THE DEVELOPMENT OF AN INTEGRATED MANAGEMENT SYSTEM TO ENSURE THE QUALITY STABILITY AND FOOD SAFETY

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Abstract: Ensuring the competitiveness of Russian producers of food products is impossible without achieving the consistent quality and food safety. Special attention in this paper is paid to the introduction of relevant management systems at the enterprises of the food processing industry. A significant number of the currently available standards and specifications enables the management of any enterprise to choose the most appropriate variant for the given enterprise: to implement a single system or a set of systems which can represent the integrated management system (IMS). The main point in this choice is the idea of these types of management systems and of the potential, additional opportunities, and advantages that can be obtained due to their implementation at the enterprises. The responsibility of food manufacturers for the implementation and maintenance of procedures based on the principles of HACCP (Hazard Analysis and Critical Control Points) also determines the relevance of the topic. The evaluation of management systems, which are possible to implement at the food enterprises, has been conducted according to the following criteria: solvability of problems, applicability for the food enterprises and the possible effect from the implementation (a potential). The availability of fundamentals for the integration of management systems has been shown, the concept of IMS has been discussed and the need for IMS from the food enterprises has been identified The detailed plan of IMS development has been proposed. The possibility and the attractiveness of the development, implementation of other management systems in the food processing industry, in particular, the environmental management systems, management systems of occupational safety and health, energy management systems, models of ethical and social management have been established. The approach to the choice of IMS components has been confirmed on the basis of the utility definition and potential advantages of each management system separately. The model of the development and implementation of the "optimal" integrated management system of quality and safety for the food enterprises has been offered. The basic point of it is the process model as the main part of the "optimal" IMS of the food enterprise.

Keywords: Integrated management system, quality stability and food safety, quality and safety management systems, food industry

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INTRODUCTION

Food quality and safety are an important criterion of "quality of life" in all countries of the world. Such characteristics of food products as "quality" and "safety" determine to a large extent the "competitiveness" and "profitability" of the food enterprise. The development strategy of the food processing industry of the Russian Federation for the period up to 2020 proposes to implement modern management methods and integrated management systems of quality indices and safety of food raw materials and food products during the processing, transportation and storage to "solve the problem of increasing competitiveness of Russian food organizations, to create conditions for the import substitution for socially important foods and the export potential"[1].

The implementation and use of various management systems standardized in the documents of universally recognized organizations primarily the International Organization for Standardization (ISO) can certainly contribute to the successful realization of this direction. A significant part of the international standards ISO is universal: the standard requirements are general and applicable to all enterprises and companies, regardless of the industry sector, size and category of products. These include, for example, ISO 9001:2008 "Quality management systems. Requirements", ISO 14001:2004 "Environmental management systems. Requirements and instructions for use", ISO 50001:2011 "Management systems in power consumption. Requirements and instructions for use", and others.

The next group of standards can be characterized as the "industry standard", that is, with a clear field of application, for example: ISO 22000:2005 "Food safety management systems. Instructions for use", ISO 13485:2003 "Medical devices. Quality management system. Requirements for regulatory purposes", and others. The popularity of these ISO standards is shown by the statistics of a large number of certifications in the world, as well as in Russia. Table 1 presents the data on the quantity of certificates of conformity for the management systems at the enterprises of two groups: "agriculture and fishery" and "production of food, drinks and tobacco" according to the report «The ISO Survey - 2013» [2].

Table 1. Quantity of conformity certificates for management systems

№	Sphere of activity	ISO 9001				ISO 14001				ISO 22000			
		Worldwide		Russia		Worldwide		Russia		Worldwide		Russia	
		2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
1	Agriculture fishery	4883	4953	4	9	1269	2467	1	1	22715	26284	171	279
2	Production o food, drinks and tobacco	33705	32519	120	677	5878	6890	35	56				

Statistics shows that the most popular standard is ISO 9001: 2008, followed by ISO 22000: 2005 and ISO 14001: 2004.

