

## **1. 26 YEARS OF VISEGRÁD COOPERATION: ECONOMIC ASPECTS OF FUNCTIONING**

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### **PRODUCT QUALITY: METHODOLOGY AND PRAXIS**

***Summary.** The research reveals the theoretical essence of product quality and presents the economic mechanism of product quality management at an enterprise. It is established that under the conditions of voluntary certification, a share of domestic producers who submit product samples for the test on compliance with the established standards is insignificant. However, about 17.0% out of the total number of samples submitted for tests on product quality to the State Enterprise “Zhytomyrstandartmetrologiia” during 2014–2016 are condemned as defective. The largest share of samples condemned as defective was found in products, which constitute the main diet of the population, namely: dairy products, vegetables, meat, fish products. The methodological recommendations concerning the improvement of the quality of dairy products as a direct factor for increasing the efficiency of its production and profitability of the operation of an enterprise are substantiated. It was established that the level of product quality forms the requirements for the quality of raw materials and advanced production technologies, biological means of production, personnel work, and management methods.*

**Introduction.** Ukrainian experience in social and economic development indicates (prep) unfavourable tendencies in the field of providing product quality and this is characteristics of the great majority of enterprises. First and foremost, such problems are manifested in the irrational usage of various kinds of resources, significantly lower quality of domestic products if compared to their analogues of economically developed countries and, eventually, in the shortfall of a significant part of the income of commodity producers and, consequently, low efficiency of their functioning.

Modern transformations taking place in the national economy under the influence of internationalization and globalization processes are accompanied by the emergence of new requirements for the quality of products manufactured by enterprises and for

product competitiveness. Improving product quality is closely connected to structural changes. The quality level forms the requirements for the quality of materials and advanced manufacturing technologies, biological means of production, personnel work, and management methods. That is why the tasks as to substantiating strategic directions to improve the outlined situation need an in-depth scientific study.

Improvement of quality management of products belongs to the scientific directions that are studied rather actively. The fundamental work in the field of economics and product quality management includes the works of such foreign scholars as E. Deming, J. Juran, P. Crosby, A. Robertson, Feigenbaum, M. Hammer, M. Minor, I. Muto, S. Shing, etc. Recently, these problems have been actively investigated in Ukraine in the works of Yu. Harachuk, V. Heiets, O. Borodin, M. Kuchera, D. Leheza, O. Momot, M. Shapoval and others.

Nevertheless, a number of problematic issues still do not have a final scientific solution. First of all, this concerns the economic and organizational aspects of the growth of the quality level of products as an indispensable element of the management process at an enterprise and the impact of product quality on the efficiency of an enterprise. The foregoing is relevant both for the sphere of production and for the activities of domestic enterprises, which led to the choice of research direction.

In order to solve existing problems in improving the product quality, first of all, it is necessary to focus on the adaptation and harmonization of the legislative and normative base according to European norms; and it is also crucial to develop a measure of economic incentives for enterprises that implement quality management systems.

### **1. Theoretical basics of product quality**

One of the strategic objectives of the national economy is the production of quality food products. The feasibility of practical actions in this direction is conditioned by the objective need of a civilized approach to the organization of environmentally safe agricultural and industrial production, preservation of the health and gene pool of the nation, formation of response measures of the state on the integration of environmental constraints into the legal basis of international foreign trade relations.

