

SCTCMG 2021
International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»

MODELLING AS TRANSPORT SERVICE QUALITY AND EFFICIENCY INCREASE

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Abstract

The most important contribution to the solution of the main tasks of the country's economic and social development is made by the successful operation of the transport infrastructure. The transport system provides conditions for economic growth, increasing national economy competitiveness and life quality of population. Transport organizations need to continually improve their operations in order to remain competitive. This requires the development of new technologies and methods for doing business, improving the quality of activities and introducing new, modern, effective methods of managing and organizing the activities of enterprises. Business process modeling makes it possible to understand the work and analyze the organization, as well as improve the quality and efficiency of the transport organization. The article discusses different ways aimed at improvement of efficiency and quality of transport organizations. The types of modeling used at transport enterprises are disclosed. Methods for business process modeling in transport organizations are presented. The recommendations of Russian Railways JSC are given in terms of improving the quality and efficiency for the following activities: freight services, freight and commercial services, maintenance of material base, infrastructure services, its maintenance and repair, services for the provision of freight cars, and their maintenance, services for the provision of locomotives and their maintenance and services for the repair of rolling stock. The authors have proposed an algorithm for assessing the efficiency of production processes in railway transport using the example of freight services.

2357-1330 © 2021 Published by European Publisher.

Keywords: Transport, efficiency, quality, simulation, business processes



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1. Introduction

In the conditions of instability of economic processes, problems of economic development of the country, the issues of increasing the efficiency and quality of work of transport organizations are relevant, important for consideration and have high practical significance.

The following Russian scientists study the issues aimed at the efficiency increase of railway transport and quality assessment of transport services in market conditions, determining the main areas of their development in world practice: I.V. Belov, V.L. Belozerov, T.V. Bogdanova, G.V. Bubnova, V.G. Galaburda, O.V. Efimova, R.A. Kozhevnikov, V.A. Kozyrev, A.V. Komarov, P.V. Kurenkov, B.M. Lapidus, L.P. Levitskaya, D.A. Macheret, V.A. Persianov, A.T. Romanova, Yu.I. Sokolov, N.P. Tereshina, M.F. Trikhunkov, N.M. Sheremet, A.D. Shishkov, L.V. Shkurina, V.V. Boytsov, U.E. Deming, J.M. Juran, K. Ishikawa, F.B. Crosby, F.W. Taylor, A.V. Feigenbaum, W.A. Shewhart and others.

The important results on the theoretical substantiation of the business process model were reflected in the works of M. Bunge, J. Wanda, R. Weber, P. Green, M. Rosemann, P. Soffer, I. Baider, M. Khomyakov, E. Dijkstra, D. Harel.

2. Problem Statement

Both efficiency and quality among transport enterprises are directly determined by competitiveness, which works according to the models, is more reliable, provides quality services, is more efficient and, as a result, is more competitive.

Thus, when assessing the quality of transport services, it is necessary to highlight such quality indicators as availability, efficiency, reliability, and convenience. To improve the efficiency of transport services, it is necessary to use reasonable indexation of tariffs and expand the range of provided transport services (Vasilenko et al., 2019).

3. Research Questions

The development of transport system, its efficiency, economic attractiveness and competitiveness are possible through the introduction of modern organizational and economic tools. One of these elements is a business process (Nesterov, 2011). The business process of Russian Railways is expressed in a set of goals aimed at producing services that are valuable to the consumer and obtaining the maximum positive economic effect from the provision of this type of service (Vasilenko et al., 2018).

There are many methods to improve the quality and efficiency of a transport organization. One of these methods is business process modeling. This method, allows to assess the current activities of the enterprise, is used to improve the efficiency and quality of work of transport organizations. The basis of this method is the description of the process through various elements belonging to the process under consideration. In modeling processes, they describe the logical relationship of all elements of this process from its beginning to its end (Bessmertny, 2016).

Business process modeling involves the description of a process through various kinds of elements (actions, data, events, materials, etc.) inherent in this process, and makes it possible to describe the logical relationship of all elements of the process at all stages of its functioning within the organization.

The purpose of business process modeling in transport organizations is to classify information about organizations and the procedures within them. The use of methods for business process modeling is aimed at an increase of the operational efficiency of organization. In another words it is aimed at the arrangement of all processes in the best way possible, leading to lower costs and, at the same time, improved quality of products or services. In order to carry out this kind of optimization, it is necessary, first, to simulate the basic processes that occur on a daily basis in all divisions of the organization. The very idea of modeling business processes is expressed in the necessity for the manager and all employees to see all the activities of the enterprise from the inside and the possibility of seeing its outcome.