DATA GENERALIZATION ACCORDING TO THE MANAGEMENT SYSTEMS

In addition to the quantitative evaluation of the implementation of management systems at the food enterprises, and in order to understand what to implement and what management system, it is important to understand what each of the systems can potentially and actually give to the enterprise and whether there can be a synergistic effect from the integration of these management systems. The integration into the world economy creates certain risks for the domestic food industry. It requires the adoption of comprehensive measures to increase the competitiveness and the practical implementation of international standards in the field of food safety. At present, the perspective is not only the development and implementation of food safety management systems but also the development and implementation of integrated management systems (IMS).

ISO 9001: 2008 (GOST ISO 9001-2011 «Quality management systems. Requirements" [3]) - the quality management system according to the requirements of this standard aims the enterprise at achieving the customer satisfaction, while observing the compulsory requirements for the products supplied. The purpose and logic of this important standard is very simple because only a satisfied customer will always buy "our" products and give "us" his/her money, thus ensuring the profitability, viability and sustainability of "our" company. For the food enterprises the important elements that determine the category of "customer satisfaction" are the quality of products, to be more exact, the quality "in dynamics" , the stability of the quality index (regardless of the day of the week, time of the working shift and time of the year of production) and the product safety . It appears that the guarantee of the quality stability of the finished products will be the controlled sequence of processes, ranging from ensuring the consistent quality of raw materials till ensuring the planned characteristics of the shipped finished products based on the concept of controlling the "product life cycle" in accordance with the evaluation data of customer requirements, on the one hand (process input), and the evaluation data of the customer satisfaction, on the other hand (process output). The practice of a number of enterprises and some large companies shows that the success is largely determined by not only the achievement of customer requirements, based on the stable product quality but the possibilities of producers to anticipate the customer requirements, that is, actually to manufacture a new product, unexpected to some extent for the consumer, and accepted by him with appreciation. In achieving these approaches the important role plays the competent application of the concept of the cycle: “Plan (Planning) - Do (implementation) - Check (checking) - Act (action)”, (PDCA). "Product safety" being certainly an essential component of the concept of "food production quality" is the central category of the other management system, which is discussed below (ISO 22000: 2005 (GOST R ISO 22000-2007), but as an important component of the index of the "product quality" in the broadest sense, it has the full right to be controlled within the quality management system according to GOST ISO 9001-2011 at the food enterprises. Thus, the advantages of the implementation of quality management systems based on the requirements of the standards ISO 9000 are as follows:

– often - putting or at least improving the general order at the enterprise: in documents, on the territory, in the industrial and utility rooms, and so on;

– positive changes in the minds of the employees and the relationship between the divisions of the enterprise, the increase of responsibility level, the understanding that wages depend on the buyer of the company's products and his satisfaction, and not from the director or accountant of the company. To obtain the needed quality and the supply conditions of interesting

products for the buyer, it is necessary to achieve satisfaction of domestic consumers;
– ensuring a stable output and the required level of quality on the basis of effective processes of the quality management system of the enterprise;
– raising the level of consumer trust;
– improving the image of the enterprise;
– additional opportunities to retain existing customers and win the trust of new ones;
– improving the overall management system of the enterprise;
– additional opportunities and incentives to reduce costs and obtain more economic benefit;
– additional opportunities to increase the competetiveness of the enterprise.

ISO 22000: 2005 (GOST R ISO 22000-2007 "Food safety management systems. Requirements for organizations involved in the food chain" [4]). Food safety management system (FSMS) can be defined as a mechanism for the organization management to ensure the food safety during the production, storage and marketing. The important thing in understanding the requirements of this standard is that it applies only to the aspects of the food safety and its field of application relates to the ability of the enterprise to control the hazards of food production and guarantee its safety for the human consumption in accordance with applicable legal requirements. The main FSMS components at all stages of the product life cycle (PLC) are:
– interactive exchange of information;
– system management;
– programs of preliminary compulsory measures;
– principles of HACCP (Hazard Analysis and Critical Control Points).

The food safety is achieved by controlling all identified hazards (considering the probability and severity degree of their occurrence) with one of three established methods: PRP (preliminary programs), PRPo (operational preliminary program) and HACCP plan.