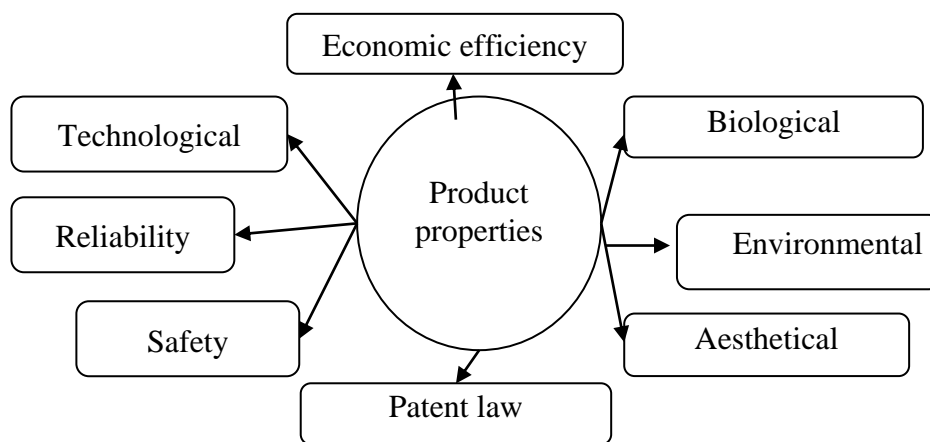
The study of the problem of improving the product quality requires the epistemology of the subject of research. In several scientific works, the concept of “quality” is distinguished as a separate philosophical aspect, which is based on the fact that objective reality is a set of processes, in which objects constantly appear, change, and wear off, and it does not consist of finished, completed objects [1; 2; 3]. In the context of such a philosophical definition, quality expresses the objectively existing integral characteristic of the functional unity of the properties of the object, which adds relative stability to it and determines its distinction from other objects or similarities to them. However, the division into primary and secondary qualities according to the degree of their objectivity was formed. The objective properties of material bodies were recognized as primary ones and the subjective feelings that differ from the properties of external objects were defined as secondary ones [4, p. 134]. This aspect further led to a long-standing scientific discussion on defining the term “quality”, which continues to this day.

According to O. Borodina, V. Heiets, A. Hutorov, “quality” is the properties of products (or services) that can be measured and that meet specific technical

requirements [5]. U. Deming identified quality with the presence of product characteristics, set by established technical requirements, which can be measured [6]. Therefore, according to one point of view, an attention is focused on the importance of evaluating the effectiveness of quality management, and according to another, an attention should be paid to the fact that quality is the property of a product that does not depend on quantitative characteristics and is directly determined by the degree of satisfaction of the consumer's needs. Thus, a significant importance was given to the property of products to meet the consumer's needs. Hence, the quality can only be determined by a specific person, and, at the same, time it is a multidimensional and multi-stage category. J. Juran and K. Ishikawa stated that the quality lies in those properties of products that meet the consumer's needs and, therefore, ensure their satisfaction with this product, and, consequently, the quality is the absence of inconsistencies [7, 8]. It is emphasized that in the narrow sense quality is the quality of products, but in the broad sense, quality means the quality of work, information, process, labour, etc., that is, all functional components of the enterprise without exception.

Other researchers define “quality” as a measure of constructive and operational perfection, which is manifested in the useful properties of the product, the totality and significance of which reflect the needs (requests) of society, formed for a certain time [9, p. 7]. Quality is also considered from the standpoint of “... the complex characteristics of a product, reflecting the degree of its technical and aesthetic and ergonomic excellence, provided with a set of properties designed to meet the conditioned or predicted needs for a given period of time with the full safety of use” [10, p. 56].

That is while assessing the product quality, it is expedient to check its main properties: a compliance with technological, biological, hygienic, and physiological norms; reliability; economic efficiency, environmental friendliness; aesthetics, patent law, etc. (Fig. 1.1).



