepted that quality management applied at the level of all firms is essential for ensuring competitiveness and strengthening of the market position. Similarly, it is important to adopt management system based on re-engineering of all business processes. Overall, the creation and management of a system of interacting dynamic processes all cooperating for the achievement of a common goal promotes the increase of productivity and efficiency of activity of the organization.
5. Optimum use of the human capital of the organization. In any organization the most valuable asset are its employees and in many respects the failure or prosperity of firm depend on them. Management of human resources is integrated part of strategic management. The main characteristics of personnel management have to include delegation of powers, continuous training, team work and personnel motivation (Dlugoborskytė et al. 2015).
6. Adoption of scientifically based decisions exploiting the analysis of detailed and reliable information. The top management decisions process mechanisms has to be based on objective and reliable data, i.e. control has to be exercised not on the basis of managers' intuition and feelings but on the basis of clearly established facts and their scientific analysis. For this to be achieved, reliable and detailed information has to gather carefully and comprehensively studied by means of modern methods, including statistical methods of data collection and analysis (Fuschi, Tvaronavičienė 2014).
7. Application of Information Technology. For the implementation of effective management, it is necessary to have the best possible information set on the operated object. As information processing abilities of a person are limited, as well as their possibility to cope with its escalating quantity, arises the need for ways of automated storage, processing and transfer information or, in other words, for proper information technologies. The main requisite for the efficiency of functioning of management systems is the existence of an integrated system for collecting and analyzing of information on production at all stages of its life cycle. For the integration of the information processes used at various stages of the production life cycle, there are various technologies that can be used for deploying the uniform information environment for the design, production, tests, delivery and operation of production processes.

According to several experts, in the coming years the whole world market of high technologies and industrial cooperation will completely migrate to information technologies and operate with production characterized by having digital documentation only. Modern management systems can be classified conditionally depending on the object of standardization in the field of management and area of distribution of systems (Fig. 1). For providing of compliance to the variety of legislative and market requirements in various fields of activity enterprises are compelled to introduce - depending on their characteristics - different management systems, and in some cases it may be even necessary to have different management systems running in parallel at the same time.

