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GENERAL GUIDELINES FOR QUALITY MANAGEMENT AND TECHNOLOGIES IN THE METALLURGICAL INDUSTRY SUPPLY CHAIN

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Abstract: In this article, a model supporting the quality management and technological processes of the supply chain in the metallurgical industry has been developed. This model is general and universal in nature, and the recommended guidelines can be implemented in various manufacturing companies. The assumptions of this model were developed on the basis of observations of Mexmash enterprise, one of the largest metallurgical plants in our region. This developed model leads to a significant improvement in the activities of metallurgical industry enterprises in terms of building effective forms of communication with customers, implementing logistics processes based on customer requirements, and providing high-level customer service. The supply chain aims to minimize inventory levels and raw material costs while maintaining the highest quality standards. The production logistics activity of the subsystem is aimed at increasing the efficiency of production processes, at the same time increasing quality standards and reducing the number of inconsistencies. In turn, the distribution subsystem integrates logistics processes, marketing, and quality to improve overall customer service.

Keywords: quality management, technology, supply chain, metallurgical industry, quality management systems, raw materials, supply chain.

Introduction. Today, the continuous development of the world's metallurgical industry, competition and globalization increasingly determine the issue of ensuring the optimal level of product quality and the competitiveness of the entire supply chain in the development of new technologies. Although the development of product quality in some manufacturing enterprises can continue based on the implementation of some standardized quality management systems, the issue of the entire supply chain remains more complex. Each of the logistics sub-systems has its own specific goals and is ultimately formed differently depending on the quality of the product being produced. [1] The supply chain aims to minimize inventory levels and raw material costs while maintaining the highest quality standards. The production logistics activity of the subsystem is aimed at increasing the efficiency of production processes, at the same time increasing quality standards and reducing the number of inconsistencies. In turn, the distribution subsystem integrates logistics processes, marketing, and quality to improve overall customer service. It should be noted that transport and logistics processes effectively implemented in these subsystems are one of the most important factors for

increasing competitiveness. [2] Private logistics subsystems need to develop optimal quality standards and effective technology management to achieve their goals and this requires a systematic approach [3].

All organizations working in the supply chain should pay attention to the equipment, methods and tools used to create joint complex systems and technologies of quality management. Researcher D.Malindžák [4] also expressed the same opinion that it is very important to develop logistics processes based on the latest technologies and quality management concepts in metallurgical industry enterprises. According to Pacana et al. [5], various methods, techniques and quality management systems have been developed in recent years to simplify operations and logistics processes and bring good benefits to organizations. Standardized quality management systems [6] and technology development support methods [7] stand out among them. According to the authors, the use of these tools further increases the efficiency of logistics processes, which ensures their full integration into the supply chain. Researcher M.Nowicka-Skowron and R.Ulewiczlar [8] confirm the above opinion, according to which they emphasize that quality management and logistics processes interact with each other and do not penetrate each other. The high quality of the manufactured product and the effective implementation of the logistics service do not affect the final success of the supply chain. Only the interaction of these elements allows the organization to operate effectively in the market and attract new customers. An important factor in determining final quality is cooperation and a similar understanding of quality for all participants in the supply chain. In general, the concept of quality management should be understood as a sequence of actions that lead to continuous improvement of internal processes based on the requirements of internal and external customers.

Research methodology. The main goal of the study was to develop a model that supports quality management and technological processes in the supply chain. The instructions of this model are sufficiently general and universal in nature to be able to be implemented in various manufacturing companies. It should be noted that quality management in large supply chain enterprises is very complex. The developed model does not simplify this process, but organizes its elements and allows more effective implementation of the adopted goals in the entire supply chain. This model is based on quality management systems, methods and their combination, which interact to improve the efficiency of logistics processes. The assumptions of the model were developed during the research conducted at the Mexmash enterprise, one of the largest and prominent factories in the region. In addition, it is one of the largest and most advanced open die casting plants in the region. Their products include aluminum and zinc die castings for the appliance manufacturers, construction industry, consumer electronics sector, power engineering and automotive industry. This facility also offers specialist CNC machining, research and laboratory testing services. With more than 40 years of experience to date, this company has a thorough expertise in casting based on its

manufacturing processes and patents. Many years of tradition and experience allow the company to meet the requirements and exceed the expectations of customers. The correct selection of production processes and their implementation are guaranteed by design engineers, process engineers and the quality control department. In order to achieve the set goals, the following tasks were performed during the practice:

- An analysis of various quality management systems implemented in Mexmash and the company's supply chain activities was conducted;
- Methods of integration of quality management systems were introduced in detail;
- System processes were analyzed and a plan of proposed measures for improvement was drawn up,
- a complex model of the quality management structure was developed,
- obstacles and limitations in the implementation of the model were identified.

