

Quality Management at Railway Transport Enterprises in Conditions of Digitalization

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Abstract

It has been established that nowadays the formation of quality management systems at enterprises is increasingly influenced by factors caused by the formation of a new technological structure, one of the key components of which is digitalization. Taking into account the influence of digitalization on the formation of quality management systems at enterprises of the industry, conceptual provisions of proactive quality management at railway transport enterprises, based on the integration of information and communication tools into the business processes of economic activity of enterprises of the industry with compliance with the requirements of consistency, customization and predictability, have been developed. It is substantiated that an important component of the quality management system at railway transport enterprises is the procedure for finding and implementing quality reserves. Based on the disclosure of the content of the scientific category "quality reserves" and their systematization, their typology was supplemented. To increase the efficiency of quality management processes at railway enterprises, a model for finding and implementing reserves in the quality management system at railway enterprises has been created, which takes into account the specifics of the transformation of the organizational and management structure of railway transport and the dominant influence of European integration processes on the formation of quality standards, the implementation of which is considered as a starting point stage of justification of quality reserves.

KEY WORDS: *railway transport enterprises, quality management, digitalization, reserves, model, information and communication tools*

1. Introduction

Today, Ukrainian railways are going through perhaps the most difficult period in the history of their development. Huge losses of assets due to both systematic rocket attacks and military operations in the country, which lead to large-scale destruction and seizure of railway infrastructure (as of 2023, «Ukrzaliznytsia» losses are estimated at 4,3 billion [1]), and the curtailment of economic activity by business entities have led to a deterioration in the economic situation in the industry. The destruction of the production infrastructure of a number of metallurgical, machine-building and construction companies that are key customers of railway transport services, the growing social burden on the industry (Ukrzaliznytsia took the main burden of evacuating the population from the war zone - evacuation trains transported) in 2022 led to a decline in demand for rail transport and, accordingly, an increase in the level of its unprofitability (in 2022, the loss of JSC «Ukrzaliznytsia» amounted to UAH 10.8 billion [2]). The relocation of production facilities, the gradual resumption of business activity in the regions liberated from the occupiers, and government support for the industry ensured an increase in the volume of work of railway transport enterprises in 2023 and a recovery in their profitability (the profit of JSC «Ukrzaliznytsia» in 2023 was UAH 5 billion) [3]. Despite the war and the economic downturn, in 2023, JSC «Ukrzaliznytsia» continued to actively work on projects to transform the industry's management system, as set out in the EU-Ukraine Association Agreement, in an effort to accelerate the process of integrating Ukrainian railways into the European transport and logistics communications system. To overcome the technological backwardness, a loan agreement was signed for the supply of 40 units of Wabtec rolling stock [3], and projects were implemented to rebuild the railway infrastructure destroyed by the aggressor's actions and to transform the railway management structure. Nevertheless, the quality of rail transport and the range of transport and logistics services for consumers continues to be not only inadequate but also extremely low. After all, the transformations implemented at railway transport enterprises are implemented with a low level of involvement of digital tools in the business processes of economic activity of enterprises in the industry, which does not meet the requirements of the digital paradigm of economic growth. This actualises the task of searching for tools to ensure the transformation

of the quality management system at railway enterprises in accordance with the principles of digitalisation and developing a model for finding and implementing reserves in the quality management system, taking into account the specifics of the transformation of the organisational and managerial structure of railway transport and the dominant influence of European integration processes on the formation of quality standards.

2. Research Results

Today, the formation of quality management systems at enterprises is increasingly influenced by factors caused by the formation of a new technological structure, one of the key components of which is digitalisation.

The main trends of the digital economy that ensure the quality of modern enterprises include: regular interaction with customers through the provision of information and communication services; flexible structure of business processes based on the introduction of predictive tools and commoditised automation systems; wide possibilities for modelling business processes through digital design and the use of technologies such as augmented and virtual reality; competence of personnel in the information and communication sphere; integration of information and communication technologies; and the use of digital technologies.