The standard recommends using the safety systems when realizing preliminary programs. They became widespread in the world, for example, GMP (Good Manufacturing Practices), GHP (Good Hygienic Practices), GLP (Good Laboratory Practices), and others. GMP system is considered to be one of the fundamental systems of the food quality and safety in the world. The food enterprises can use several elements of GMP system, in particular, the procedures in sanitizing rooms and equipment, in personnel hygiene, storage and others. The impact of GMP and GHP is aimed at the production on the whole, while the HACCP plan is developed for specific products, production lines and aimed at managing the significant and quite specific risks beyond the scope of GMP and GHP. To construct the effective FSMS it is important to understand all the distinctive features of these systems, their interrelationship (presented in Figure 1), aimed at achieving the single purpose - the safety of food products.

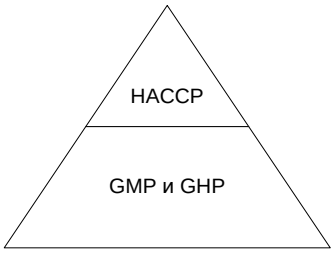

Fig. 1. Interrelationship of subsystems HACCP, GMP and GHP.

When using FSMS according to GOST R ISO 22000-2007 it is important to understand that the management system does not solve the issues that are considered in the quality management systems according to GOST ISO 9001-2011, namely, the achievement of customer satisfaction through the delivery of quality products. And this issue has been agreed by the authors who believe that FSMS is not a complete substitute for a quality management system [5].

FSMS implementation based on GOST R ISO 22000-2007 enables:
– customers to be sure that the products are manufactured in compliance with the hygiene requirements and that they are harmless;
– to demonstrate the intention to take all necessary precautions and to ensure the hygienic production of foods;
– to comply with the requirements for food safety of the legislation of the countries where the company exports its food products;
– to reduce significantly the number of evaluations made by the customer and, therefore, to save time and costs;
– to reduce rejects and return using the resource-saving technologies;
– to reduce costs by establishing better contacts with national food safety organizations;
– to increase the effectiveness of the management system concerning the food safety and to further develop the company.

The main advantages of the implementation of the food safety management system are the following:
– responsibility for the food safety;
– documented assurance concerning the food safety, which is especially important in trials;
– systems approach involving all the parameters of food safety from raw materials to end-users;
– more economical use of resources to control the safety; a significant reduction of the financial costs associated with the production of poor quality (dangerous) products;
– a significant increase of the consumer trust in the food products;
– optimization of the control systems and verification and, in particular, the company on the whole;
– new opportunities to enter new markets and to expand existing ones;
– the increase of the competitiveness level of the food production;
– competitive advantages in participating in important tenders;

– investors are more willing to invest;
– maintaining a reputation of a food safety manufacturer.

ISO 14001: 2004 (GOST R ISO 14001-2007 "Environmental management systems. Requirements and instructions for use" [6]) is an environmental management system. According to this standard the company focuses on reducing the negative impact on the environment, with the subsequent transition to the pollution prevention on the whole, the rational use of natural resources in balance with meeting social and economic needs. The environmental management system during its development is integrated into the overall management of the company, the integral part of which is the environmental protection system, acting at the enterprises in accordance with the legislation of the Russian Federation in this field. The problems of ensuring compliance with the requirements of the legislation in the environmental protection are in the foreground for many companies, implementing the environmental management system. In particular, the food processing industry affects the water resources most of all in the intensity degree of the negative impact on the environment. The enterprises annually emit about 400 thousand tons of harmful substances and only 44% are cleaned. As a rule, outdated treatment plants and equipment do not provide the required degree of purification. The proportion of wastewater contaminated with substances of chemical and microbiological composition is approximately 77% to the total volume of waste. It also confirms the low efficiency of the industrial wastewater treatment plants [7]. It turns out that the priority is providing the legal requirements, and only then - the implementation of the environmental management system, which will require significant resources in wastewater treatment plants, and possibly the reconstruction of production. Thus, for the implementation of environmental management systems more resources are expected to use than in the implementation of quality management systems, food safety management. The availability of the environmental management system gives additional opportunities to the enterprises:
– a better balance of environmental, economic and industrial components, opportunities to reduce costs;
– reduction of the level of risk environmental aspects;
– increase of the trust level on behalf of the controlling organizations, both state and public;
– strengthening of the positive image of the company, based on responsibility and environmental achievements;
– additional advantage in the eyes of potential investors, and in some cases - a prerequisite for the investment;
– the result of the previous advantages is synergistic effect, the increase of the competitiveness at the markets.