**Fig. 1.1. Main product properties that are defined in the process of evaluating quality**

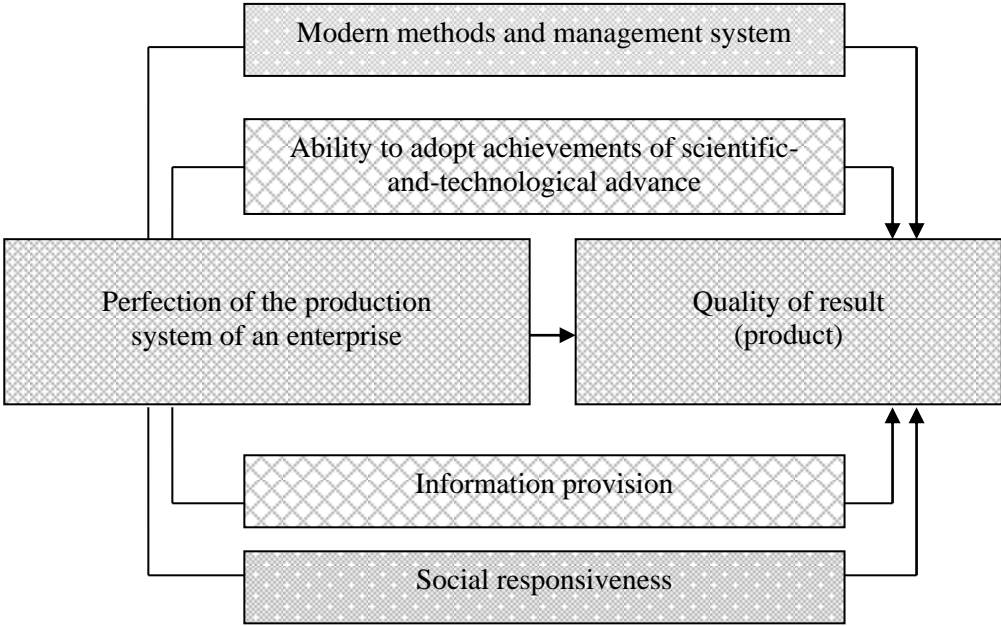
*Source: the author's research*

However, it seems necessary to clarify the approach to the concept of quality at the level of an individual enterprise and the corresponding set of production processes. Consequently, the full range of economic and social and economic aspects of this

concept can be taken into account when considering the product quality as an object of management, where quantitative and statistical characteristics of individual products are clearly specified.

The methodology of quality management was substantiated in the works of E. Deming [11], J. Juran [12], P. Crosby [13], A. Feigenbaum [14], V. Shukhart [15] et al. It specifies that management of enterprise includes three elements: the subject of management (the personnel of an enterprise), the object of management (production process), the management mechanism, which is carried out through the implementation of a set of management functions with their correction according to goals and objectives in the quality policy.

Accordingly, a productive and effective process of quality management should cover all stages of production and activity of an enterprise as a whole, that is, it is of a complex nature. The basis of modern production of quality products is the following system: “initial raw materials – semi-finished products – components and additives used – finished product”. Within the framework of this scheme, quality management is recommended as a set of actions and measures that allow establishing, providing, maintaining, controlling, and stimulating receiving of quality raw materials and food (Fig. 1.2).