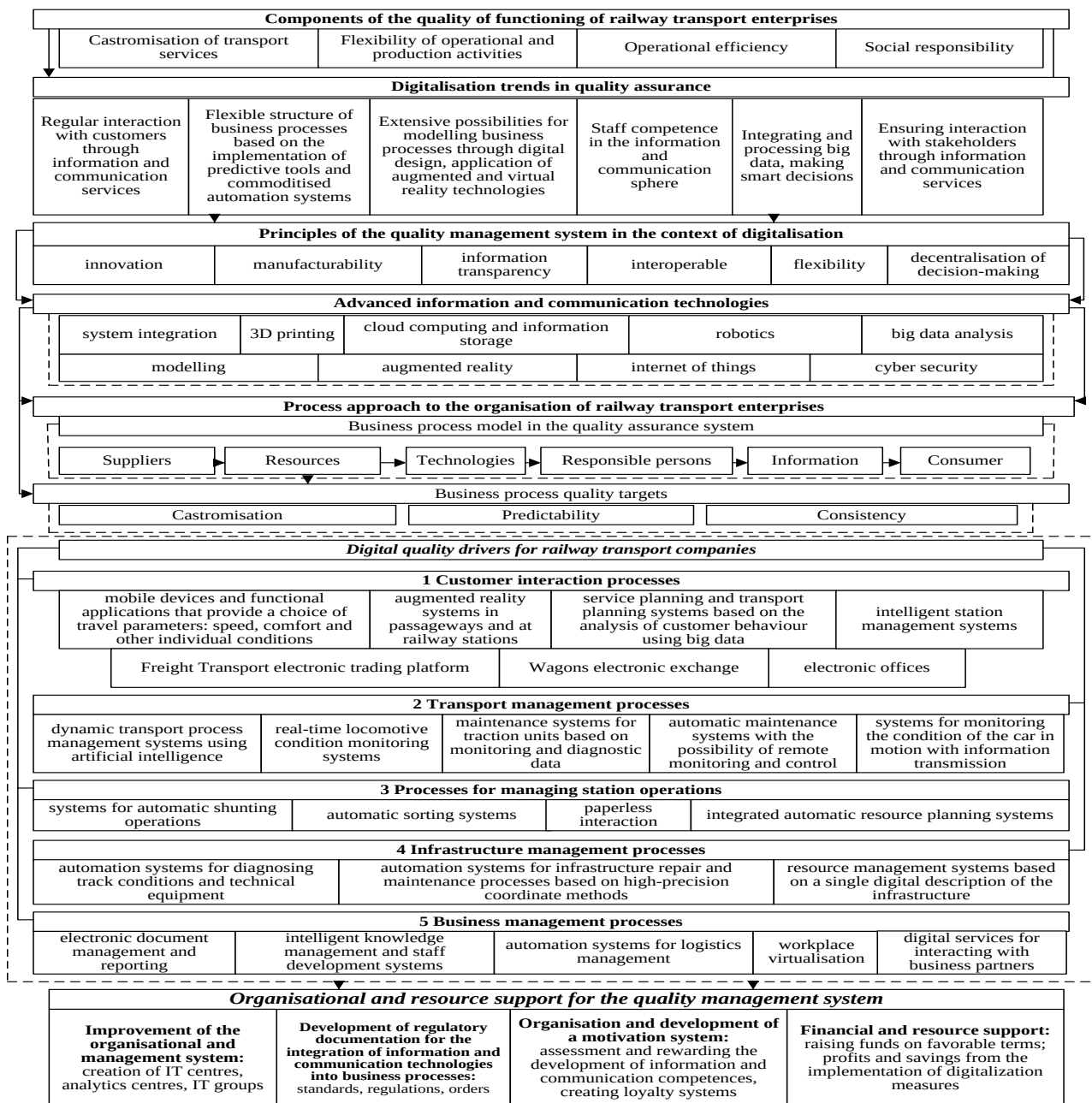


Fig. 1 Conceptual provisions of proactive quality management at railway transport enterprises

Thus, the main principles of quality assurance in the context of digitalisation should include innovation, technology, interoperability, flexibility, information transparency and decentralisation of decision-making. Fig. 1

outlines the information and communication tools that determine the digital transformation of enterprises and argues for the timeliness of their implementation in the business processes of railway transport enterprises as a comprehensive quality embedding technology.

