

# Logistics Model for Improving Quality in Railway Transport

Eva Nedeliakova, Juraj Camaj, Jaroslav Masek

**Abstract**—This contribution is focused on the methodology for identifying levels of quality and improving quality through new logistics model in railway transport. It is oriented on the application of dynamic quality models, which represent an innovative method of evaluation quality services. Through this conception, time factor, expected, and perceived quality in each moment of the transportation process within logistics chain can be taken into account. Various models describe the improvement of the quality which emphasizes the time factor throughout the whole transportation logistics chain. Quality of services in railway transport can be determined by the existing level of service quality, by detecting the causes of dissatisfaction employees but also customers, to uncover strengths and weaknesses. This new logistics model is able to recognize critical processes in logistic chain. It includes service quality rating that must respect its specific properties, which are unrepeatability, impalpability, their use right at the time they are provided and particularly changeability, which is significant factor in the conditions of rail transport as well. These peculiarities influence the quality of service regarding the constantly increasing requirements and that result in new ways of finding progressive attitudes towards the service quality rating.

**Keywords**—Logistics model, quality, railway transport.

## I. INTRODUCTION

LOGISTICS chain is influenced by quality of services in railway transport. In the appreciation of quality of service in a company, it is important to consider the approach those methods, techniques and quality models, which combine objective and subjective components of rating [1]. Progressive approaches towards the service quality rating must in general find the current level of quality of service. Other more these attitudes reveal the causes of dissatisfaction of both customers and the company employees, finding the strengths and weaknesses of company and also its suppliers and competition. They should offer relevant data for processing constant improvements of quality of service and bring qualified, measurable outputs with the ability to evaluate trends in the quality of service [2].

Within the scientific research undertaken by the University of Žilina, institute of rail transport were researched different ways of appreciation of quality of service. One part of methodic had been already successfully applied in the conditions of transport enterprise, carrier-offering services of

rail freight transport, specifically in the application on conditions of wagonload transport.

The service quality rating must respect its specific properties, which are unrepeatability, impalpability, their use right at the time they are provided and particularly changeability, which is significant factor in the conditions of rail transport as well. These peculiarities influence the quality of service regarding the constantly increasing requirements. In the contemporary literature in Slovak republic the quality of service problem is discussed mostly theoretically, often only in general which absents the usage of approaches particularly in the conditions of railway transport. There exist several models of service quality abroad, which are often concerned about this problem in different aspects, different from conditions of railway transport, which for railway transport implies that it is a necessity to look for more suitable approaches. In service quality, rating in a company it is important to take in mind approaches of those methods, techniques and models of quality, which connect objective and subjective aspects of rating that was the impulse for creating a scientific research, which one of the outputs is this article.

The goal of the research was solving the current issue necessary to keep railway transport on track of the transport market concerning the search for innovative options of service quality identification [10].

The goal of this article is the characteristics of author created methodic as a progressive approach towards service quality rating, which allows identifying the current service quality level, to find the cause of dissatisfaction of customers and company employees. This approach also not only finds the pros and cons of the company, but also its suppliers and competition. It offers relevant data for the process of constant service quality improvement and brings qualified, measurable outputs with the option of evaluating trends in service quality. This model, verified in practice, can be used in a uniform manner. It is unified and thus applicable in different branches and types of business.

## II. NEW LOGISTICS MODEL

The first part of the model is characterized by calculating the complex indicator of quality for the corresponding process of the provision of service. It is based on two basic sources:

- Questionnaires for customers, which serve to detect the weight of the process (this part of research was supported by software solution).
- Process cards for the auditor of company, developed for individual phases of service provision, which are detailed in the research [3].

Eva Nedeliakova is with the Department of Railway Transport, University of Žilina, Univerzitna 8215/1, 010 26 Žilina, Slovakia (corresponding author, phone: +421908456938; e-mail: eva.nedeliakova@fpedas.uniza.sk).

Juraj Camaj and Jaroslav Masek are with The Department of Railway Transport, University of Žilina, Univerzitna 8215/1, 010 26 Žilina, Slovakia (e-mail: jaroslav.masek@fpedas.uniza.sk, juraj.camaj@fpedas.uniza.sk).

Second part of the level of quality identification model is focused on three approaches i.e. customer, employee and supplier oriented approach. New logistics model includes the calculation of complex quality marker, which is intended for executing intern audit for the needs of the company management [4]. The very models procedure is following:

- designed different questionnaires for customers, particularly for the pre-transport, during transport and post-transport phases,
- questionnaire is published on the internet portal,
- intern audit is held twice a year, in June and December,
- customers in questionnaires will fill in the weight, which they ascribe to a process in individual transport chain phases with three options: high, medium and low weight,
- auditor will process for individual train stations and transport chain phases questionnaires and calculate the weight coefficient.