GOST R 54934-2012/OHSAS 18001:2007 "Management system of occupational safety and health. Requirements "[8] is a part of the general management system which is used to maintain the policy and management of its risks in the field of OHSAS (Occupational Health and Safety Assessment Series - a series of standards dealing with occupational safety and health). The management system developed by this standard is intended to meet the challenges of the systematic monitoring of hazards and risks in the workplace, continuous improvement of working conditions of employees and prevention of incidents, accidents and emergency situations. The management system of occupational safety and health in its philosophy, mission and methodological approaches is very similar to the environmental management system in the standard GOST R ISO 14001-2007. The benefits of implementing the management system of occupational health and safety are the opportunities to eliminate or reduce the risks of performers who may be exposed to hazards and risks associated with their work and, as a result, there is a reduction of losses (including financial) from accidents at work, monitoring for dangerous production factors, improvement of the psychological climate in the workplace, positive changes in the image of the company.

GOST R ISO 50001-2012 "Energy management systems. Requirements and instructions for use "[9] is a part of the general management system, which will optimize the process of energy consumption. The problem of limited energy resources, their high cost and the constant increase make the energy management systems attractive for the food processing industry. One can identify the potential benefits of the implementation of the energy management system:
– the system provides transparent and objective efficiency assessment of energy consumption;
– professional analysis of energy consumption makes it possible to reveal energy-consuming areas and so to reduce energy costs;
– reduction of risks with abrupt changes in energy prices and the high investment potential of energy efficient projects ultimately increase the competetiveness of the enterprise;
– origin and / or strengthening of the company's reputation as a socially responsible organization that cares about the environment and the rational use of non-renewable resources.

Currently there is no information about the practice of implementing the energy management systems at the food enterprises, but the potential of these systems enables to express confidence in the perspective of their implementation in the future.

GOST R ISO 26000-2012 "Instructions on Social Responsibility" [10]. A special feature of this standard is that it is not a management system standard and it is not intended for certification purposes, compulsory or contractual use. Lack of information about the practice of implementing the given standard at the food enterprises enables to say only about the potential benefits, which the implementation of the concept of social responsibility includes:
– strengthening of the positive image of the enterprise based on social responsibility of the food manufacturer;
– the possibility to attract and retain the qualified personnel, particularly in the context of an acute shortage;
– building confidence between the parties concerned, in particular, from the authorities, business partners;
– the opinion formation about the enterprise as a territory of social well-being [11].

An important element of the quality management system and ensuring the stability of the food quality is the sensor control system. The term "sensor" means "feeling" (derived from the Latin word “sensus” - feeling, sensation) and it is used with the term "organoleptic", which means "the identification with the help of senses". The so-called human factor plays a significant part in the sensor control. That is why, the results of organoleptic evaluation were considered insufficiently reliable for a long time. Modern methods, accumulated experience and the existing normative base, can essentially reduce the variability of estimates, increase the reproducibility of the results, which increase the level of trust and popularity of these estimates and enable to conclude that the sensor control is not an alternative, but an important part of the quality control along with the instrumental research methods (physical, chemical). Knowledge of the sensory characteristics of the incoming raw materials and products at all stages of their manufacture and maintenance of these characteristics at the required level are an important task of food workers responsible for the reception of raw materials, quality control and design of new food products. The application of the sensor control system at the food enterprise enables to obtain the following advantages:

– formation of food quality indices at the early stages of development: marketing research, the development of a new food product;

– ensuring the stability of organoleptic product characteristics at all stages of the product life cycle;

– the possibility of obtaining additional information about the characteristics of the food product by means of the descriptive sensory analysis.