**Fig. 1.2. The principle of operability of the production activity of an enterprise concerning product quality**

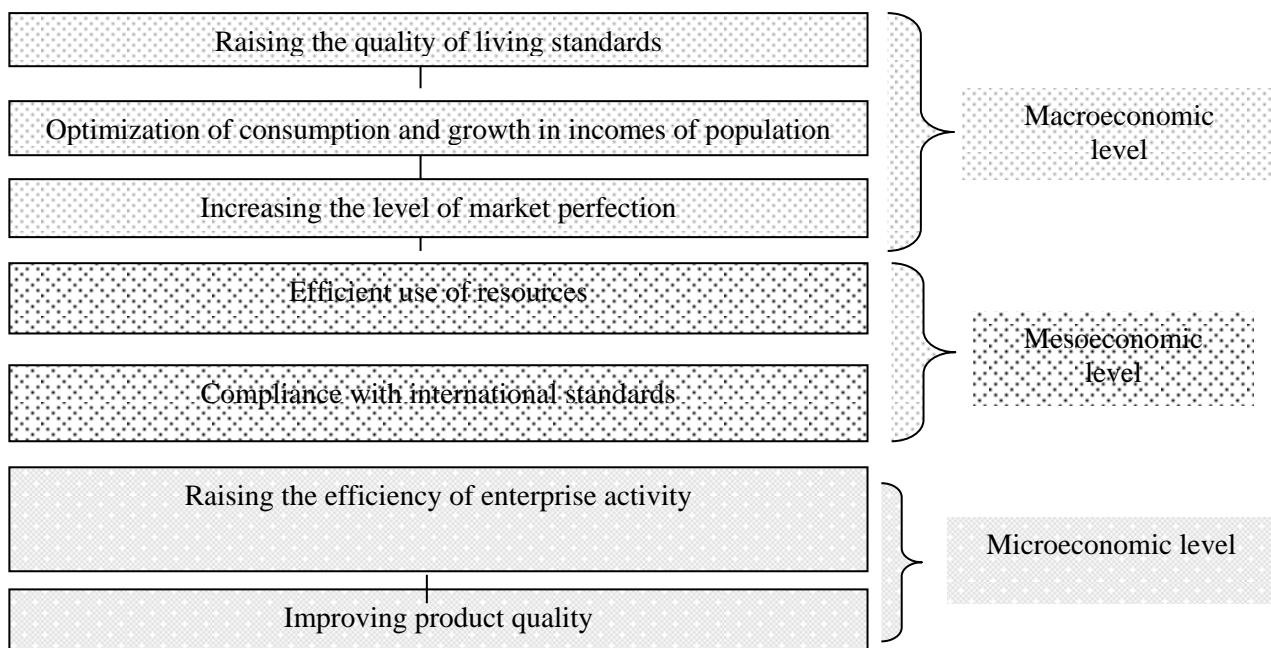
*Source: adapted [16, p. 99–102]*

Assurance of product quality at an enterprise requires multi-elemental focusing of enterprise management, covering requirements for management activities, production systems, organizational structure, processes, operations and production methods, etc. [17, 18]. Quality is a complex concept that characterizes the effectiveness of all aspects of the activity: development of strategy, an organization of production, marketing, etc.

The essence of the effect of “quality” at the microeconomic level is to achieve positive dynamics of profitability of an enterprise. It can be achieved through obtaining benefits from improving the product quality; the latter involves both

reducing the losses from shortages and imperfect products, and obtaining direct benefits from marketing better and more expensive products. At the same time, it is suggested to consider both macro- and meso-economic aspects of the effect of implementing an effective mechanism of quality management (Fig. 1.3). Since the beginning of the 2000s, the substantiation of the benefit of the transition of post-Soviet management to the principles of international standards and quality systems, as well as the key benefits of a reasonable increase in the expenses for the quality have been substantiated in a large number of scientific and applied works of domestic researchers [19, 20]. The recommendations of the scientific and applied plan regarding the introduction of quality management or its individual elements were suggested [21, 22].

The product quality is essential for Ukraine’s integration into the world economy. International standards of ISO 9000 series concerning the creation of systems of quality control have become widespread and for several decades they have been a common demonstration of reliability, stability of quality and competitive ability of products all over the world. [23, p. 3].



**Fig. 1.3. Milestones for the implementation of the economic mechanism of managing product quality at an enterprise**

*Source: the author’s research*

Consequently, in the general scientific sense, quality is a category that reflects the important aspects of objective reality. It is a synthetic indicator, which reflects the manifestation of many factors, namely: the dynamics and development of the national economy to the ability to organize and manage the process of forming quality within a separate economic entity. World experience of management shows that it is the product quality, which is one of the main factors of successful activity of enterprises in a market economy.

## **2. The contemporary state of product quality and strategic directions of its improvement**

The quality control of food products is one of the most important links in the long chain of healthy eating. A significant extension of the range of food products on the consumer market does not happen without the manufacturer's attempts to release undisguised copycats or products of low quality in the guise of well-known brands. Falsification of food products has become widespread, that is, their falsification by means of food and non-food additives, which are used to improve organoleptic characteristics, or the replacement of a higher grade product by a lower one.