4. Purpose of the Study

When modeling business processes, it is very important to make a decision about the structure and content of modeling objects, to determine what elements the business process should consist of. Any sufficiently complex business process can include five main elements that should be reflected in the development of models, i.e. planning of activities, implementation of activities, registration of data, control and analysis, decision-making management (Skorodumov, 2014). Business processes modeling in transport organizations makes it possible to understand the work of the organization and conduct its analysis. The analysis carried out allows one to adjust the work of the organization in a more efficient way. Modeling has to be performed in more detail and multifaceted way, since it has a large number of cross-functional connections. To improve the modeling process in transport organizations, the types of modeling presented in Figure 1 are most often used.

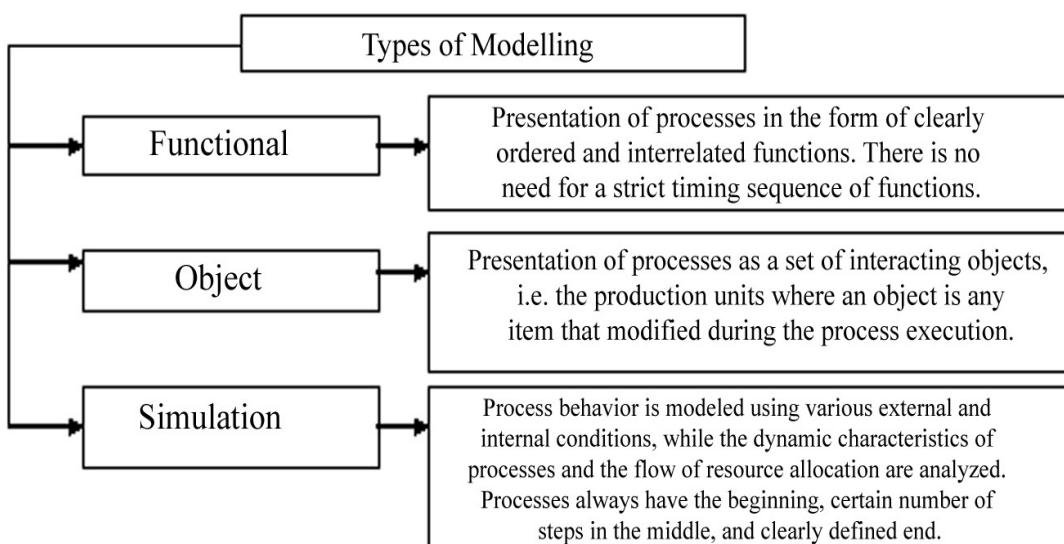


Figure 1. Modelling types at transport enterprises

The listed modeling methods used to improve the quality and efficiency of transport organizations are designed to solve the most common transport problems (Yarlykova, 2016).

At Russian Railways' Quality Management Strategy the business process is represented by a set of various processes united within a certain type of activity (business), as a result of which a finished product is created that is of value to an external consumer.

Improvement of the economic management of process quality affects all stages of management: planning and forecasting, accounting, analysis and control, regulation, and motivation. Detection of a defect leading to a failure at the initial stage will save significant funds, increasing the overall economic effect of the provision of transport services.

Transport organizations need to improve their operations in order to remain competitive. To do so, it is necessary to develop new technologies and business strategies, to improve quality of goods and services, and to introduce new effective methods of management and organization of enterprises' activities. Currently, computer-based media and software are used to model business processes at transport enterprises (Bessmertny, 2016).

5. Research Methods

Business processes modeling in transport organizations is performed using the methods presented in Table 1.

Table 1. Modelling methods of business process modeling in transport organizations

Methods of business process modeling	Functions
Flow Chart Diagram	1. Graphical description of the work. 2. Logical sequence of the process
Data Flow Diagram	1. Data transfer between operations to describe business process content. 2. Input and output data monitoring loaded into the system and into each operation separately
Role Activity Diagram	1. Process modeling in terms of individual roles, group roles, and the interaction of roles in the process. 2. Description and analysis of each part separately; analysis of their interaction
IDEF (Integrated Definition for Function Modeling)	1. Description of various aspects of business processes. 2. Display and analysis of the activity model of a wide range of complex systems in various sections
IDEF0	1. Functional model development. 2. Analysis of performed actions. 3. Model modification. 4. Cost analysis
IDEF3	1. Process model development. 2. Analysis of the operations performed. 3. Model modification
Colored Petri nets	1. Process flow depiction. 2. Required data processing simulation. 3. Description of algorithms as a block diagram. 4. Dynamic modeling of the process behavior
Unified Modelling Language (UML)	1. Use case model development. 2. Development of timing diagrams. 3. Models modification. 4. Case study
EPC modelling	Model development as a sequential chain of event-driven processes. 2. Model modification