All this shows the need to define the sensor evaluation method as an integral part of the unified system of the quality management of the food enterprise aimed at creating products of the stable quality, safe and attractive to the consumer.

The above data confirm not only the popularity and demand for these management systems, but also the fact that some enterprises have implemented not one but two or three management systems. In the situation of more than one implemented management system, there arises a question about the interaction of these systems, that is, these systems are combined to form a new unit from several components under a single governing body. Thus, the so-called "integrated management systems" are created. It is recognized that the integrated management system is a part of the general management of the enterprise corresponding to the requirements of two or more international standards for the management systems and functioning as one unit.

The modern manager has a wide range of possible management systems, which he can choose and integrate into the existing (or being created) concept of the general management of the enterprise. High attractiveness and individuality of each management system separately (it is potentially possible to obtain considerable benefit from the implementation of any particular system) promote the widespread implementation of IMS on the one hand and a sufficient number of common approaches on the other hand. In particular, the factors contributing to the integration of management systems may include the following general requirements:

– constructing a system based on achieving these goals;

– the concept of continuous improvement based on the application of PDCA cycle;

– principles of management (mostly) laid down into the quality management system according to the standards of ISO 9000: customer orientation (desire to achieve customer satisfaction, and each system has its own "customer"); leadership of the manager (the effectiveness of any system to a large extent depends on the level of realization of this principle); involvement of employees (involvement of relevant categories of employees for achieving the set goals is also true for almost all management systems); process approach (applicable for most management systems); system approach to management (without the implementation of this principle it is impossible to construct any effective systems); making decisions based on facts is a universal system-wide principle; mutually beneficial relations with suppliers (they can be interpreted as building mutually beneficial relations with stakeholders);

– requirements for documenting the management systems.

All this proves the validity of the approach to the choice of the foundations of the integrated management system. This foundation is the quality management system according to the requirements of ISO 9001.

Some support in the development and implementation of IMS can be GOST R 53893 - 2010 "Guidelines and requirements for integrated management systems" [12]. This document should be used together with the specific requirements of the management system standards to which the company joins during their development. It is expected that the implementation of the guidelines and requirements will help enterprises achieve the benefits when consolidating the general requirements for all standards of the management systems. The benefits include such factors such: improved business focus, a more holistic approach to the management of occupational risks, reduction of conflicts between systems, reduction of work duplication and bureaucracy, more efficient and productive internal and external audits.

The basis for the integration of management systems according to this standard is the general requirements established in the standards for the management systems: policy; planning; implementation and production; productivity evaluation; improvement; management review. This approach, according to the authors, basically does not contradict the above point of view. An important starting point in making decision about IMS development must be the understanding (identification) of the enterprise needs in the specific management systems and the anticipating of benefits that can be obtained from the integration.

The main IMS advantage is systematization of requirements for the enterprise activity in specific fields of management. It enables to minimize the functional dissociation of structural units, to eliminate

duplication in making management decisions, to optimize the number of external and internal connections.

It is important to understand the possible connection variants of different management systems, ways of IMS developing, difficulties and positive aspects within a single enterprise. The analysis shows that the construction of several management systems including those based on integration, is currently carried out in three fundamentally different ways:

(1) the parallel construction of several management systems, without any integration links;

(2) the so-called additive model when other systems based on the model of integration are consistently added to previously implemented management system;

(3) the model of the simultaneous creation of the integrated management system from a particular set of systems.

The first variant represents, in fact, the functioning of independent management systems isolated from each other. This model is characterized by duplication of processes (documents) and actions. This signify-cantly increases the pressure on the entire staff of the enterprise.

