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Scientific and Theoretical Bases of Product Quality Management in Food Industry Enterprises

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Abstract: This article analyzes the scientific and theoretical foundations of product quality management in food industry enterprises. The relevance of the study is determined by the sharp increase in requirements for the safety and quality of food products in global and national markets, as well as the growing need of consumers for quality products. In this regard, the issue of improving quality management systems is of significant scientific and practical importance. The work studies the theoretical aspects of quality management systems, in particular, international standards, quality management principles, and mechanisms for their implementation in practice. The definitions and approaches to quality management given by international organizations and economists are also highlighted. The study is based on the importance of quality management in standardizing production processes and increasing labor productivity. The research methodology used a systematic approach, scientific generalization, comparative analysis, and statistical data study and evaluation methods. Using these methods, the effectiveness of quality management systems in the food industry and their impact on production processes were assessed. The product quality management system in the food industry of Uzbekistan was analyzed, a number of systemic and practical problems in this area were identified, and scientifically based conclusions and proposals were made to solve them. The article is intended for researchers, practitioners and industry specialists in the field of economics and management.

Citation: Mirakul ugli B. U. Scientific and Theoretical Bases of Product Quality Management in Food Industry Enterprises. American Journal of Economics and Business Management 2026, 9(4), 36-41.

Received: 8th Feb 2026

Revised: 12th Feb 2026

Accepted: 26th Mar 2026

Published: 2nd April 2026



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Keywords: Food Industry, Product Quality, Quality Management, Quality Management, International Standards, HACCP System, Competitiveness, Food Safety

1. Introduction

In the conditions of accelerated economic development and competitive environment, product quality is becoming a decisive factor in any industry, especially in the food industry. For food manufacturing enterprises, quality management is of strategic importance not only in terms of economic efficiency, but also in terms of ensuring the health and safety of consumers.

The quality management process in food industry enterprises is relevant worldwide. Today, according to the World Health Organization, approximately 600 million people in the world, or 10 percent of the world's population, fall ill every year as a result of consuming unsafe food products, and 420,000 people lose their lives from these diseases [1].

In the context of economic modernization, the concept of "quality management" is distinguished by its complexity and versatility. The ISO 9000:2015 standard developed by the International Organization for Standardization (ISO) defines the quality management process in industrial enterprises as follows: Quality management is a coordinated activity to direct and control an organization with respect to product quality. This definition reflects three specific aspects of quality management: directing, planning, and controlling [2].

Literature Review

The scientific and theoretical foundations of quality management began to emerge in the late 19th and early 20th centuries. F.W. Taylor substantiated the principles of standardization of production processes and increasing labor productivity. Later, Walter Shewhart developed the concept of statistical process control (SPC), which revolutionized quality management. In the second half of the 20th century, the TQM (Total Quality Management) system was formed by W. Edwards Deming, Joseph M. Juran and Philip Crosby.

Among the theories of quality management, the ideas of W. Edwards Deming and J.M. Juran occupy a special place. Deming is known as the "veteran of quality management", his philosophy is based on cooperation and continuous improvement of processes [3]. Juran, on the other hand, is called the "architect of quality" and he put forward the concept of the "Juran troika" of quality management - quality planning, quality control and quality improvement stages [4]. These theories are the basis of modern quality management systems.

In the economic literature, there are various approaches to the concept of quality management. In particular, the American economist J.M. Juran defines quality as "compliance with consumer requirements" [5], while Japanese scientist Genichi Taguchi interprets quality as "a product that does not harm society" [6]. Among Uzbek economists, scientists who have deeply studied and analyzed quality management at the level of our national economy - Kh.I. Fattakhov, N.T. Toshmatov and others - occupy a special place.

2. Material and Methods

In this study, a complex methodological approach was used to deeply study and evaluate the scientific and theoretical foundations of product quality management at food industry enterprises. A systematic approach was chosen as the methodological basis of the study, through which quality management processes were considered as a single system and all its structural elements were analyzed in their interrelation.

In the process of research, using the method of scientific generalization, existing theoretical views on quality management, approaches of economists, and international experience were studied and summarized. Based on the method of comparative analysis, quality management systems used in different countries, in particular approaches based on international standards, were compared. This made it possible to identify best practices and adapt them to national practice.

Also, the study used the method of statistical data analysis to study the relationship between product quality and production efficiency in the food industry. Using this method, the impact of quality management systems on the activities of the enterprise was quantitatively assessed. Expert opinions were also used in the assessment process, identifying existing problems in practice and their causes.

In addition, based on an analytical approach, the current state of the quality management system in the food industry of Uzbekistan was studied, and its shortcomings and development trends were identified. In order to ensure the reliability of the research results, various sources were compared, including scientific literature, regulatory documents and practical information.

This set of methodological approaches ensures the scientific validity of the research and serves to develop scientifically sound conclusions and proposals for improving product quality management in food industry enterprises.

3. Results and Discussion

During a deeper analysis of the issue of product quality management at food industry enterprises, it was revealed that this concept has different interpretations in the scientific literature. The category of quality management was formed at the intersection of economic, management and technological approaches, and different authors have assigned it different content and essence.

In particular, some researchers interpret quality management as a process of ensuring product compliance with established standards, while others interpret it as a complex management system aimed at meeting consumer needs at a high level. Also, in today's economic approaches, quality management is considered an important element of the overall strategic development of the enterprise. In order to systematically summarize these approaches and identify their specific aspects, various scientific definitions of the concept of quality management are presented in the table 1 given below.

