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Six Sigma and Dynamic Models Application as an Important Quality Management Tool in Railway Companies

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Abstract

The most effective way of achieving superior business performance is related to the understanding of the process and subsequent improvement. This article focuses on the various management tools of quality those interconnection conditions in a railway environment together generate positive synergies. The following philosophy as Kaizen, Total Quality Management, Six Sigma or usage of dynamic models in terms of the railways belong to an innovative approach to improving the quality of services. Their thought of process optimization, as well as continuously improving the expertise of its staff, makes it easier to cope with global changes but also a service disruption and extraordinary circumstances. Within these tools, it is also essential to have a detailed knowledge of customer requirements, the use of not only subjective, but particularly objective data and especially the use of statistical analysis to achieve success in a transport company. Effective measurement of services quality cannot be bound only to a particular point in time, therefore it is necessary to ensure continuous monitoring of quality throughout the process of services provision. The connection of Six Sigma and dynamic models, which are shown in this paper, represent a modern trend in quality management. Dynamic models follow the procedural character of the provided services that are unique, unrepeatable and constantly changing.

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Keywords: dynamic models, Six Sigma, Leonard Berry model, railway transport, quality management, process-oriented management

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1. Introduction

It is obviously important in the competitive environment in railway sector to make efforts, maintain or create a new service that appeals to customers in different areas. In addition, the railway transport has safety and environmental impacts that are considerably less than other modes of transport. Therefore, it would be necessary to encourage and accentuate its position on the transport market by increasing service quality.

The goal of a research was to highlight the advantages of using Six Sigma in railway transport whereby Six Sigma would become an integral part of the culture in railway companies. An important step towards the implementation Six Sigma is the training of staff. According to the research which has been solved at the Department of Railway Transport, University of Žilina in cooperation with foreign research institutions, dynamic models represent one of the best approaches to the quality improvement. Apparently, service quality in railway transport is currently often discussed problem, especially in view of the existing competitive environment. Railway companies need to find ways to identify quality through which they can precisely intercept the procedural character of the services provided [1].

The advancement of quality journey in services is accomplish by using significant methods in this area. One of them is Six Sigma, which has been adopted as a quality philosophy by lots of companies. Motorola Company, as its pioneer, extents own profile by inventing the Six Sigma quality improvement process.

Services can be defined as intangible activities that produce time and place. They are created and consumed simultaneously (or nearly simultaneously) [2]. Furthermore, we can define the service features as inseparability, complexity and uniqueness. Quality of services is defined as the degree of fulfilment of customer expectations by a service rendered or the disharmony between expectations and perceptions. The definition of the quality of transport services is specific and it is perceived differently by user, who is the customer, a service provider or a transport operator, but also by the whole society [3]. According to Schmenner, the services are categorized into four categories (service factory, service shop, mass service and professional service) in the service process matrix. Transport services are included in the group service factory, which fall under a low degree of interaction and customization and they also have a low degree of labour intensity, thereby the service quality is easier to manage [4].

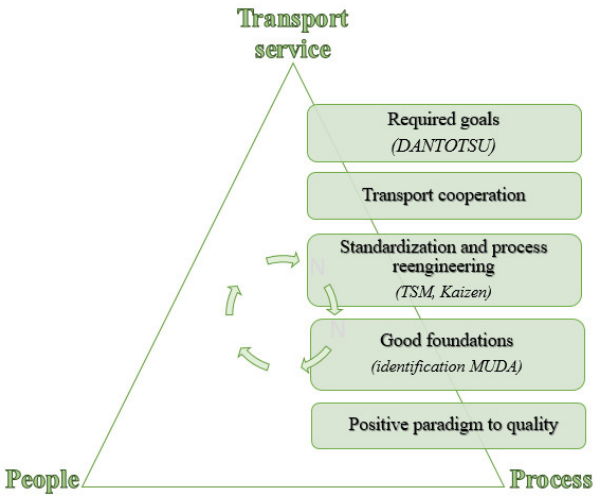

Fig. 1. Transport model TSM.