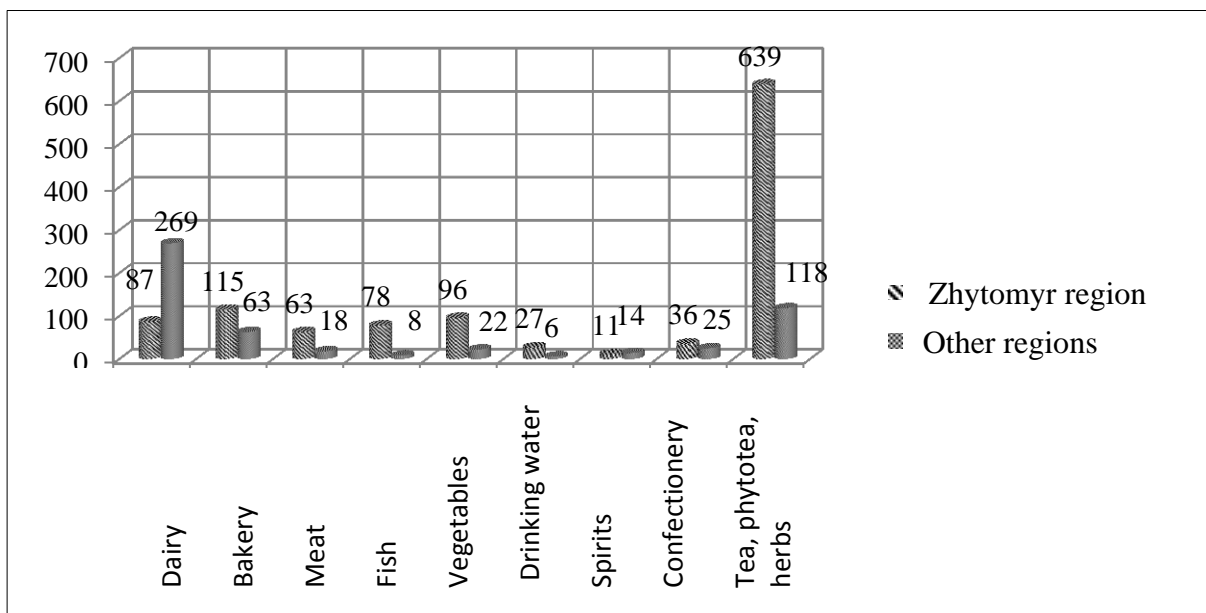
However, since 2017, according to the requirements of the Law of Ukraine "On Basic Principles and Requirements for the Safety and Quality of Food Products", the mandatory condition for carrying out production activities at food enterprises is the introduction of permanent procedures based on the principles of the system Hazard Analysis and Control at Critical Points (HACCP). In addition, the "Blue Guide" of the EU sets the regulatory regime that exists in the EU for all types of products. At present, a number of legislative acts were adopted in Ukraine; they are harmonized with relevant acts of the legislation of the European Union, the EFTA and associated countries. Based on 27 acts of European sectoral legislation, 24 technical regulations were adopted in Ukraine, 21 of which are already mandatory. The Ministry of Economic Development developed and adopted 2313 national normative documents, 1998 of which are harmonized with international and European ones [24]. European experts also notice success, but they urge not to focus only on numbers. They admit that the process is not easy. A lot depends on the manufacturers themselves; they must understand the new rules and use them effectively.

It should be noted that responsible manufacturers looking into the future not only introduce such systems but also certify them. That is, it is documented that this system is evaluated and recognized by a third party, an accredited certification body.

In 2014–2016, the Testing laboratory of the Zhytomyr Scientific and Production Center for Standardization, Metrology and Certification, which, according to the results of comparative laboratory tests, is among the top ten in Ukraine, tested on average 1695 samples of food products (289 samples of which were condemned as defective, 210 of them according to microbiological indicators and 79 according to physical and chemical indicators) and 1406 samples of industrial products, no violations were detected in proven samples.

The dynamics of the tests carried out for certain types of products are shown in Fig. 2.1.

Under the conditions of voluntary product certification, the majority of tests to establish product quality were carried out on samples of bakery – 115, vegetables – 96, dairy – 87, fish – 78, meat – 63. These are the products which form the basis of the diet of the population. However, leader products in determining the product quality are tea, phytotea, and herbs. This situation is explained by the presence of the TOV (LCC) "Liktravy" in Zhytomyr. The population of Zhytomyr region and other adjoining regions carries out the harvesting of medicinal and phyto-plants for this enterprise. Apart from tea, phytotea, and herbs, the majority of samples that the DP (State Enterprise) "Zhytomyrstandartmetrologiia" received for quality testing were dairy products – 269 and bakery – 115 pcs.



**Fig. 2.1. Carrying out tests for product quality in DP (State Enterprise) “Zhytomyrstandartmetrologiia” on average during 2014–2016, pcs.**

*Source: built according to the data of Zhytomyr Scientific and Production Center for Standardization, Metrology and Certification*

Of the total number of samples submitted for testing on product quality in the DP (State Enterprise) “Zhytomyrstandartmetrologiia” during 2014–2016, about 17.0% were condemned as defective (Table 2.1).

Table 2.1

**The share of product samples condemned as defective in the total number of samples submitted for testing to DP (State Enterprise) “Zhytomyrstandartmetrologiia” on average during 2014–2016.**

Types of products	Total number of submitted samples, pcs	Number of samples condemned as defective, pcs	Share of samples condemned as defective in the total number of samples, %
dairy	356	116	32,6
bakery	178	25	14,0
meat	81	24	29,6
fish	86	19	22,1
vegetables	118	50	42,4
drinking water	33	4	12,1
spirits	25	6	24,0
confectionery	61	14	23,0
tea, phytotea, herbs	757	31	4,1
Total	1695	289	17,0

*Source: built according to the data of Zhytomyr Scientific and Production Center for Standardization, Metrology and Certification*

The largest share of samples condemned as defective was found for vegetable products – 42.4%, dairy products – 32.6%, meat – 29.6%, spirits – 24% and confectionery products – 23.0%.