Taking into account the revealed trends of informatisation and properties of information and communication tools, it is necessary to define target criteria for the quality of business processes that characterise the requirements of key business process stakeholders, such as suppliers, responsible persons and consumers. Thus, from the point of view of consumers, the results of business process quality when implementing information and communication technologies are determined by customisation, inefficiency and consistency. From the point of view of responsible persons, business processes should be manageable and defect-free (i.e. predictive), and from the point of view of suppliers, they should ensure effective interaction with them, which is possible by achieving consistency of actions.

Thus, the criteria that ensure the quality of the implementation of a set of information and communication tools in business processes are customisation, predictability and consistency. The digital drivers of quality assurance at railway transport enterprises are the following processes: customer interaction; transportation management; station operation management; infrastructure management; and business management.

Currently, the implementation of quality management systems at railway transport enterprises is significantly influenced by the processes of reforming the industry and the expansion of European integration ties as a result of the signing of the Association Agreement between Ukraine and the European Union. These factors necessitate, firstly, the implementation of the EU directives and regulations in the field of railway transport, which affects the quality requirements and the process of developing and implementing quality standards; secondly, changes in the organisational and management structure of JSC «Ukrzaliznytsia», which is carried out by creating companies in the main business areas of railway transport, which allows focusing on the specifics of business processes of the relevant activities and models of quality assurance specific to them.

An important component of the quality management system at railway transport enterprises is the procedure for finding and implementing quality reserves. It should be noted that the formation of reserves to ensure the effective operation of the enterprise is influenced by material, economic, socio-political, financial, technical, organisational and other factors that reflect the real picture of the entire economic activity of the enterprise [4]. Also, resources are managerial factors of production that have value properties and opportunities for transformation, with the help of which the enterprise ensures and develops production processes for the implementation of strategic and tactical plans.

Modern enterprises use the following types of reserves [5]: 1) reserve stocks, namely raw materials, supplies, components and other labour items required for the rhythmic production activities of the enterprise; 2) reserves that are unused capabilities of the enterprise in the field of application of scientific, technical and innovative achievements, namely improvement of quality characteristics of products or services, use of new equipment and modern technologies, use of new types of materials, etc; 3) - reserves arising from the irrational use of all types of resources, namely all types of possible losses and cost overruns that occur during the production process.

It should be noted that the quality of goods or services is improved by improving production technology, raw materials and supplies, as well as by improving the performance of employees of all categories. However, the use of these reserves does not always have an impact on the competitiveness of a product or service. Therefore, the company is forced to look for other reserves to improve quality. Identification of such reserves and their timely introduction into the production process is one of the new tasks in the quality management system, the solution of which will allow the enterprise to occupy its niche in the market [6]. Thus, the reserves for improving the quality of a product or service are understood as unused opportunities for an enterprise to improve the quality characteristics of a product or service by changing or improving their properties and characteristics, using more advanced techniques, materials and technologies, improving production and technological processes, changing the labour organisation system, etc. Reserves for improving the quality of goods or services have the following gradation [7]:

- real or unused capabilities of the enterprise to improve the quality characteristics of the product in the most efficient and productive way when designing, manufacturing and performing its intended purpose;
- potential - known, but not used for various objective or subjective reasons;
- probable - unknown, but which can be used by the company when applying various innovations and innovations.

However, for enterprises that want to be competitive in the market, including railways, it is not enough to focus on finding reserves only in materials, technology and personnel. After all, the activities of railway transport enterprises are quite large-scale, so quality reserves for railway transport enterprises should be based on the following additional features:

- Integration, which identifies such types of quality reserves as hyperlinked, complementary and individualised;
- hierarchical level of management, which allows to allocate quality reserves of production units, branches, structural units, departments of JSC «Ukrzaliznytsia»;
- type of changes, which divides quality reserves into modernisation and conversion (transformational);
- degree of specialisation, according to which quality reserves can be differentiated, low-differentiated and dedifferentiated;
- the degree of relevance, according to which quality reserves should be divided into relevant, adaptable, irrelevant.

In accordance with the above, it is advisable to form a model of searching for and implementing reserves in the quality management system at railway enterprises (Fig. 2). This model provides for the following stages of searching

for and implementing reserves in the quality management system at railway enterprises. At the first stage, a system of quality standards should be formed in the following key areas: quality standards for customer service in freight transportation, quality standards for transportation management processes, quality standards for passenger transportation, quality standards for railway infrastructure, quality standards for maintenance and repair of technical means, and quality of corporate governance of JSC «Ukrzaliznytsia».