Total Service Management is such a newly adopted philosophy that helps any organization to fulfill its goals concerning innovative quality approach (Fig. 1). It is nothing but an aggregation of measuring, improving and controlling sets for any service organization. It is obviously essential to implement dynamic quality models in Total

Service Management. The main concern the service organizations have is a good understanding on what exactly the people want and how the service should be ensured [5]. Total Service Management represents a formidable challenge for service providers seeking to understand what makes their services shine in the eyes of their customers [6]. Total Service Management is a comprehensive model that represents a particular sequence of steps to be followed in order to streamline performance and improve service quality [7]. Model should be built on the good foundations (people, organizations, system), and it is important to initially define a waste (MUDA), which means work without a product or it is defined as wasted effort. It is essential to eliminate these losses and gaps in all transport areas and improve processes.

Another very important step of transport model is standardization and process reengineering. To ensure compliance with the standards and achievement positive feedback, that is needed to create it with the people concerned in this field. Interrelatedness of all carriers involved in the transport process, there are reflected synergies and thereby increasing customer satisfaction. The highlight of the whole process is to acquire the required goals, so called DANTOTSU known as the means to have an aim to be better than the one who is the best in the industry.

According to [8] dynamic models are identified by their ability to see the transport process upon the time, in the whole transportation chain, to catch various changes of customer's behavior in time and the needs, requirements and expectations.

2. Interconnection between primary and advanced Six Sigma tools

Six Sigma is a scope of techniques and tools as are primary methods, for example histogram, flowchart, Pareto charts, control charts and Ishikawa's fish bone diagram. Dynamic quality models can be considered as an advanced methods, for instance Boulding model, Stauss ans Neuhas model, Liljander and Leonard Berry model. Some of them were theoretically described in various publications. Among them the Leonard Berry model has never been applied in the field of its using in the transport sector before (Fig. 2). Hence, this research brings new view on this issue [9].

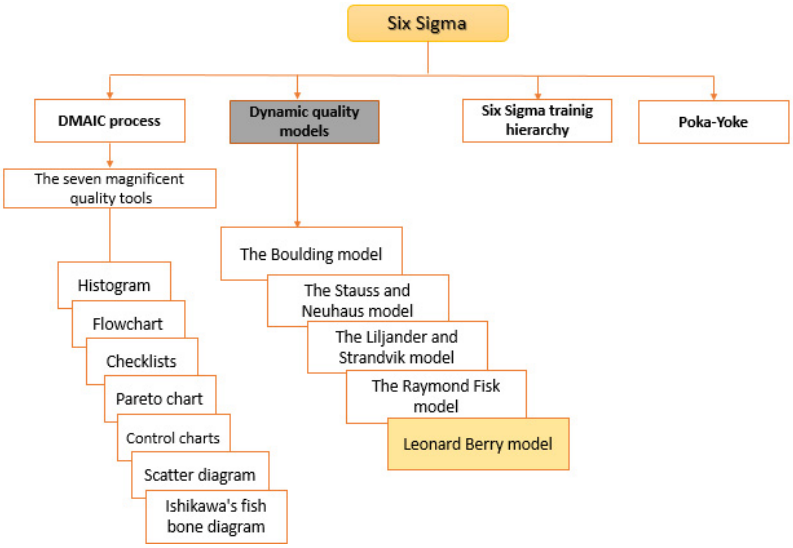

Fig. 2. Leonard Berry model/The Six Sigma toolkit.

Six Sigma is targeted on two levels of quality, potential and current quality, the difference between them is a waste. In Kaizen philosophy, the waste is specified by the word Muda, and so if we can detect Muda, it means that we have discovered a profit potential (Fig. 3) [7].

Dynamic models represent a modern trend in quality management. Models follow the procedural character of the provided services that are unique, unrepeatable and constantly changing. Therefore, their usage means one of the way how to complete successfully done quality evaluation.