In particular, 11.4% of the total number of product samples submitted for testing in Zhytomyr region and 29.1% of samples from other regions did not meet the standards (Table 2.2).

Table 2.2

**Noncompliance of product samples with the established quality requirements in Zhytomyr region and other areas**

Types of products	Indicators of product quality, according to which noncompliance was established	Noncompliance of samples with the established quality requirements			
		Zhytomyr region		Other areas	
		number of samples condemned as defective, pcs	share of samples condemned as defective in the total number of submitted samples, %	number of samples condemned as defective, pcs	share of samples condemned as defective in the total number of submitted samples, %
dairy	nondairy fats (butter, milk)	21	24,1	95	35,3
bakery	microbiological indicators, preserving agents	14	12,2	11	17,5
meat	hormonelike materials, nitrosamines, pesticides, radionuclides and antibiotics	18	28,6	6	33,3
fish	microbiological indicators, preserving agents	15	19,2	4	50,0
vegetables	nitrate, nitrite, heavy metals	32	33,3	18	81,9
drinking water	microbiological indicators	3	11,1	1	67,0
spirits	microbiological indicators	2	18,2	4	28,6
confectionery	microbiological indicators	8	22,2	6	24,0
tea, phytotea, herbs	radionuclides	18	2,8	13	11,0
Total	-	131	11,4	158	29,1

Source: built according to the data of Zhytomyr Scientific and Production Center for Standardization, Metrology and Certification



The dairy products that passed the test showed noncompliance with the indicator of the content of non-dairy fats. Drinking milk, curd products, buttermilk, sour cream, canned milk, and other products from this group do not meet the quality requirements. Standards on storage terms, technical specifications for dairy products procurement, including baby food, methods of fat determination, water purity, microbiological analysis, and others are not followed [25, p. 175]. As for meat and meat products, the noncompliance with the requirements for safety indicators is even greater, with respect to the content of mercury, lead, copper, zinc, cadmium, arsenic, mycotoxins, hormonelike materials, nitrosamines, pesticides, the activity of radionuclides and antibiotics.

In recent years, there has been a clear tendency to increase the production of vegetable products with higher nitrate content. In general, in Ukraine, more than 30% of agricultural products have a nitrate content that exceeds the permissible level. The problem is that nitrates are the main source of nitrogen feed, and the excess of these compounds leads to severe environmental consequences that affect human health.

Under the conditions of saturation of the world market with food products, standards are the model and quality benchmark that commodity producers must aim for in order to withstand the expansion of more experienced competitors from market players. This is a requirement not only of the current legislation but also of time. Modern production of safe food products should necessarily have, if not a complete food safety management system (HACCP), then at least introduce its basic elements. It is clear that the use of HACCP procedures at production requires both time and money, that is why the legislation determines a transitional period for their mandatory implementation. In particular, for enterprises that carry out activities with food products, which include raw ingredients of animal origin (except small enterprises) – from September 20, 2017. This category includes all dairy plants, slaughterhouses, etc. For enterprises that carry out activities with food products, which contain no raw ingredients of animal origin (except small enterprises) – from September 20, 2018 (these are producers of juices and sweets, etc.); for small enterprises – from September 20, 2019.

Transition periods enable market operators to reorient themselves to new requirements and bring food production in line with the provisions of the new legislation. After September 20, this year, the State Committee for Supervision of Civil Service conducts inspections to check compliance with the requirements of the above-mentioned Law of Ukraine. If market operators fail to fulfil the obligation to implement the HACCP system, fairly significant penalties will be imposed. For legal entities, for example, the amount of fines will be from 30 to 75 minimum wages, which in the monetary equivalent amounts to 36-91 thousand UAH.