The complexity of a holistic perception of the management system by the enterprise management often arises with the additive model of construction and, consequently, low efficiency of planning, control and management in general. The volume of work, the need for resources and the development time of the integrated management system also increase in this case. A positive aspect of the given variant is the possibility of using the accumulated experience in the development of the first (basic) system during the implementation of the subsequent management systems. The historical prerequisite of this IMS development variant is the prolonged difference in the appearance of international standards and promptness in making decisions about their use by enterprise managers.

The third variant involves design, development and implementation of all management systems simulta-neously on the basis of the above mentioned principles of integration. The indisputable advantages of this model are: the elimination of duplicate elements of the implemented management systems, prevention of interrelationship confusion between management systems, a significant reduction of the creation terms of the integrated management system and labor intensity and resources; the processability of the entire development, implementation and further IMS functioning increase.

In general, the presence of several management systems has great appeal to consumers, stakeholders and investors.

The creation of the integrated management system to ensure the quality stability and food safety is almost identical to the implementation scheme of the separate management system [7, 13]. The following main stages of work are.

Stage 1: general organization of work in creating IMS (the formation of a strategic decision to establish IMS: understanding of the goals to be achieved, time and financial resources required for this task, the potential benefits as a result of IMS implementation (strategic, marketing, economic, image). It is recom-mendded to start the learning process of the development team already at this stage;

Stage 2: IMS design. The configuration of the future integrated management system is determined, a team of developers is finally formed, a detailed work plan is formed, the learning process continues;

Stage 3: IMS documentation. The working capacity of the formed integrated system and its effectiveness largely depend on the realization of this stage. The system-wide and specific documents are developed, the training of employees continues;

Step 4: IMS implementation. This stage includes the reconfiguration of the enterprise activities to fulfill the requirements of the developed IMS documentation, the correction of the documentation, which is not viable during the trial operation of IMS. It is crucial to achieve a positive perception of the changes that have made created IMS by all employees of the enterprise.

At the final stage of the implementation, it is recommended to conduct internal audits to determine the readiness of the developed and implemented integrated management system for the certification audit.

Stage 5: IMS certification. It is the logical culmination of the development and implementation processes, despite the optionality, along with the voluntary creation of all general management systems. An important aspect of this final stage is the choice of the certification body, which should be legitimate, significantly perceived at least by consumers of the developed management systems. It is economically expedient to choose the certification body that is able to certify all members of the IMS management systems. The successful result of this stage is to obtain a set of certificates of conformity for the management systems (for each system separately) within the created integrated management system of the enterprise.

The activity analysis of the food enterprises in developing, implementing and certifying the quality management systems and food safety has shown that the highest activity is observed in those sectors of the food industry, where there is the greatest competition, for example, in the beer industry. Breadmaking and confectionery industries on the contrary have objective reasons for the slow inclusion in creating the management systems - this is the low profitability of the industry and the lack of any subsidies. Although many enterprises now recognize the need for modern management systems and they are making efforts to implement them. Some enterprises, without having the right information about the financial and practical advantages to be obtained in a couple of years after the system implementation, consider it just a tribute to fashion and, of course, they are not in a hurry to invest in its development [14].

RECOMMENDATIONS IN USING IMS FOR THE FOOD PROCESSING INDUSTRY

The above mentioned evaluation, as well as the practice of development, implementation and certification of the management systems, allow to

formulate a group of "significant management systems for the food processing industry," which include: a quality management system, a food safety management system based on the principles of HACCP with GMP and GHP elements, a sensor control system forming a part of the integrated management system of the food enterprise to ensure the stability of quality and food safety and the important additions are an environmental management system, a management system of occupational safety and health, an energy management system, and the principles of social responsibility of business. The specified set of systems constitutes the "optimal" IMS, which can be recommended for a large number of food and processing enterprises. Taking the process model as the main forming part of the "optimal" IMS of the food enterprise, it can be represented as follows (Fig. 2). Figure 3 shows a graphical representation of the "optimal" IMS of the food enterprise as the most important part of the overall management of the enterprise.