Table 1. Definitions of quality management by various authors

Author/Source	Definition of quality management	Main idea
ISO 9000:2015	Coordinated activities to direct and manage the organization with respect to product quality	As an organizational management system
Juran J.M. (1988)	Quality is an economic category that characterizes the degree of suitability of a product to meet consumer needs.	Consumer-centric approach
Deming W.E. (1986)	Quality is the ability to create products based on the future needs of consumers.	Continuous improvement
Crosby P.B. (1979)	Quality is conformity to requirements, and ensuring it is a costly process.	The concept of "zero defects"
Taguchi G. (1986)	Quality is the minimum harm a product causes to society after it is released to the market.	Loss function basis
Feigenbaum A. (1991)	Quality is a system consisting of marketing, engineering, and production processes that are determined by consumers.	Comprehensive quality control
Fattaxov X.I. (2019)	Quality management in the conditions of Uzbekistan - an integrated system aimed at increasing competitiveness	A model adapted to the national economy

The analysis showed that the foundations of quality management theories are also widely applicable in the food industry. International experience shows prevention based on the American approach: for example, the requirements of the FSMA (Food Safety Modernization Act) introduced by the FDA in the USA obliged enterprises to organize internal controls based on risk analysis. Studies have shown that the implementation of FSMA requirements has led to a significant reduction in foodborne illnesses [7].

In Japan, the focus is on employees and continuous improvement. Japanese scientists argue that by introducing the concepts of TQM and Kaizen into the food industry, continuous improvement in production can be achieved [8]. In this approach, each employee is responsible for the quality of the product.

If we look at the research on quality management, the modern food industry uses not only technical means, but also management and digital solutions for quality control. For example, in Europe and the USA, blockchain technologies are being introduced, and the origin and supply chain of products are being fully controlled [9].

According to international statistics, in countries where quality management systems have been introduced, food poisoning cases have decreased [10]. This indicates the importance of modern quality management systems in protecting human health.

Quality management in the food industry has its own challenges. For example, since products are highly perishable, quality control is necessary at every stage, from production to storage and transportation. Working under the threat of global supply chains and climate change makes it urgent to reduce the risk of microbiological and chemical contamination [11].

A scientific and theoretical analysis of the product quality management system in the Uzbek food industry shows that there are a number of systemic and practical problems in this area. These problems significantly affect the competitiveness of enterprises and their sustainable operation in domestic and foreign markets.

The level of implementation of quality management systems, their adaptation to modern standards, the lack of improvement of technological processes and shortcomings in human resources are of urgent importance [8], [12]. In particular, the lack of full and effective implementation of these systems and the insufficient formation of mechanisms for working on the basis of modern requirements further complicate the problem.

At the same time, some shortcomings related to the insufficiently effective organization of certification processes, their transparency and reliability also negatively affect quality indicators [13].

Table 2. Main problems of quality management in the food industry of Uzbekistan

№	Problem	Reason	Consequence
1	ISO/HACCP Low level of certification	Financial obstacles, lack of qualified personnel	Limited export opportunities
2	Insufficient laboratory capacity	Lack of capital investment	Ineffective quality control
3	Weak quality management throughout the supply chain	Insufficient contractual relationships with raw material suppliers	Instability of final product quality
4	Low level of use of digital technologies	Slow progress of technological transformation	Lack of use of modern methods in quality monitoring
5	Insufficient staff qualifications	Gaps in the vocational education system	Quality problems caused by human factors

According to the results of the analysis, the main reason for the problems is the insufficient systematic approach to quality management, that is, the lack of a holistic, integrated quality management system, despite the existence of separate control functions (Table 2). This confirms the concept of the “system problem” highlighted by Deming. The analysis of the presented data shows that the problems associated with quality management in the food industry are largely interrelated and complex in nature. In particular, the imbalance between technological, organizational and institutional factors hinders the effective functioning of the quality system.

Also, the low level of implementation of modern quality management systems at enterprises and the difficulties in adapting to international standards further exacerbate the existing problems [14]. This, in turn, reduces the competitiveness of products in domestic and foreign markets. To eliminate these situations, it is necessary to implement comprehensive measures aimed at improving the quality management system, introducing innovative technologies and improving personnel skills.

In Uzbekistan, efforts are underway to improve the regulatory framework and bring it into line with international standards to strengthen food safety. In particular, Uzbekistan is implementing a project to assess the food control system in cooperation with FAO. The recommendations identified as a result of this initiative will help rebuild the national system based on international standards; this is expected to ensure the supply of high-quality and safe products and increase the export potential of local products.

The analysis of the data showed that in many enterprises, quality improvement is not based solely on technological measures [15], [16]. For example, the above studies emphasize that improving quality management requires not only changing equipment and processes, but also improving personnel skills, developing corporate culture and responsibility, and improving state control mechanisms. According to the analysis, such an approach allows maintaining product quality proactively, rather than reactively.

4. Conclusion

In conclusion, it should be noted that the theories of economists Deming and Juran, who conducted scientific research on product quality management, still form the scientific and theoretical foundations of quality management systems today, and these approaches are successfully used both in the mass and food industries. In this regard, it can be said that modern standards (ISO 9001, HACCP, ISO 22000 and other approaches) serve as the main tool in ensuring the safety and quality of food products. International experience shows that it is necessary to address product quality and safety as a strategic issue at the state level; that is, public health can be protected through the harmonious implementation of state control, corporate responsibility and international standards.

In conclusion, the following proposals can be made to improve product quality management: First, it is necessary to widely introduce ISO 9001 and HACCP standards at Uzbek enterprises, as well as develop a training and certification system. Second, attention should be paid to ensuring product consistency using digital technologies. The third proposal is to strengthen a proactive approach to quality issues: preliminary risk analysis, regular training of employees, and active internal audits are required. The above measures will serve to improve the quality of food industry products, ensure consumer confidence, and strengthen the competitiveness of the industry.

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