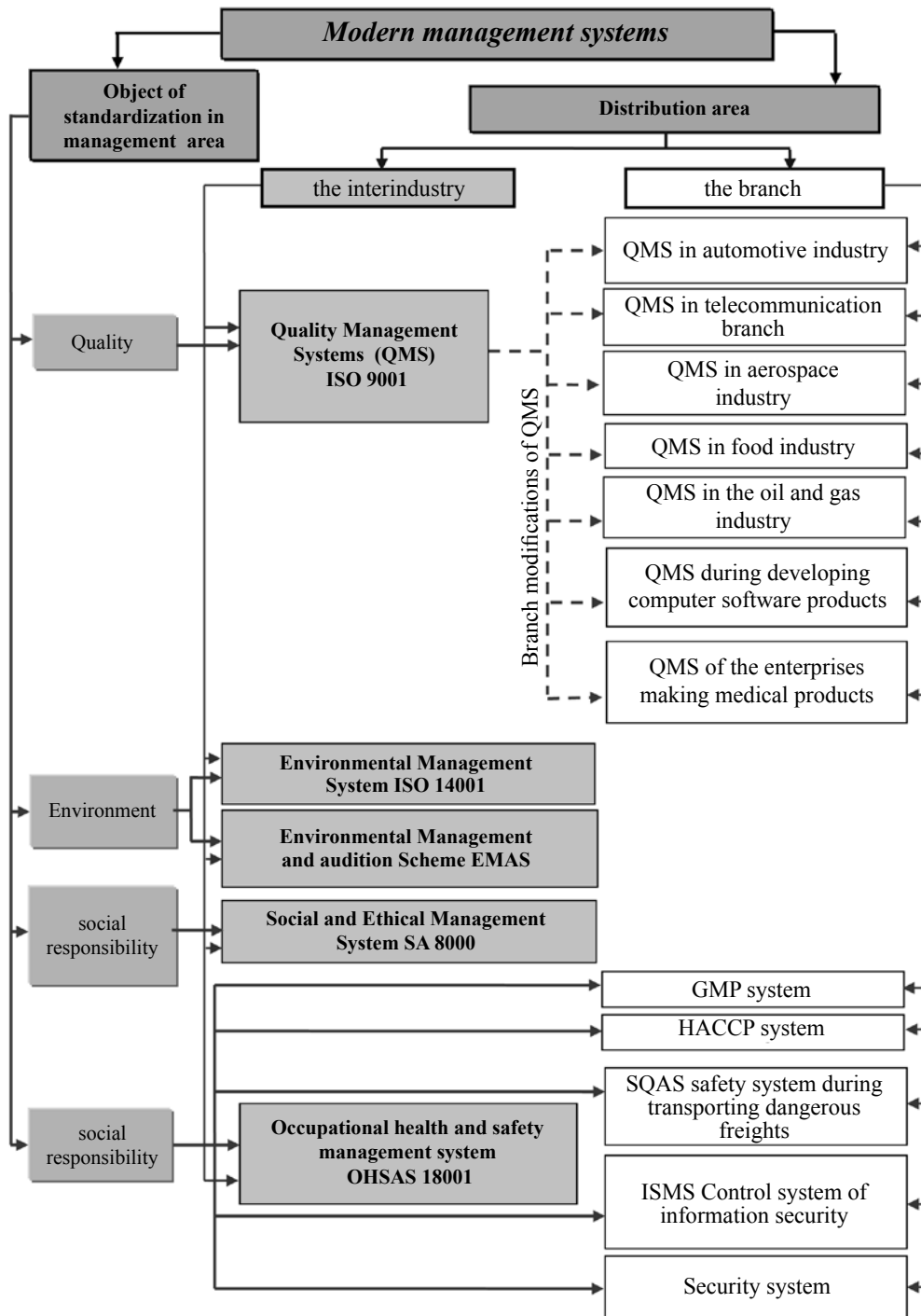


Fig.1. Modern management systems

The HACCP system - risk analysis and critical control points (Hazard Analysis and Critical Control Point) is the system for safety of products recognized in the world for consumers operating control over risk factors during the full cycle of production and transportation of foodstuff. The main objective of QMSs is ensuring competitiveness of production or a better positioning in the market. The purpose of management systems based on the HACCP model is connected, first of all, with the safety of products, and already in this respect issues of competitiveness have to be resolved. The purpose of HACCP is safety of products for consumers by operating control over risk factors during the full cycle of production and transportation of foodstuff (Management Systems in the Food Industry: ISO 22000//ISO 9000 standard + 14000, 2005).

For the integration of quality management, it is important to provide effective management of the processes operating at the enterprise. This is because the quality depends directly on the efficiency of these processes, their components, and the organization of the information streams between processes and operations during production. Therefore, quality is defined by the control of processes, the applied techniques and the work of the personnel. Thus, only thanks to enterprise wide management systems, which conceptual basis is the QMS, the enterprise can achieve prosperity of the business through quality.

The main author in co-operation with Omarova A. (Akhmetova et al. 2014) has developed a technique for the creation of a QMS for food enterprise on the example of the Raimbek Agro Company. The possibility for creating QMS according to the requirements of ISO 9001:2008 (ST of RK ISO 9001-2009) and the principles of HACCP ISO 22000:2005 (ST of RK ISO 22000-2006), was explored and established starting by the analysis of the reference standards mentioned. The theoretical and practical aspects of construction and development of QMS and HACCP systems were analyzed in the perspective of the development of algorithm of creation of IQMS. Similarly, were adopted procedures such as: inspection of the enterprise for detecting its readiness for the acceptance of an IQMS system; the development and deployment of documentation, training of the personnel including aspects such as carrying out self-inspection and certified audit. A specific algorithm for the creation of an IQMS that takes into account all the above mentioned complex stages and the specifics of development and deployment of two standard systems takes as reference model was created. Finally, a specific algorithm describing the technique of creation of an IQMS of the food enterprise has been developed.