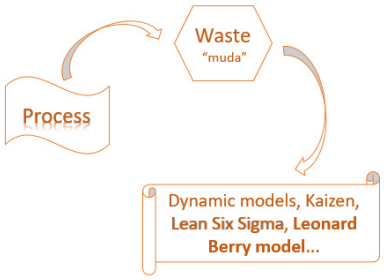

Fig. 3. The difference between potential and real quality.

3. Application of Leonard Berry model in the railway transport

Model Leonard Berry is one of dynamic models through which it is possible to measure quality of provided services in railway passenger transport.

As a part of the model it is to combine objective and subjective evaluation of quality and are rated two sets of dimensions:

1. Routine/normal dimension, which is the normal operation (customer expected the transportation as it is known).
2. Exceptional/particular dimension, which is the special operation (where is the need for a special approach to the customer, or the necessity of making additional performance e.g. of the transport service) [10].

In this model, it is necessary to make a selection of characters for normal (routine) and extraordinary (exceptional) operation (e.g. wagon, locomotive, employees and others). Then you need to find out what can be measured or select criteria for measurement (e.g. the standards – reliability, security, …) and define on which situations depends the quality of service (e.g. the internal regulations of the higher standards or customer needs).

To assess the resulting levels of quality it is necessary to combine the results of the measurement and evaluation of both types of methods. All of the above model principles must be based on clearly defined objectives to business quality as well as the expectations and needs of customers.

Using the model of Leonardo Berry in railway passenger transport is possible in both normal and exceptional operation since:

1. Model highlights the using of trained first contact employees, because only by trained employees who are able to respond properly especially during extraordinary circumstances, is possible achieving the expected quality of service,
2. Model combines the results of subjective and objective methods and through them carrier is able to assess the level of quality service more precisely that is difficult to evaluate.

When applying this model in railway passenger transport it is necessary to ensure that services provide trained employee of the first contact, the results dealing with the normal operation and special situations based on a clear business philosophy and accurate procedures for accessing customers. In extraordinary circumstances, the model highlights that the company must be prepared for these events and be able to correct (i.e. fast, efficient, factual) react.

Than normal and in the event of extraordinary dimension, resp. operation, it is essential for carriers to be clearly defined quality criteria and techniques for measuring and assessing the level of quality provided [11].

Since Leonard Berry model is linked with ordinary and extraordinary dimensions, there is a necessity to address not only passenger's opinions on the quality, but also the views of practitioners and employees of carriers and infrastructure manager.

The carrier and employees during extraordinary operation are governed by documents aimed at taking measures for preventing this circumstance and procedures for increasing security. These documents include:

1. Prescription for reporting, recording and detection of causes of accidents and extraordinary circumstances.
2. Technological procedure, provisions for train operation and procedure for extraordinary stop run over.
3. Prescription for broadcasting announcements to inform passengers.

4. The rules for railway operation.
5. The operational management of transport on the railway network.
6. Safety Management System.
7. Report on the activities of the quality services – an overview of the performance and quality standards.

When an extraordinary operation, the carrier, as well as in normal operation, establishes the criteria of service quality. Consequently, it is necessary to establish measurable criteria. The criteria that can be measured and quantified are assessed by objective methods.

In the first step of applying Leonard Berry model (Fig. 4) in an extraordinary operation, it was necessary to identify the causes of dissatisfaction of the passenger that reduce the quality of service. With reference to the survey, which is included in this publication, it was found that among the most common causes of dissatisfaction of passenger belong non-compliance with quality criteria for information and flexibility in solving extraordinary circumstances. A more detailed look at the causes of the shortcomings in these criteria can provide Ishikawa diagrams.