The weight coefficient is designed in the following way:

$$kv_j = 2 - \sum_{i=1}^n v_i / n \quad (1)$$

in which, kv<sub>j</sub>–weight coefficient of respective process, v<sub>i</sub>–weight value for corresponding answer in questionnaire, n–number of answers in questionnaires.

After calculating, the weight coefficient auditor monitors and identifies the quality level of processes right in the process card, assign points based on the score from the process card for corresponding stations and segments, fill in process card, process results from the process card and evaluate them

Calculate complex quality marker for corresponding process based on the designed formula:

$$KU_j = Q_j \times kv_j \quad \text{[Number of points]} \quad (2)$$

in which, KU<sub>j</sub>–complex quality marker for respective process, Q<sub>j</sub>–level of fulfilment, real number of points of respective process in stations or segments from the intern audit, in which complex quality marker for respective process can achieve a maximum of 10 points.

Limit of acceptability within the model is set to 5 points (Fig. 1).

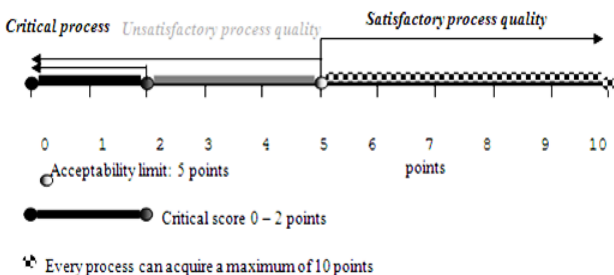


Fig. 1 Acceptability limit of quality service within the model

Auditor calculates the total complex quality marker based on the designed formula for respective station respectively segment:

$$CKU = \sum_{i=1}^n Q_i \times kv_i \quad \text{[Number of points]} \quad (3)$$

- auditor compares the value of total complex CKU marker with the scoreboard listed in the process card, particularly for each station respectively segment. The final solution must be noted in the “Intern audit registry”,
- time set for the intern audit for 1 railway station is 2 weeks,
- auditor decides about the quality of individual processes, forms a document named “Intern audit registry”, separately for satisfactory rated processes, which passed the acceptability limit of 5 points (from the process card),
- he creates the registry separately for unsatisfactory processes, which have not passed the acceptability limit of 5 points (from the process card) and separately for critical processes, which acquired critical score of 0-2 points (from the process card) [6].

TABLE I  
EXAMPLES OF RATING CRITERIA VIA THE PROCESS CARD

Process	Criterion
1. Direct customer contact	Understanding and knowledge of customers
2. Employee codex	Customer care
3. Knowledge level	Understanding and knowledge of customers
4. Information through the internet	Information, Accessibility
5. Advertisement	Communication
6. Place equipment	Trustworthiness
7. Wagon stock	Accessibility
8. Railway operation techniques	Accessibility
9. On time information	Time
10. Transport order	Customer care
11. Placing of wagons at Loading	Understanding and knowledge of customers
12. Loading	Customer care
13. Consignment soundness	Reality

In Table I, there is listed a fragment of specific model quality rating developed by the authors, which serves as a service quality identification support in the application on the rail freight transport in individual transport phases i.e. pre-transport, during transport and post-transport.

Station score through process card continues by forming rating tables with given date, process card number and making a registry of the score. Auditor calculates the process weight coefficient and sets the number of points modified by the process weight. Every station can acquire a maximum of 130 points and each process 10 points [9].

For processes, which have not acquired acceptability limit of 5 points (critical process included) auditor suggests corrective actions with the cooperation with a liable employee (competent process owner), when they do not agree on corrective actions, auditor states this fact in the „Intern audit registry”. This fact needs to be retired to the company management and it solves the case without the cooperation with the owner and immediately states corrective actions for

increasing the quality of competent process. Through this approach, the introduction of activities is possible for achieving the wanted quality level and constant improvement of this process, respectively introducing methods necessary for securing an effective operator and management of this process.

In Fig. 2 is shown the procedure of quality level identification within logistics model.