3. Methodology: implementation of the process approach

The main activity of the Raimbek Agro Company is the production of dairy products. Raimbek Agro is the leading producer of ultra-heat-treated milk in the Republic of Kazakhstan. As raw materials, Raimbek Agro Company uses only natural, whole, fresh, cow's milk meeting all sanitary and veterinary standards for the production of dairy product. Each lot of products has to pass microbiological controls in a factory laboratory, and is also subject to certification without fail. The laboratory also controls the quality of all production, using microbiological and physical and chemical analysis methods and standard procedures. All production undergoes a procedure of mandatory compliance. In addition, the Academy of food of the Republic of Kazakhstan, SES, Committee on Technical Regulation and Metrology regularly perform controls on the productions made.

Considering the special importance of production quality for a successful business, in September 2005 the management of Raimbek Agro Company took the decision of establishing a QMS meeting the requirements of ISO 9000-2000. In 2008 and 2011 the enterprise adopted QMS enhancements in accordance to the requirements of ISO 9001-2008. In a context of increasing competition, the management decision was motivated by the desire to improve the control system of the enterprise in general, to increase the quality of products and provided services, to provide closer interaction with consumers and to offer clients new services.

Having chosen the ISO 9000-2000 standard as an effective mechanism of organization management, there was also the need of application of the "process approach" for all aspects of its activity and, in particular, in relation to administrative decisions. In 2013, the enterprise developed, introduced and now exploit in working order an effective quality and safety management system for food production in accordance with the requirements of ST RK ISO 22000-2006 (ISO 22000:2005) and ST RK ISO 9001-2009 (ISO 9001:2008) standards. Process approach, is one of the most known and popular theoretical concepts, at the same time it is one of the most difficult to implement in practice. The main complexity is that the enterprises organizational structure is usually constructed according to the functional principle, i.e. has pronounced division into structural elements according to their functional role. A similar approach (Scientific Management) entered into practice following the theory of Frederick Taylor in 1905, however, now if applied as defined, it doesn't allow the organization to react adequately to changes of environment and to keep a necessary level of competitiveness. Only by adapting processes and constantly improving them, the enterprise is capable to achieve higher efficiency in its activities.

It is clear that for the complex systems such as enterprises, it is almost impossible to have a unique model suitable for addressing any cases the managers may face. Each enterprise already has a set of processes in place, so it has to carry out independently the final identification of processes taking into account specifics of production, the status and importance of the processes which are already operating at the enterprise. Within the studied company the solution for achieving a good modeling has been based on a structural and a functional scheme of the enterprise, the enterprise adopted standards and a detailed description of its divisions. Besides, the enterprise proceeded from the principle that the identified processes of QMS have to meet the requirements of all sections of the ST RK ISO 9001-2009 standard. Then the processes were classified in main processes, auxiliary processes and management processes, allowing to logically allocate processes of various importance depending on the purposes of processes. On the basis of this classification, a specific coefficient of importance was assigned to each process. This has been reflected in an assessment of the productivity of the QMS in general.

Within the development of the process optimization approach, there is the need for an adequate representation of the existing processes of the enterprise for information purposes. In our practice the combined text and graphic description of processes was applied. All information on the processes allocated and functioning at the enterprise were collected in a separate document: “Raimbek Agro Company Process Model”. This document is intended for providing information on all identified processes to the personnel of the enterprise and promote understanding of the essence of the process approach. The document contains all available information on process organization and their description, it includes the following main sections: main characteristics of QMS processes and sub-processes, processes cards, process network (PERT Diagram).

The Table 1 “Main Characteristics of QMS Processes and Sub-processes” presented below provides description of all processes under consideration.