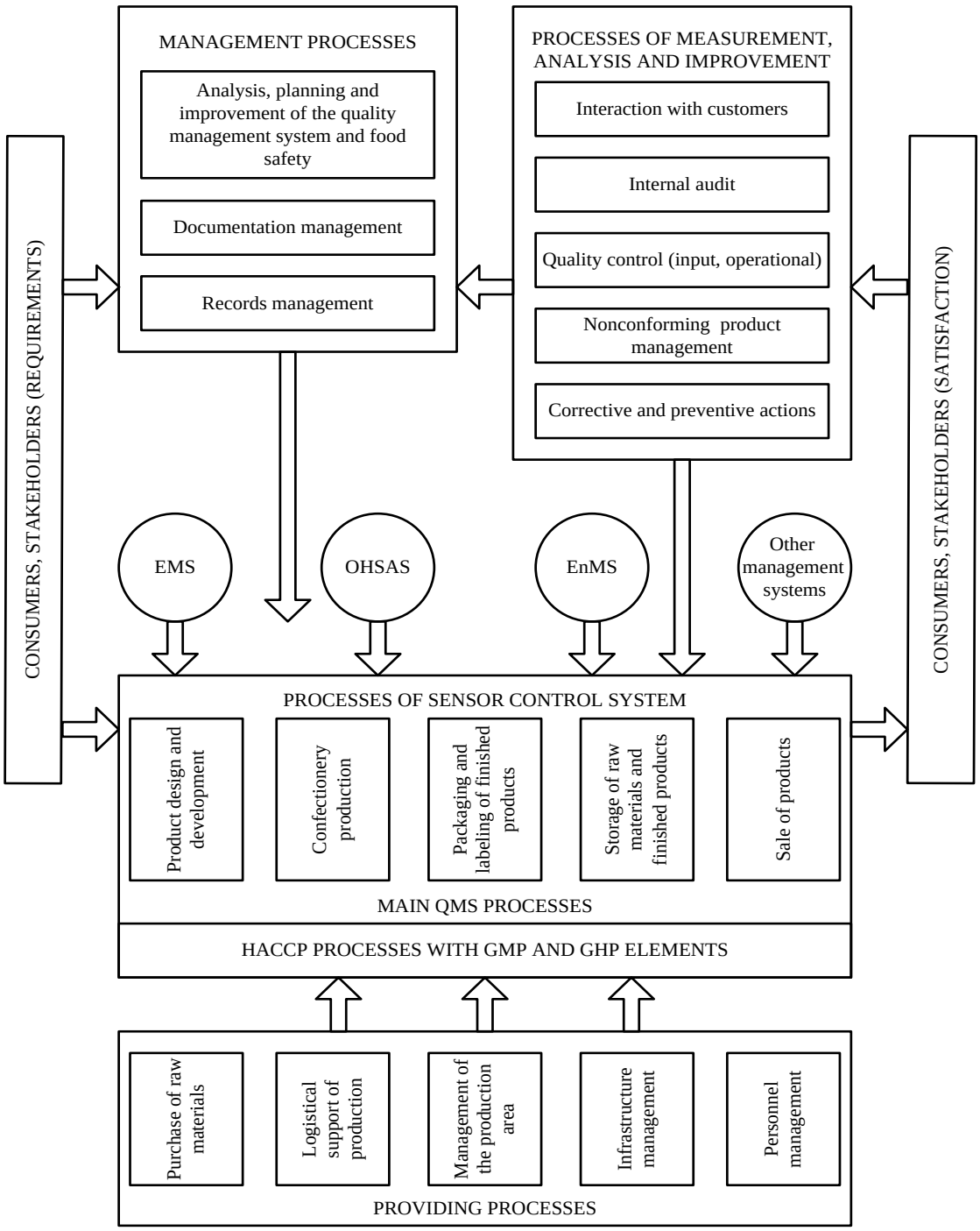

Fig. 2. Process model of the «optimal» IMS of the food enterprise.