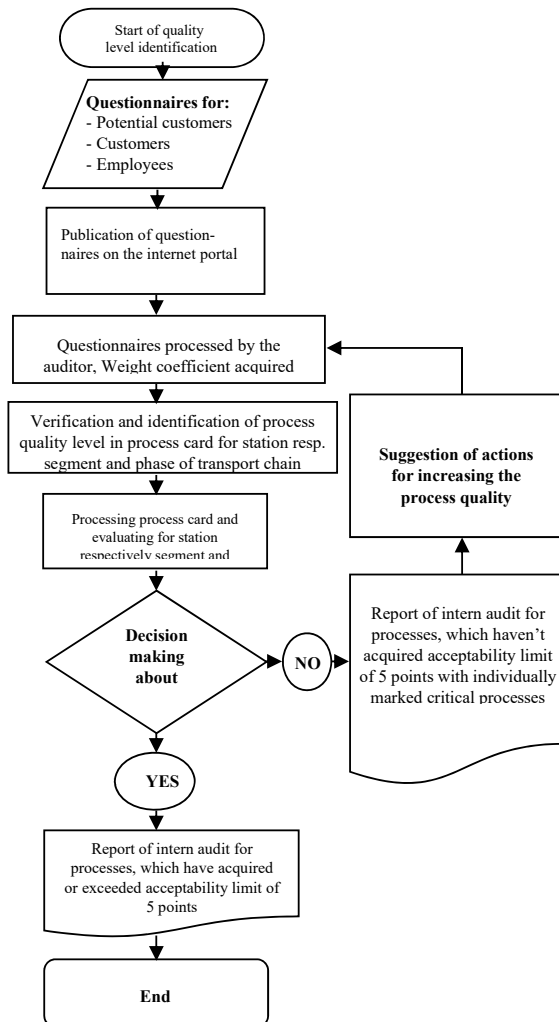


Fig. 2 Flow chart of quality level identification model

During decision about the critical processes, the intern audit will again evaluate processes suggested by the model and if the processes again acquire critical score (0-2 points) and will write a report about unacceptable state, who resigns immediate supervisor responsible employee, which will again initiate correcting actions [6]. There can occur only two cases in deciding about process quality – satisfactory or unsatisfactory process quality (based on model score rating in given process card).

### III. CONSTANT PROCESS IMPROVEMENT

Measures for the increase of process quality should be derived from so called continual improvement principle which is derived from KAIZEN philosophy terms of quality monitoring it is important that following approaches are used:

- Customer Oriented Approach:

Railway company must create a mechanism, which will ensure the update and satisfaction of customer's needs.

Plans, vision, strategy and targets must be up to date if the customer modification occurs [5].

- Potential Customer Oriented Approach:

Railway company must create its own intern system which can look through a customer and his intentions.

Railway company must establish a communication system which will repeatedly look for new ways of gaining potential customers and simultaneously offers products of railway company to the widest potential market [8].

Modern plans for obtaining potential customers must be kept as project plans where appropriate methods of modern planning with typical software support can be appointed.

- Employee Oriented Approach:

Railway company management must enforce employee courage participate in improvement.

Railway company employees must attend and ask which activities are needed for the quality process increase and what benefits it will bring.

Railway company must create employee rating, employee education and employee needs identification systems.

Potential barriers inside Railway company must be identified and eliminated.

- Process Oriented Approach:

Railway company must identify all its processes and list them in an appropriate manner (process card).

For every process must be identified owner of the process, process customer or process supplier (identification ensures intern audit).

Processes must be rated in regular intervals (i.e. intern audit will be held twice a year, in June and December) [11].

All processes and activities, which railway company performs and do not give any value to the final product must be eliminated.

- Supplier Oriented Approach:

Railway company must use only those, which will ensure the accomplishment of desired parameters based on customer needs.

Railway company prefers only principle of reliable, on time and high-quality delivery [9].

- 3rd Party Oriented Approach:

A mechanism must be set in railway company, which will ensure the update of needs of all stakeholders.

A mechanism must be set in railway company, which will ensure the satisfaction of needs of all stakeholders.

Railway company must appoint a modern suitable system for increasing the communication speed between the company and stakeholders [6].