A model of quality management and technology in the supply chain - assumptions

According to scientific researcher Zimon, logistics subsystems provided with quality management concepts and technology and properly organized and managed have a significant impact on the process of production and distribution of products. Figure 1 below provides an overview of the total quality management model and technology concepts for supply chain organizations.

The model of the supply chain presented above has a general feature, which requires a lot of flexibility in choosing methods of optimal management specific to a particular supply chain. For its proper implementation, it should include the following principles:

- The quality management model and technology are subject to the mission and strategy adopted in the supply chain (must be supportive).
- The mission, goals and objectives of logistics must be defined before implementing the model. This determines the position of quality management departments along the supply chain [9].
- Before implementing the model, it is necessary to develop a strategy for the development of technologies and periodically check its effectiveness.
- Design, control and quality management are supported by tools, concepts and quality management systems created and selected based on customer and market needs [10]. This idea is to develop a model of the philosophy of total quality management in the entire logistics chain.
- Improvement of logistics processes and development of technologies should arise from the needs of external and internal customers.

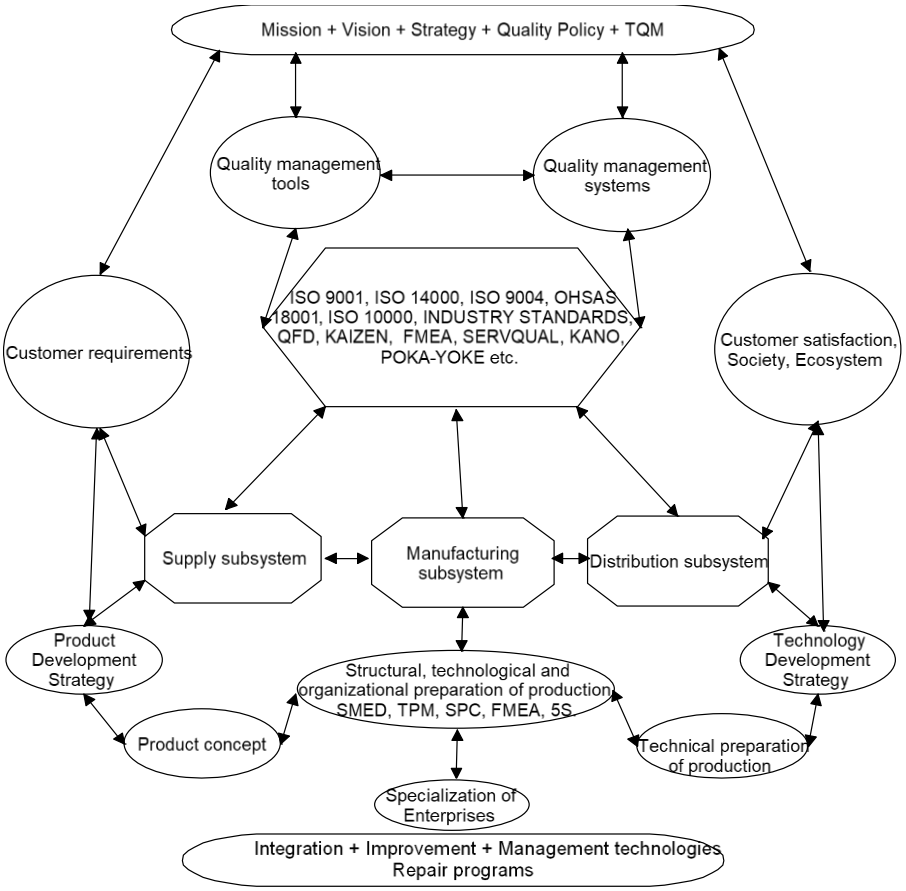

Figure 1. Model of quality management and technology in the supply chain.