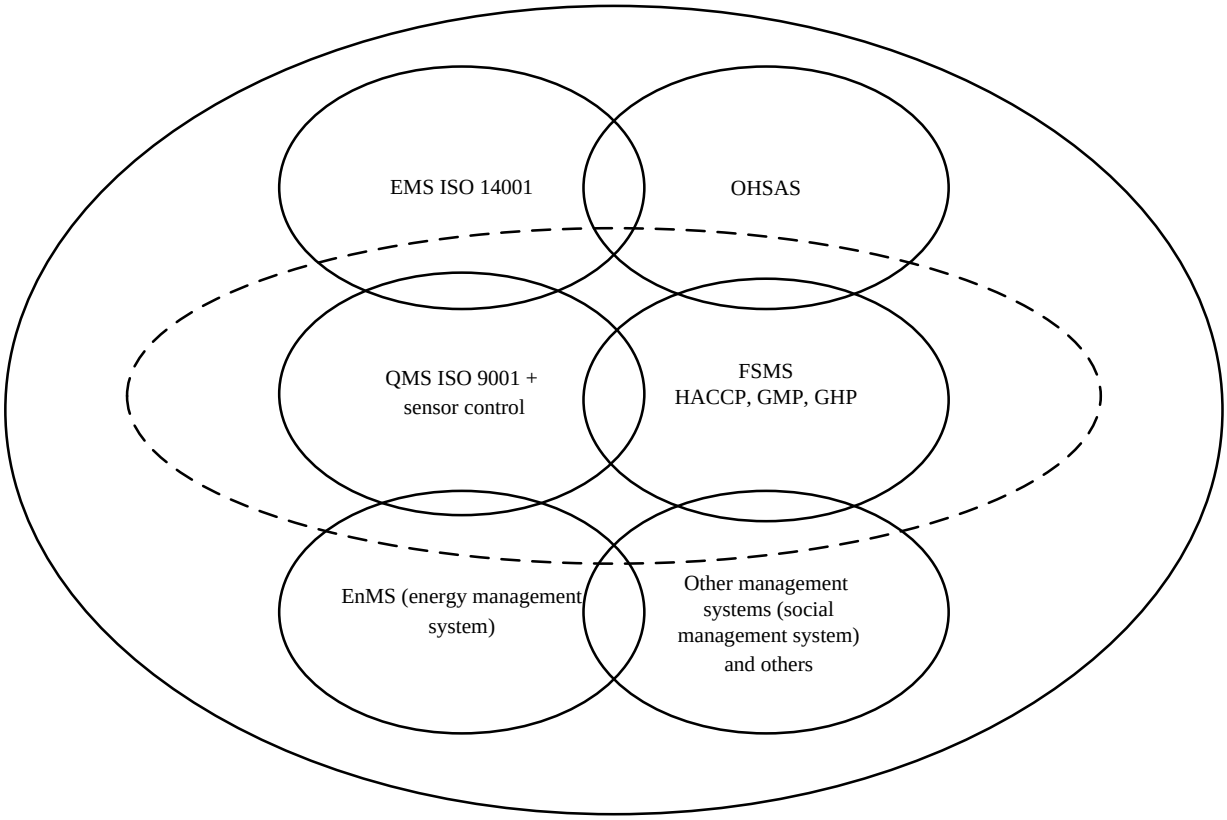

Fig. 3. «Optimal» IMS within the general management system of the food enterprise.

Ensuring the food production quality, which includes such important components as: safety, usefulness, attractiveness to consumers (taste, appearance, packaging, acceptable price), and the stability guarantee of these characteristics are the key to the success of the food enterprise, its effectiveness and long-term competitiveness. The management systems according to international standards and their highest form of realization that can provide a synergistic effect, the integrated management system, contribute to the solution of these tasks. It is possible to form the "optimal" IMS model for the food enterprise.

It is also important to realize that the work after certification audits does not finish there, and in fact, it is just beginning to achieve and maintain the stability of quality and safety of food products, finding the ways to enhance and improve them. If the food enterprise stops at some point, even at a high level, these gains and achievements could be lost in course of time, and the enterprise itself stops functioning.

Ensuring the continuous improvement of IMS functioning is the basis of the prosperity of the enterprise and the satisfaction of its customers.

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