Despite the rather significant transition period provided by the legislation, the vast majority of food producers in the Zhytomyr region did not wait for the critical deadlines for introducing HACCP systems. This concerns both large and small enterprises. Moreover, honest manufacturers, which still had enough time to get started, began work in this direction among the first; and they were awarded certificates for the quality management system according to DSTU ISO 9001: 2009 and food safety management system for compliance with DSTU ISO 22000: 2007. The producers who took this way are: PAT (PJSC) “Zhytomyr Butter Plant”, TOV (LLC) “Berdychevpyvo”, PAT (PJSC) “Novograd-Volynsky Bread Factory”, TOV (LLC) “Brusyliv-Meat”, TOV (LLC) “Marian”, TOV (LLC) “Ovrutsky Milk-canning Plant” and a well-known regional producer of functional and special dietary foods

based on innovative technologies, the Scientific and Production Limited Liability Company “Zhytomyrbioproduct”.

Since 2016, 19 Ukrainian enterprises producing dairy products, 11 producers of meat products, 3 enterprises producing fish products, and 2 producers of eggs and egg products have received permission to export products to the EU market. In the final decision, published by the European Commission on the inclusion of our dairy and milk processing companies and enterprises processing dairy, meat and fish products, the official list of approved exporters in the EU includes: PrAT (PJSC) “Yagotinsky Dairy Plant” (Kyiv region), PrAT (PJSC) “Zhytomyr Butter Plant” (Zhytomyr region), PrAT (PJSC) “Zolotonisky Maslorobny Kombinat” (Cherkasy region), branch “Poultry Factory “Avis” and PrAT (PJSC) Poultry Farm “Chervony Prapor” (Khmelnysky region), TOV (LLC) “Imperovo Foods” (Ivano-Frankivsk region), TOV (LLC) “Tulchyn Miaso” and TOV (LLC) “Litynsky Meat Processing Plant” (Vinnytsia region), TOV (LLC) “Zagotzbut” (Ternopil region), TOV (LLC) “More 2007” (Dnipropetrovsk region), TOV (LLC) “Pyriatynsky Delicacy” and PrAT (PJSC) “Kremenchuk City Milk Plant” (Poltava region), PrAT (PJSC) “Bogoduhivsky Meat-Packing Plant” and PJSC “Complex Bezlyudovsky Meat-Packing Plant” (Kharkiv region) and others.

During this time, these enterprises significantly changed their infrastructure and considerably increased the level of competence and responsibility of production personnel. Of course, every manufacturer went their own way, but the goal was the same: to upgrade production capacities so that they meet the requirements of international standards. And for this purpose, it was necessary to take into account the state of the infrastructure and maintain it at a level that could provide consumers with the production of safe products. That is, during production, strict control of the internal environment of production should be carried out; and only such technological operations, which exclude any possible contamination of raw materials and end products, should be performed.

It should be noted that the introduction of an effective management system of food safety is not a matter of one month; this process can take from a few months to a year or even more. Moreover, after the completion of the entire complex of planned work on the implementation of the HACCP system, many manufacturers decided to certify it. And that was not a spontaneous step since among the mandatory requirements of a number of Ukrainian retail chains and demands for the export of products is the presence of a certified HACCP system.

It is worth highlighting that the requirements for management systems of food safety established by the international standard DSTU ISO 22000: 2007 are common and suitable for use by all organizations of the food chain, regardless of their size and complexity. These include not only food manufacturers, but also many other organizations, one way or another involved in one or more parts of the food chain. In particular, these are: feed producers, harvesters, farmers, manufacturers of ingredients, retailers, food outlets, product suppliers and even organizations that provide cleaning and disinfection services for transport. In the same range, there are suppliers of equipment, washing and disinfectants, packaging materials and other materials that are in contact with food. This is how the well-known chain “from the field to the table” should be built up.

The formation of a promising strategy for enterprises at the present stage requires a clear description of the causal relationships and patterns between the determinants that influence the product quality.

The general analytical model for describing the role of the quality control factor in the activities of enterprises is emphasized on the determining role of the two main system elements, such as biological and technological level of quality:

$$AL_q = BL_q + TL_q$$

where:  $AL_q$  stands for the achieved level of quality;

$BL_q$  stands for the biological level of quality;

$TL_q$  stands for the technological level of quality.

The biological level of quality is achieved in the production of products at the expense of natural, soil, and climatic conditions and with the minimum use of technological costs in the process of processing raw materials.