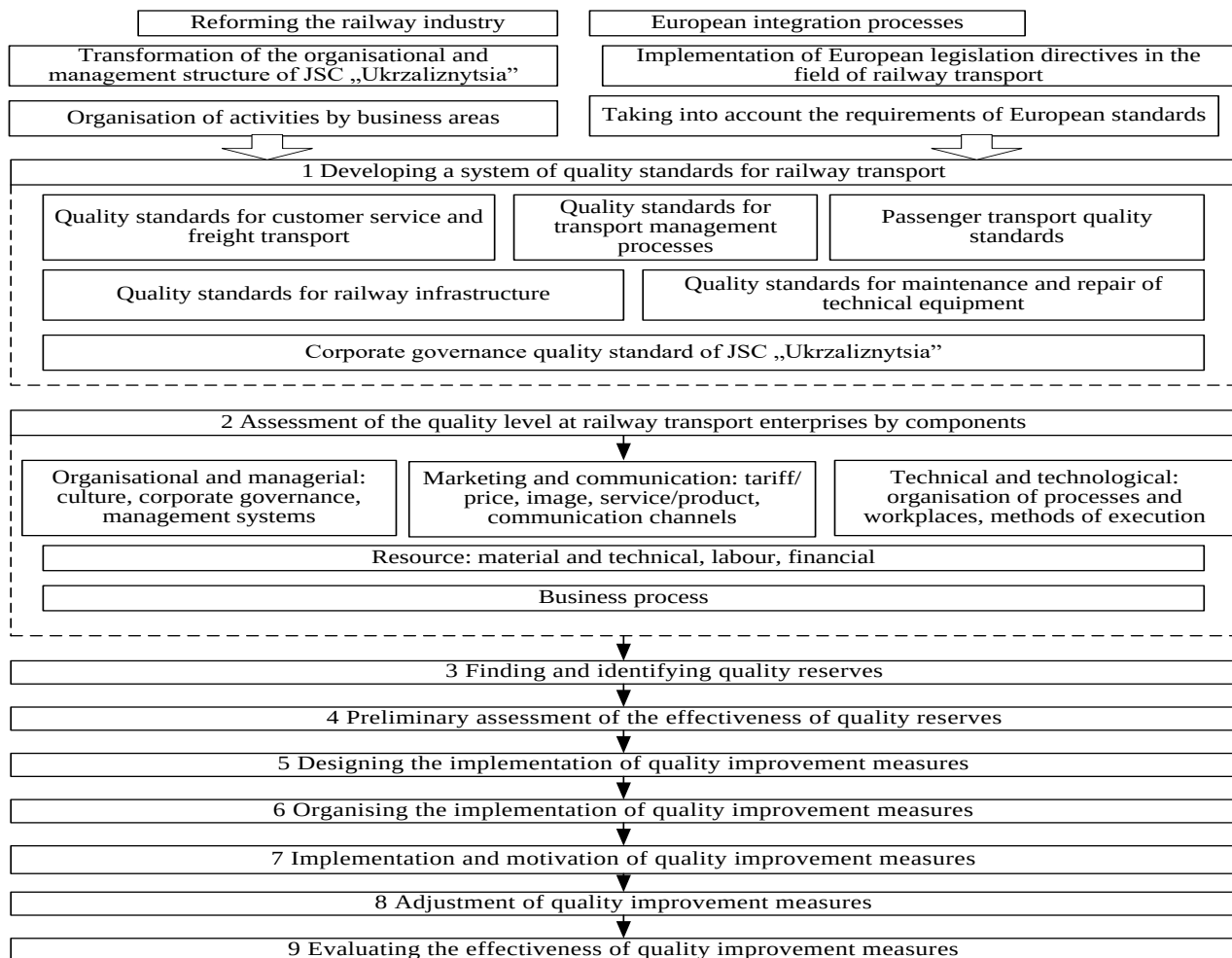


Fig. 2 A model of search and implementation of reserves in the quality management system at railway enterprises

At the second stage, the quality level is assessed by the following components: organisational and management, marketing and communication, technical and technological, resource and business processes. This assessment will enable the search for and identification of quality reserves, which is carried out at the third stage. This is followed by a preliminary assessment of the effectiveness of quality reserves (stage four) and the design of quality improvement measures (stage five). The sixth and seventh stages involve the organisation, implementation and motivation of quality improvement measures. Subsequently, the effectiveness of the quality improvement measures is adjusted and evaluated.