Business process modeling at Russian Railways makes it possible to do the following:

- 1) To improve management and control of the quality of work at different stages, which is possible due to a good overview and understanding of all business processes of the company.
- 2) To understand what kind of employees and resources the company needs, which makes it possible to increase the efficiency of personnel selection.
- 3) To improve financial performance.
- 4) To apply a system of business processes to improve the quality and efficiency of work.
- 5) To standardize processes (if you follow the rules for their implementation, you can achieve the desired effectiveness).
- 6) To establish relationships between processes (to make sure the procedure is correct) (Macheret & Valeev, 2019).

A clear description of all actions as well as workflow preservation allows one to standardize information or data about the organization and its operations in order to display everything in a graphical form later. Looking at the diagrams from the outside helps noticing the mistakes and think about how to avoid them.

Russian Railways is a large diversified company (Lapidus, 2004). The main activities, goals and processes carried out at Russian Railways are presented in Table 02.

Table 2. Main types of activities, goals and processes carried out at Russian Railways JSC.

Types of activities	Goal	Processes
Freight services	Income under the agreement for the carriage of goods by rail in general use	Forecast of the volume of cargo transportation and the need for services of business processes involved in the implementation of cargo transportation; service quality management
Freight and commercial services. Material base maintenance.	Income under the agreement with a carrier from loading cargo and containers into wagons, as well as from unloading from them in public places, as well as income from other services of cargo and commercial work	Forecast of the volume of cargo transportation and commercial work and the need for technical means necessary for its implementation; organization of transportation of goods and needs; organization of cargo and commercial work, current maintenance and repair of technical equipment; service quality management
Infrastructure services. Its maintenance and repair.	Income under the agreement with a carrier for organizing transportation, as well as for works and services performed by the owner of the infrastructure at the request of shippers or consignees	Forecast of the volume of work of the infrastructure and the need for carrying capacity and technical means necessary for its implementation; organization of the current maintenance and repair of infrastructure and technical means, contractual work on their maintenance and repair; safety and quality management
Provision of freight cars and their maintenance	Income under the agreement with a carrier in the implementation of the transportation process using wagons that are owned by the operator or otherwise	Forecast of loading volumes, needs for freight cars and their technical characteristics; organization of the purchase of wagons; organization of supply of serviceable wagons for loading; development of a loading plan; safety and quality management
Provision of locomotives	Income under the agreement with	Forecast of the size of traffic, needs for

and their maintenance	the owner of the infrastructure in the implementation of the transportation process using locomotives that are owned by the owner of the locomotives or other rights	locomotives and their technical characteristics; organization of operational management of the locomotive fleet of Russian Railways JSC; organization of supply of serviceable locomotives to the train; safety and quality management
Rolling stock repair services	Income under the agreement with railway rolling stock operators and locomotive owners for repairs	Forecast of the needs for repair and development of repair facilities; development of a plan and organization of railway rolling stock repair; management of the safety of repair works and the quality of repairs

The following can be seen from Table 01:

1. It is advisable to establish a business process responsible for the implementation of carrier functions to increase the competitiveness of Russian Railways in the field of freight services, to strengthen the Company's position in the profitable and highly profitable segments of the freight services market, to ensure at least 50 % of the share of the Russian Railways fleet for each type of freight cars. According to Article 12 of the Federal Law "On Railway Transport in the Russian Federation", in order to implement the functions of a carrier in the most efficient way, Russian Railways JSC must transfer functions aimed at generating profit from the use of freight cars owned or otherwise authorized by Russian Railways JSC to a division of the Companies (branch of Russian Railways JSC). These functions include the development of the required structure of the fleet, requirements for technical specifications, applications for the purchase of new freight cars; leasing, selling, etc., as well as the design of the Company's policy as the main public carrier.