Table 1. Main characteristics of QMS processes and sub-processes

№	Process / Sub-process Code	Name of the process / Sub-process	Aim of the process /Sub-process	Process Standards	Process Inputs	Process Outputs (results)	Processes Owners
1	2	3	4	5	6	7	8
8	BII-1	Providing and human resource management					
	BII-1.1	Workforce recruiting	Providing the enterprise with the personnel in adequate number and with the necessary qualification	PK 1.4-01-2002 “The management of quality” Item 6-01-2002 STP “Quality management system. Management of human resources. Selection, preparation and training of the personnel”	Staff schedule, duty regulations	Staff	Head of human resources department
	BII-1.2	Personnel training	Acquisition of practical skills and professional development		Training programme	Personnel with the due level of competence	
	BII-1.3	Internal informing	Ensuring awareness of the personnel on relevance and importance of its activity and a contribution to achievement of the objectives in the field of quality		Information connected with the activity of the enterprise	Informed personnel	
	BII-1.4	Personnel certification	Confirmation of qualification of the personnel		Personnel of the enterprise	Personnel conforming to the established requirements	

Processes Owners were appointed by the top-management and granted the authority to resolve any arising issues at the horizontal level. Within process, heads of any other divisions interacting with the process would be subordinated to the process owner. The process owner would also be liable for achieving the process objectives as established. A graphic description of the processes (in the form of cards reflecting the main characteristics of processes) was carried out and would include: owners, processes inputs/outputs, and also the sequence of the related sub-processes. These Cards allow to describe the processes precisely, quite concisely, so they are convenient for the perception and analysis, and identification of what activity is carried out, who is responsible for it, and - which is the the most important aspect - to define processes input and outputs. An accurate description of the input and outputs allowed us to reduce (or prevent) significantly problems possibly arising at the interface between processes.

4. Results and Discussion

The systematic analysis of QMS performances (in terms of its productivity, suitability and needs for improvement) is one of requirements of the ISO 9001-2009 standard. This has to be done by the management following the principle of quality management, thus implementing a decision-making process based on facts. To achieve this a specific technique for the assessment of productivity of QMS was developed. In light of the process approach the QMS represents itself as a network of the interconnected processes, therefore the assessment of its productivity is reduced to the assessment of the productivity of the processes and an initial stage of the assessment is the identification and classification of the processes depending on their role in the QMS. The top-management of the “Raimbek Agro” LLP develops the Policy and the Purpose in area of quality and provides instructions for their compliance to the current and perspective requirements of the Enterprise for the implementation of consumers’ requirements. The guide to quality of the Enterprise contains the description of QMS processes interaction by means of a QMS processes interaction scheme based on IDEF0 technology. The ISO9000 standards series do not offer a clear mechanism for the assessment of QMS processes productivity and therefore, in general, the questions connected with an adequate and objective assessment of QMS has significant practical importance. The developed technique for the assessment of productivity and continuous improvement of QMS according to which the systematic analysis of QMS of Raimbek Agro Company was carried out offers a practical and effective solution of this issue. This technique contains three logically interconnected stages. The first stage is directed to the establishment of indicators of QMS processes productivity and reflects the realization of process approach in the enterprise. The second stage allows carrying out the assessment of productivity of QMS. The third stage provides definition of the directions to follow for improvement of the QMS functioning. The first stage includes identification and classification of QMS processes; the creation of the adequate network of the enterprise processes, and also the definition of a system of indicators for the quantitative assessment of processes productivity and establishment of proper methods measurement. Having analyzed the state of the art in the field of quality and having analyzed established practices of work of enterprises, it was possible to clearly identify the functioning of the processes operating in Raimbek Agro Company, subsequently, by defining productivity indicators for each process it was also possible to determine their planned values. It should be noted that the nomenclature of the indicators of productivity can be changed depending on the specifics of the enterprise and the directions of its activity. Further for the chosen indicators the methods of to be used for their measurement were defined. The development of the document “Raimbek Agro Company Process Model” previously described is one of the main result of this stage. The document includes the following main sections: main characteristics of QMS processes and sub-processes, processes cards, processes network and processes productivity. At the second stage, the monitoring of processes, data recording and calculation of productivity of QMS was carried out. The results of monitoring gave the opportunity to obtain data on process functioning, and also to correct and improve the QMS processes. In Raimbek Agro Company the monitoring data reflecting actual values of indicators of processes productivity for the current half-year were collected and presented by the specialists of various Departments to the Quality Management Department and archived. Obviously that for the assessment of processes productivity it is necessary to use a certain system of indicators, its development and justification represents *per se* a rather difficult task. This may be due, firstly, to the high degree of coherence required for these indicators (i.e. the change of one can be a consequence of the change of others) and this makes it very difficult to allocate the most significant indicator. Secondly, in depending on the sphere of activity of the organization, the indicators can differ significantly. We have studied the approach of various experts in quality area in relation to these indicators. Most often their opinion is, that it is necessary to know in advance what indicators exactly should be used. However, when it was attempted to directly apply the techniques developed by these experts we faced that the majority of such indicators were non-informative for “Raimbek Agro” Company. Therefore we came to the conclusion that some time was required to study the functioning of the processes which would be necessary for the establishment of indicators really significant for the enterprise in order to identify problems in their functioning and can characterize productivity of each process. For the assessment of the processes productivity of the enterprise is important the development of an adequate measurements system. Measurement processes in QMS are the most difficult tasks in practical application. Depending on the processes features different methods of measurement can be used: sociological, expert, comparisons, settlement and tool.