A prerequisite for the introduction of an effective quality management system and the implementation of quality reserves at railway transport enterprises is the development of a system of quality standards and their certification. In accordance with existing quality management concepts, it should be noted that their successful implementation is based on certification, which is based on the confirmation of the quality characteristics of products to the established and documented regulatory requirements. In general, product certification is a whole range of various activities, the main purpose of which is to confirm the compliance of manufactured products and services with established standards [8].

Moreover, the use of standards allows enterprises and organisations to: guarantee consumer confidence in the quality characteristics of products; promote the improvement and ease of production of goods by the consumer; to have reliable data on consumer and quality characteristics of products; create conditions for successful competition with competitors, especially with producers of non-certified goods; maintain a high organisational and technological level of the production process; facilitate international production and trade relations; promote innovative and social development of the enterprise, etc. Today, global requirements for the quality of transport and logistics services are based on ISO standards, which are based on compliance with standards, continuous inspection of all types of products for compliance with standards, creation of conditions for the production and sale of quality products, and quality control. The main ones are as follows:

- ISO 9000 reveals the main principles of forming a quality system for manufacturers of products and services;

- ISO 9001 specifies the rules for the operation of a quality management system based on the satisfaction of customer requirements in the manufacture of products or the provision of services;
- ISO 9004 provides advice and guidance on how to operate a quality management system and achieve useful results through improved performance and customer satisfaction;
- ISO 19011 is the universal standard for all ISO standards and provides guidance on the control of the quality management system and the environmental impact of the processes of production, sale and consumption of goods or services.

The application of ISO standards in the activities of enterprises and organisations leads to the development of international cooperation and mutual understanding in production, trade, financial and other activities in a market economic system.

For example, the quality of transport products in Europe is determined by Council Directive 91/440, adopted in the 1980s and supplemented by Directives 95/18 and 2001/12. Directive No. 2001/14 defined the peculiarities of access to railway infrastructure through the Network statement document, which defines the conditions for the use and management of railway capacities [9]. Council Directive 2004/49 sets out the requirements for the security of railway networks and amends Directives 95/18, 2001/14 and 91/440, which contributes not only to improving the security of railway traffic but also to facilitating the functioning of the freight market. In 2004, the European Union paid attention to the state of the railway network and established the European Railway Agency, whose main task is to ensure the competitiveness of the continent's railways through transit and international freight traffic and the safety of the transportation process. As for passenger traffic, in 2007 a number of Directives were adopted, including Directives 2007/58 and 2007/59, regulating the quality of passenger traffic and expanding its cross-border scope [10]. In view of the need to take into account the reform and European integration processes, it is necessary to develop systems of quality standards in the following areas: transportation of customer goods; transportation of passengers; transportation management, infrastructure condition; maintenance and repair of railway transport equipment.

3. Conclusions

Thus, the loss of competitive positions of railway transport enterprises in the transport market is largely a consequence of the low level of quality of transport services. Taking into account the factors of negative impact on the level of quality of transport services of enterprises in the industry and trends in the digital economy, which ensure the quality of functioning of modern enterprises, the principles of quality assurance in the context of digitalisation are established, information and communication tools that determine the digital transformation of business processes of economic activity of enterprises in the industry are defined in compliance with the requirements of consistency, customisation and predictability. This formed the basis of the proposed concept of proactive quality management at railway transport enterprises. The study of the essential and fundamental characteristics of the concept of 'quality reserves' and approaches to the classification of their types allowed to expand the existing typology with such features as integration, hierarchical level of management, type of changes, degree of specialisation, and degree of compliance. Taking into account the specifics of transformation of the organisational and managerial structure of railway transport and the dominant influence of European integration processes on the formation of quality standards, the implementation of which is considered as the initial stage of substantiation of quality reserves, a model for searching for and implementing reserves in the quality management system at railway enterprises has been developed.

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