- Cooperation in the supply chain and the realization of common goals should be supported through technology transfer (knowledge transfer projects, joint ventures, sale of infrastructure).

- It is necessary to improve the technology in order to better meet the existing needs of the organization, increase productivity, improve the quality of the manufactured product, integrate processes, and reduce the negative impact on the environment. These activities should be aimed at taking into account the development of technology in the overall strategy, analyzing its implementation, introducing continuity of control and starting processes that improve the skills of employees.

- The basis of the model is based on externalization (to customers) and strengthening of relationships between supply chains. Implementation of standardized quality management systems shows the leading role of the customer in business management [11].

- The model emphasizes the importance of effective communication systems within the organization and throughout the supply chain.

- The model is based on type IV integration (integration of the main systems with the system industry). For organizations that do not have standardized quality management systems, it is recommended to implement it. Research conducted by M.

Bernardo and other researchers [12] shows that implementing the above increases the level of efficiency and integration.

- Improvement of technological production processes and logistics infrastructure is equally important. Modern concepts of quality management must take into account technological development.

- Subsystems of logistics and organizations participating in them should be included in the implementation of the philosophy of quality management. In this case, each link is important because it performs tasks that affect the improvement of the customer service process.

- Joint development of recovery plans and procedures [13].

- It is important in the implementation of the full obligations of the top management [14], in adapting to the specific characteristics of the company and in improving the system.

Limitations of the model

The author described some of the obstacles and limitations of the model after interviewing Mexmash plant employees and managers and getting detailed information about the company's operations. Knowing these obstacles allows companies to properly prepare for the implementation of the model. The most important limitations of the model include the following areas:

- The development and implementation of the model suggested above will be somewhat expensive. Manufacturing companies have to invest heavily in external quality assurance costs, including the design and implementation of various quality management systems, staff training costs, external audits, etc. Therefore, this model is primarily intended for medium and large-scale production enterprises. This model should provide a strong economic position and innovative solutions.

- Companies with a small production volume can also implement certain parts of this model, but in their circumstances it is not recommended to implement it in general.

- In order for the model to work properly, it is necessary not to fully involve the top management representatives. Unfortunately, the results of the conducted studies show that not all representatives of the top management can devote enough time to actively participate in the implementation and improvement processes of this model.

- The basis of this proposed model is an integrated approach to issues related to the development of new technologies, according to observations, business entities do not have a specific management strategy developed in this area.

Despite the above-mentioned limitations, in the opinion of the author, the implementation of the above-recommended model is appropriate and will allow companies to significantly improve their competitive position in the long run.

Summary. Comprehensive quality management and supply chain technology development are two areas that provide practical support for increased efficiency. The implementation of the proposed model of total quality management in the supply chain supports and develops the potential of technological innovation in enterprises and enables the production of products that strictly obey the customer's requirements.

According to the author, the developed model contributes to the significant improvement of the activity of metallurgical industry enterprises by creating effective forms of communication with customers;

- effective implementation of logistics processes based on customer demands and offers;
- providing high level of customer service,
- improvement of production and technological processes that help to reduce inconsistencies;
- determination of effective methods of control;
- establishing strong relations with cooperators;
- creation of an effective organizational management system;
- mobilizing the organization's top management for greater involvement in management processes;
- optimal technological preparation of the production process;
- improvement of technologies and production processes.
- improvement of technologies and production processes.

These points are confirmed by the results of tests carried out by M. Yusr and other researchers [15], who show that complex models of quality management support the development of technology, which leads to the improvement of the entire supply chain. Similarly, according to another researcher, B. Skowron-Grabowska [15], integrated models of quality management implemented in enterprises and supply chains ensure that they improve their operations and achieve long-term economic income.

In conclusion, it is worth noting that the development of the optimal strategy for quality management and technology in the supply chain is a very personal matter, which should take into account the specific characteristics of a particular supply chain operation. Therefore, the presented model is general and universal, allowing it to be implemented by companies representing different industries after adjustments arising from their specific characteristics and external environmental conditions.

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