As a result of the carried-out work indicators of productivity and methods for their measurement were established, additionally, while the updating of the «Raimbek Agro LLP Process Model» document became a major achievement. It is worth noting that particularly difficult is the measurement of non-technological processes productivity which is defined by quality of the administrative decision that various factors can influence, in particular, character of the decision (quick, tactical, strategic), completeness and character of information, complexity of the task to be solved, correctness of the definition of the purpose etc. from this set of factors, definition of the purpose is key for establishing the quality of the decision. Incorrectly defined purpose would affect the possible decision leading to incorrect results and among the consequence there will be inefficient processes. Therefore, object of measurement for QMS non-technological processes is the extent of achievement of the defined purpose. Thus, in reality it would be more correct to speak not about a measurement, but about an estimation by comparison of the reached results in relation to fixed purposes. For this it is necessary to establish planned or desirable values for the indicators against which the actual values will be compared. For the analysis of processes functioning results it is possible to use the comparison with similar results of the previous period or with the established values on the basis of the available experience. After the establishment of the planned values for the processes productivity indicators it is necessary to collect their actual values. The main way of obtaining data of the functioning of processes is their monitoring (Monitoring and measurements on ISO 9000:2000). By definition, Monitoring is the technique and system of supervision over a condition of a certain object or process giving opportunity to observe them in development to estimate and/or reveal, quickly, the results of influence of various external factors. The results of monitoring give opportunity to receive real information of the functioning of process and to bring adjustments on its management. It is important to note also that huge importance needs to be given to the definition of the period used for carrying out of the monitoring of processes productivity. For example, the data collection in “Raimbek Agro” Company was carried out in half a year. The actual values of processes productivity indicators can be also established in the course of internal audits as, according to ST of RK ISO 9001-2009, it is recommended (as an objects of consideration at internal audit) to consider: the productivity of introduction of productivity indicators, the feasibility of the processes, and (as a consequence) the possibility of continuous improvement. The relevant collected data from experts and departments about the results of processes functioning doing the half-year observation was provided to the Department of Quality Management and were recorded in the Registration Sheet of Summary Information on QMS Productivity (Table 2).