2. The provision of infrastructure services as well as operation and maintenance of fixed assets of the infrastructure is a monopoly type of activity. Taking into account the possibility for an increase in the number of transportation companies and the need to improve the efficiency of this type of activity of Russian Railways, it is advisable to establish a department within the Transportation Management Department or a Corporate Transport Service Center, having the following functions: organization of work with transportation companies to provide infrastructure services, i.e. marketing, sales plan, product mix policy, contract work.

3. In order to increase revenues, Russian Railways should provide for the development and implementation of measures aimed at creating and expanding the range of services provided at deregulated prices and tariffs in the framework of each business process of Russian Railways (forming product mix policy for various types of services that differ in terms and urgency of cargo delivery, time for processing applications, types of contractual relations, possibilities of commercial dispatching, transport logistics, etc.).

4. During the transition to the functional principle of management of Russian Railways JSC there should be defined the responsible persons for the corresponding functional area. At the same time, in the functional direction or area called "Customer" the following should be implemented: market monitoring, product mix policy, pricing (tariff) policy, contract work with customers, formation of a sales budget. As part of the "Process" direction there should be the forecast of the load of technical devices, determining the needs for their development and modernization, the organization of current activities and maintenance

of fixed assets, the development of requirements for material and technical means and the organization of their procurement, safety and quality management. The direction "Personnel" includes the business process provision with qualified workers to perform the functions assigned, training and retraining of personnel, social security in accordance with corporate standards. As part of "Finance" direction there should be established the organization of settlements under contracts with customers and under contracts with third-party organizations for the work and services performed by them. Preparation and contract signing, selection of a car, selection of a driver, determination of a route, terms and prices - all these are parts of an integral system of business processes for the delivery of a specific consignment of cargo to a specific location (Azarov et al., 2018).

6. Findings

The degree of sophistication and efficiency of the company's business processes directly affects the indicators of satisfaction with the goods and services of its customers (Sokolov et al., 2019). Developing the most effective model of business processes focused on the end customers within the company is an urgent problem, both in international business and for domestic enterprises. Thus, the output or result of business process execution is always information, services or goods demanded by Customers. At the same time, a business process can have several outputs (Titova & Veinberg, 2011).

In 2020, according to the annual reports of Russian Railways, the main business process that brings the largest amount of revenue is freight service. An algorithm for assessing the efficiency of production processes in railway transport using the example of freight traffic is shown in Fig. 02.