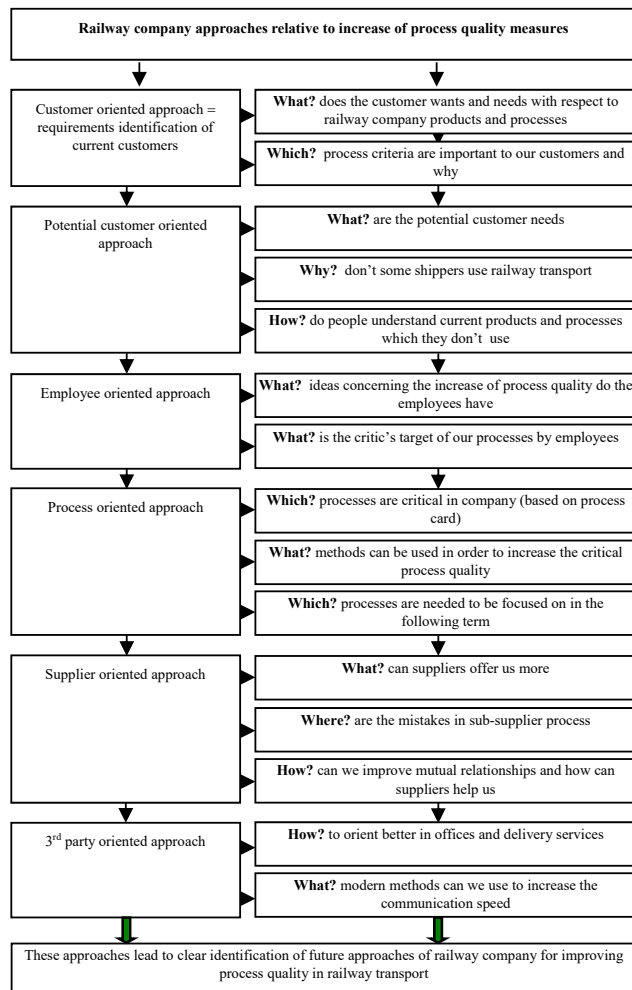


Fig. 3 Constant process improvement approaches

#### IV. CONCLUSION

New logistics model involves improving quality of the transportation chain by correct selection of service quality criteria. It observes and evaluates quality and on this basis realizes intern audit of logistics chain [10]. This unified quality rating system can be applied for all kinds of service, departments and companies. It is inevitable in terms of strategic decisions in practical company operations. It can become a way out for regulation of service, which increase in quality is urgent condition for keeping companies in competitive business environment [1].

Service quality improvement is difficult in terms of their necessary interconnection so that the customer gains the most benefit. It is long term and never ending process. Customer requirements are diverse and persistently changing [7]. It is only a matter of time when will every organization, if they want to succeed on market, is forced to invest all their effort to

quality and trying to constantly satisfy the needs for their customers which can be done only by perfect knowledge.

#### ACKNOWLEDGMENT

This paper is prepared with the support of the project "The quality of education and development of the human resources as pillars of the knowledge society at the Faculty PEDAS", ITMS project code 26110230083, University of Žilina.



*Modern education for the knowledge society / Project is co-financed by funds from the EC*



#### REFERENCES

- [1] E. Nedeliaková, A. Dolinayová, I. Nedeliak, "Methods of evaluation of the transportation services quality", University of Žilina in Žilina, EDIS, 2013.
- [2] I. Kubasáková, M. Šulgan, "Modern logistic system – effective customer response (ECR)" in Transport and communications, University of Žilina in Žilina, 2005, pp. 5-10.
- [3] J. Camaj, A. Dolinayova, J. Lalinska, M. Bariak, "The Technological Problem of Simulation of the Logistics Center", World Academy of Science, Engineering and Technology, International Science Index, Economics and Management Engineering, 1(4), 2014, p. 2618-2622.
- [4] J. Camaj, J. Lalinska, J. Masek, "Simulations of continental logistics center from the perspective of gechnologist" in ICIMS 2014 International Conference on Industrial Engineering, Management Science and Applications 2014. Proceeding book of conference. Beijing: IEEE, 2014, p. 305-308.
- [5] J. Gnap, M. Poliak, J. Sosedová, J. Jagelčák, "Zasielateľstvo", University of Žilina, 2011.
- [6] J. Majerčák, I. Nedeliak, "Practical experiences with modeling of IT systems and business processes," in 6th Forum of rail transport, Bratislava, 2010, pp. 81-84.
- [7] J. Majerčák, J. Plevko, P. Majerčák, "Logistics assessment of functional performance of material flows in railway transport," Sovremennye realii, trendy i innovacii v upravlenii biznes-processami na transporte: Trudy mezhdunarodnoj naučno-praktičeskoj konferencii. Moskva: OOO "NIPKC Voschod-A", 2014, p. 299-301.
- [8] J. Sekulová, I. Nedeliak, "Utilization of GAP model in providing of services in the railway freight transport," in Perner's Contacts, 8th ed. vol. 4, 2013, pp. 67-75.
- [9] KEGA 026ŽU-4/2015 "Innovative approaches in system of teaching management in the study program Railway transport with a focus on application the dynamic quality models in the railway transport", University of Žilina in Žilina, 2015.
- [10] M. Poliak, "Current problems of procurement of transport services by public passenger transport," in Current problems in transport 2009, Pardubice: Institut Jana Pernera v Praze with Přepravní laboratoři Dopravní fakulty Jana Pernera, 2009, pp. 213-218.
- [11] P. Majerčák, E. Majerčáková, "The aim of distribution logistics in the Supply Chain," in SCIECONF 2014, proceedings in scientific conference, University of Žilina, 2014, p. 520-523.