Table 2. Form of Registration Sheet of Summary Information of QMS Productivity

process / Sub-process Code	Name of the process / Sub-process	Value of an indicator of productivity			Importance of the primary indicator	Group indicator of productivity of process	Group indicator of productivity of process
		the planned	the actual	the settlement			
1	2	3	4	5	6	7	8
Summary indicator of QMS productivity							

On the basis of the data obtained during the monitoring the group indicators of processes productivity were counted. For the calculation of group indicators the δ were used relative to primary indicators of the processes productivity η_i^o, q_i “weighed” taking into account their importance:

$$\delta = \sum_{i=1}^n \eta_i^o q_i$$

The relative importance of the coefficients has been defined empirically, and $\sum q_i = 1$.

Primary indicators of processes productivity can be set quantitatively in the corresponding units of measure, percent or points. Due to the heterogeneity of the set, primary indicators of processes productivity they were recalculated in relative sizes η_i^o by comparison of the actual value of primary indicator at time η_i^m to planned value of this indicator at time η_i^n : $\eta_i^o = \eta_i^m / \eta_i^n$.

Further, we counted a summary indicator of QMS productivity: Θ on the basis of group indicators of the pro-

cesses «weighed» taking into account their importance q_j :

$$\Theta = \sum_{j=1}^m \delta_j q_j$$

After the definition of the indicators of processes productivity the general QMS productivity is computed.

As final stage of the technique it is possible to perform informed decision-making taking into account the results of the assessment of a possibility of the development of actions for improvement, need of carrying out the correcting and warning or remedial actions. All information streams were gathered in a uniform stream in the Department of Quality Management for documenting by means of the QMS functioning report. This stream contains information on the results of production activity, characteristics and trends along with the possibility to perform correcting and warning actions, about suppliers, needs for resources, improvements, consumers' satisfaction. Overall it shows QMS suitability and productivity.

Conclusions

The main result of this work is the development of methodical approach to the creation of an IQMS on an exemplar company of the food industry. The deployment of an IQMS for the food enterprise reflecting branch specifics has been carried out on the basis of the carried-out analysis of trends of development of modern management. The assessment of productivity of QMS, the analysis of performance of the warning and correcting actions planned by the results of there functioning, further planning of improvement of QMS provide continuous improvement of activity of the enterprise. Thus, we proved the possibility of deploying an acceptance method for operationally measure the IQMS achievement in accordance to the planned the purposes and adapt it to change when needed already at intermediate stages of operation by adopting the principle of Pareto achieving the most possible result with minimal effort. The "Raimbek Agro Company Process Model" has been developed and implemented allowing to realize process and system approaches and to formalize activity of the enterprise as desired. This model includes:

- nomenclature of all the processes/sub-processes and their main characteristics;
- individual cards of all the processes;
- full process network for the Raimbek Agro Company;
- a system of indicators for the quantitative assessment of processes productivity
- methods of measurement of the defined and chosen indicators.

A technique for the assessment of productivity and continuous improvement of QMS has been developed and implemented on the basis of the performed analysis of QMS functioning carried out at the Raimbek Agro Company. The technique allows establishing a cause and effect relationships between the planned and reached results. Technique was implemented and used for the assessment of the improvement of QMS in 2014. The assessment of QMS productivity which was carried out in the second half 2014 according to the developed technique allowed to establish that the growth index of QMS productivity in respect to the first half of 2014 resulted in: $I_{QMS} = R_2/R_1 = 1,041$ which testifies the positive changes taking place in the enterprise and the possibility to develop new objectives. On the basis of the comprehensive analysis of the obtained data and the assessment of QMS functioning, it was possible to develop an enterprise development strategy focused on the satisfaction of the requirements of all interested parties and comprising the integration of HACCP system into the operating QMS. A composite design of the processes on the basis of the revealed areas of integration of HACCP and QMS systems was carried out and indicators of processes productivity and methods of their measurement developed. The resulting IQMS will enable the enterprise to meet the present-day market requirements and to ensure the competitive production of goods.

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