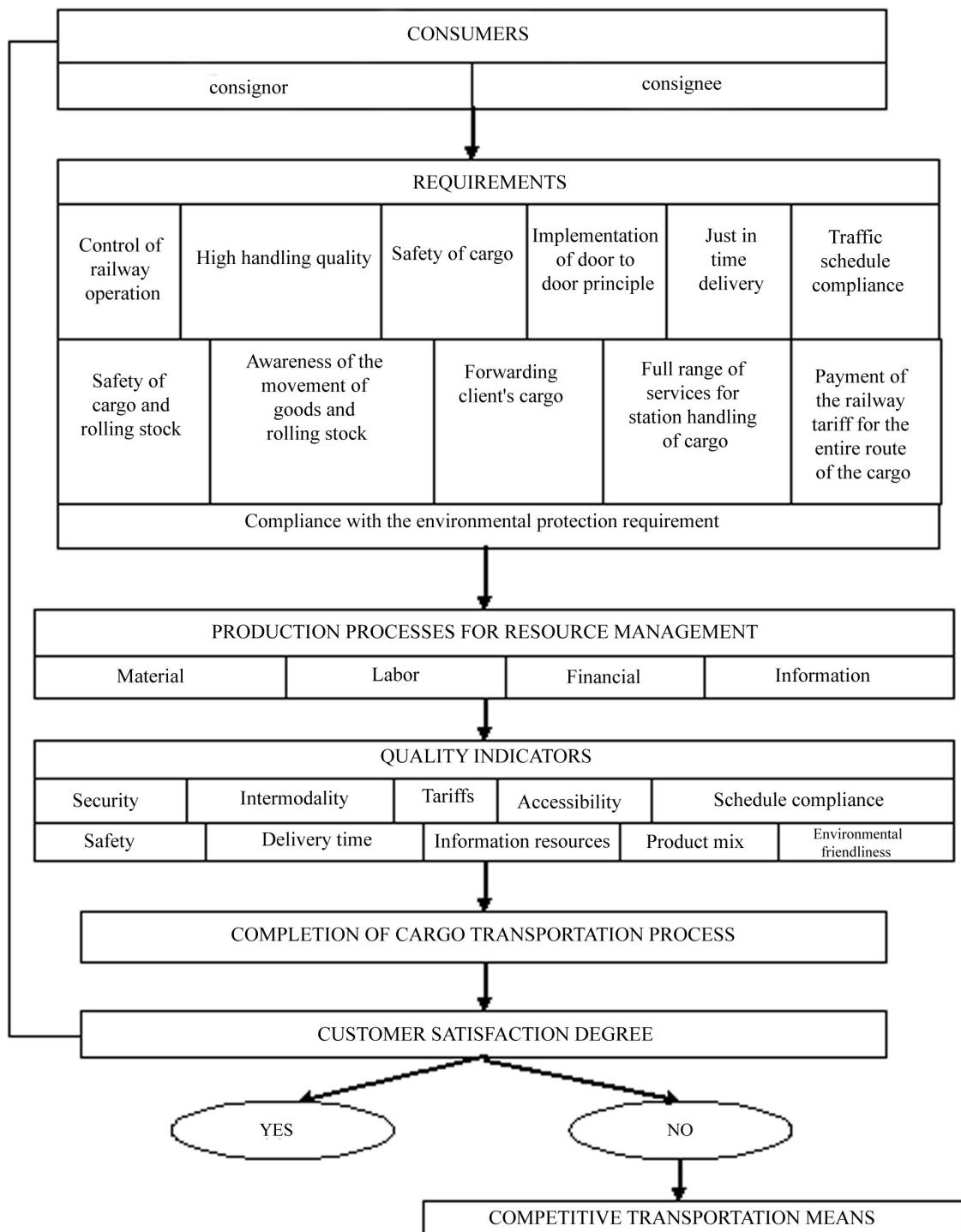


Figure 2. Algorithm for assessing the production process efficiency regarding railway transport using the example of freight services

Fig. 02 makes it possible to trace the relationship between subjects that arises during the implementation of the business process of freight services.

7. Conclusion

The ultimate goal of business process modeling at transport enterprises is to improve the quality and efficiency of the organization as a whole. To achieve this goal, the analysis focuses on increasing the value of results and reducing the cost and time of processes.

References

- Azarov, V. N., Mayboroda, V. P., & Leokhin, Y. L. (2018). The Approaches to the Design of Integrated Quality Management Systems for the Digital Enterprise. In *Quality Management, Transport and Information Security, Information Technologies* (pp. 3–8). St. Petersburg.
- Bessmertny, A. S. (2016). Business process modeling as one of the methods to improve the efficiency of an enterprise. *Science Magazine*, 5(6), 12–14.
- Lapidus, B. M. (2004). Russian Railways: Approaches to Development Strategy. *Railway economics*, 1, 11–28.
- Macheret, D. A., & Valeev, N. A. (2019). Opportunities for economic efficiency growth of Russian Railways. *Transport of the Russian Federation. A journal about science, practice, economics*, 4(83), 13–17.
- Nesterov, A. A. (2011). Improving the efficiency of transport enterprises. *Proceedings of St. Petersburg State University of Economics*, 3, 67–69.
- Skorodumov, P. V. (2014). Spatial development issues. *Modeling business processes: approaches, methods, tools*, 5(15), 1–11.
- Sokolov, J. I., Efimova, O. V., Lavrov, I., & Dmitrieva, E. I. (2019). Integrated Quality Management Systems in an Innovative Transport Company. In *Quality Management, Transport and Information Security, Information Technologies* (pp 54–56). Sochi.
- Titova, E. V., & Weinberg, R. R. (2011). Modeling business processes using instrumental methods. *Logistics*, 05(58), 17–20.
- Vasilenko, M. A., Kuzina, E. L., Drozdov, N. A., & Tagiltseva, Y. A. (2018). Modeling of Efficiency Assessment for Enterprises Economic Activity in Environmental System. In *Quality Management, Transport and Information Security, Information Technologies* (pp. 98–102). St. Petersburg.
- Vasilenko, M. A., Kuzina, E. L., Tagiltseva, Y. A., Drozdov, N. A., Sheremeteva, N. A., & Semibratova, S. V. (2019). Algorithm for Assessing The Extra-Sectoral Effect Of Improving Organization Quality. *EpSBS, LXXVI*, 789–797.
- Yarlykova, Z. I. (2016). *The main areas of improvement of the Russian Railways Holding in terms of business units*. <https://cyberleninka.ru/article/n/osnovnye-napravleniya-sovershenstvovaniya-holdinga-rzhd-po-biznes-blokam>