It is expedient to determine the relationship between the level of profitability of manufacturing products and the level of profitability of the operation of an enterprise and the dynamics of indicators of its quality. In this context, the product quality index was used.

To measure the quantitative relationship of qualitative parameters of production of dairy products and resulting indicators, a multi-factor regression model was used for 4 enterprises of Zhytomyr region: PAT (PJSC) “Zhytomyr Butter Plant”, TOV (LLC) “Galiivsky Butter Plant”, TOV (LLC) “Nash Molochnyk”, TOV (LLC) “Andrushivsky Maslosyrzavod” (Table 2.3).

The investigated enterprises should invest extra resources in improving the quality of dairy products as a direct factor in increasing the efficiency of their production and profitability of the operation of enterprises. Since the profit for 1 UAH of the sold products will grow from 18% to 46%, and the level of profitability of the operation of an enterprise from 6% to 16%.

**Conclusions.** Thus, the current trends in the social and economic development of society require the introduction of effective measures to improve the product quality as one of the main and non-alternative factors of modern micro- and macroeconomic growth. The trend of gradual growth of the quality of domestic products in the last decade has an objective character, which is conditioned by the effect of increasing the technological and scientific and technical support of production. However, taking into account the potential of Ukraine and the global trends concerning food security, this dynamics is clearly insufficient.

The study showed that under the conditions of voluntary certification, the share of domestic producers that submit samples of products to the test for compliance with established standards is insignificant. However, about 17.0% out of the total number of samples submitted for tests on product quality to the State Enterprise “Zhytomyrstandartmetrologiia” during 2014–2016 are condemned as defective. The largest share of samples condemned as defective was found in vegetable products – 42.4%, dairy products – 32.6%, meat products – 29.6%, spirits – 24%, and confectionery – 23.0%.

All tested products showed the discrepancy in the content of many components. Dairy products showed incompliance in terms of non-dairy fats; bakery in terms of microbiological indicators and preserving agents; meat – hormonal preparations, nitro substitutes, pesticides, radionuclides, and antibiotics; fish – microbiological

indicators; vegetables in terms of nitrates, nitrites, heavy metals; drinking water, spirits, and confectionery products in terms of microbiological indicators, tea, phytotea – radionuclides.

Table 2.3

**Calculating predicted values for enterprises under investigation**

Indicators		PAT (PJSC) “Zhytomyr Butter Plant”	TOV (LLC) “Galiivsky Butter Plant”	TOV (LLC) “Nash Molochnyk”	TOV (LLC) “Andrushivsky Maslosyrzavod”
Index of quality of dairy products	Factual index (2016)	0,72	0,61	0,55	0,58
	Forecast for 2018	0,80	0,70	0,61	0,67
Income for 1 UAH of sold products, UAH	Factual income (2016)	2195,0	1118,0	1431,0	1684,0
	Forecast for 2018	2894,0	1589,0	1812,0	2002,0
Profitability level of producing dairy products, %	Factual profitability level (2016)	45,0	31,0	55,0	41,0
	Forecast for 2018	72,0	45,0	69,0	53,0
Profitability level of the operation of an enterprise, %	Factual profitability level (2016)	41,0	32,0	36,0	35,0
	Forecast for 2018	55,0	48,0	40,0	46,0

*Source: calculating using the data from financial statements of PAT (PJSC) “Zhytomyr Butter Plant”, TOV (LLC) “Galiivsky Butter Plant”, TOV (LLC) “Nash Molochnyk”, TOV (LLC) “Andrushivsky Maslosyrzavod”.*

The results of research on the example of 4 enterprises of Zhytomyr region (PAT (PJSC) “Zhytomyr Butter Plant”, TOV (LLC) “Galievsky Butter Plant”, TOV (LLC) “Nash Molochnyk”, TOV (LLC) “Andrushivsky Maslosyrzavod”) showed that the synergy of the growth of the quality of dairy products was accompanied by the effect of increased profitability of the operation of enterprises (from 18% to 46%).

In turn, the determining factors of increasing the effectiveness of product quality management are: 1) the development and implementation of an effective and appropriately focused business development strategy; 2) the level of corporate culture from the standpoint of the role of motives concerning sustainable growth of quality; 3) the organization of production processes, which also includes technical and technological aspects of solving the problem. These are the aspects, which determine the direction of further research.

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