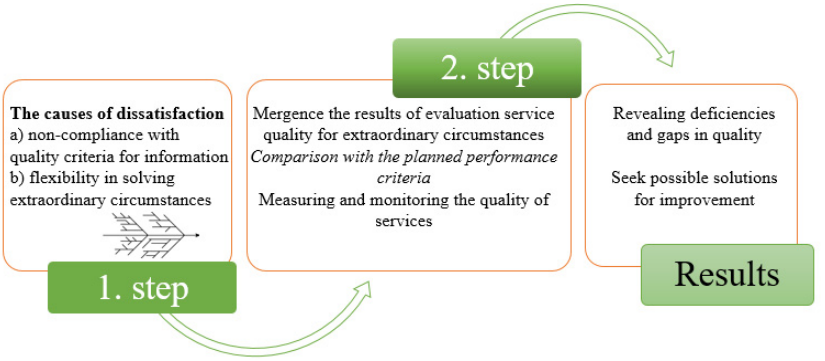

Fig. 4. Leonard Berry model in an extraordinary operation.

Another step of the model is to merge the results of evaluation service quality for extraordinary circumstances and comparison with the planned performance criteria. Measuring and monitoring the quality of service, followed by revealing deficiencies and gaps in quality during such a situation, the carrier may seek possible solutions for improvement.

4. The algorithm of dynamic models application

Application of dynamic models in the railway sector can be performed pursuant to the following steps described in the Fig. 5.

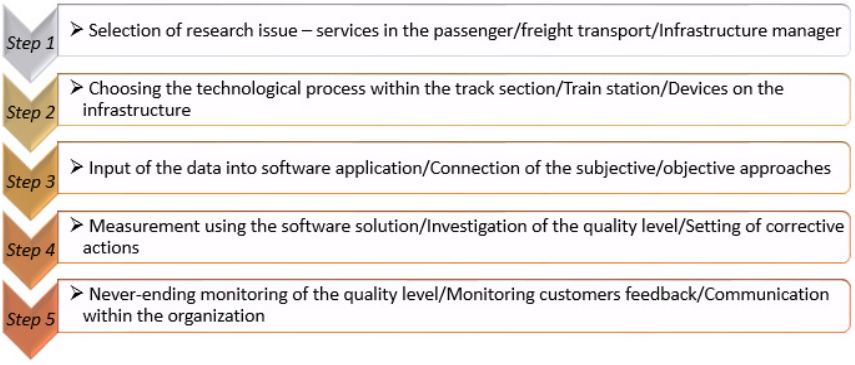

Fig. 5. Application of dynamic models.

For the individual steps in applying dynamic models, a methodology of procedures has been established – algorithms using individual methods. Compliance with these procedures may result in full implementation of the dynamic models in operation, thereby enhancing the performance and reflecting the quality that carriers actually require [10].

5. Conclusions

Quality is perceived differently by a transport user (passenger, carrier), a service provider or a transport operator, but also by the whole society. This is caused by many factors, which are typical of transport, but also because of a non-systematic approach to service quality evaluation, often with no consideration of the interaction of persons transported on passenger services or carriers of freight transport, with a transport or a delivery system [12].

Dynamics of everyday life carries changes, customer requirements and needs are different today and in the future whereupon it is essential to respond to them. The process improvement is an endless cycle, which is developing forward at the same pace as we are able to explore and develop its possibilities [13].

The requirements for quality service keep growing at present, it is therefore necessary to look for new ways of increasing quality that will meet international standards and reflect the increasing demands of customers.

The dynamic models represent an innovative method of evaluation services quality [14]. These models allow taking account a process character of provided services respecting the expected and perceived quality from the customer's perspective. Through application models in railway passenger transport can take into account the time factor and define the expected and perceived quality in every moment of the transportation process.

Among the basic advantages which bring using dynamic quality models belong mainly provisions of documents for improving the quality plan, analysis or processing [15].

Suitably chosen methodology for improving services quality and for identifying the level of quality of transportation services must meet the requirements in the environment transport market and in specific examples, for a selected stations and track sections to provide relevant results [16]. Involving Six Sigma with its tools allows in relation to dynamic models to enhance the quality of services provided in railway transport [17].

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