# INNOVATIVE METHODOLOGY FOR QUALITY AND RISK MANAGEMENT IN LOGISTICS PROCESSES OF TRANSPORT UNDERTAKINGS

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***Abstract***

The quality of service connecting risks is one of the most discussed topics of today in everyday work and social life. The main reason for the research was the necessity to look for new ways of improving quality that would meet international standards and reflect the increasing demands of customers in transport undertakings. The purpose is to highlight several possibilities of innovative approach to logistics processes quality improvement connecting risk monitoring. This paper is focused on the methodology for the integration of quality and risk management in logistics processes, which can be applied to the specific frame of the transport undertakings. This methodology is substantial because of the growing importance of sustainable development in the transport market. The research includes an advanced algorithm which has the effect of transforming the undertaking into a modern, process-controlled and dynamic organization. It is supported by the results of a questionnaire survey carried out under the conditions of rail undertakings in practical operation. The fundamental findings come from dynamic models application, such as Lynn Shostack and Leonard Berry model divided into routine and exceptional operation.

**Key words:** quality, risk, management, logistics process, transport undertaking

## 1. INTRODUCTION

Each transport undertaking tries to maximize safety, improve quality, eliminate risk and enhance reliability. The essential role of an infrastructure manager is also to permanently and safely operate the track with the required quality (Blaho et al., 2017). In recent years an economic aspect of quality is getting into the forefront on the larger scale (Šatanová & Sedliačiková, 2015). Quality of provided services is a main observable file of characters for end customer when choosing a services supplier (Pfohl et al., 2008). If the customers perceive the services as a satisfaction of their needs, there is a great precondition, that the customer will accept the offer in the future (Coronado and Antony, 2002). Inner emotional speech of customers is the manifestation on the offered service. If it is positive, is possible with a great probability assume the formation of a partnership (Chesbrough & Rosenbloom, 2002).

Therefore, in evaluating a level of quality of logistics processes, it is necessarily based on real opinions and feelings of customers (Youssef et al., 1996). Negative gaps, represented by risks, must be measured so that it will be possible reduce with remedies and compare it with the previous state (Brown, 1992). This is only possible by providing regular detection what the customer perceives, in order to satisfy its requirements (Heidari & Loucopoulos, 2014).

However, requirements on services do not come only from customers. In the area of logistics processes in transport they are influenced by European norms which contain the basic definition of quality and risk management, specified quality criteria and methods for their measurement and evaluation (Vetráková et al., 2013), (Welch, 2005). Quality and risk management is a part of undertaking management (Drucker, 1999). The task is to ensure that requirements on quality and eliminating risks of services or conducted logistics processes have been given among to main priorities of an undertaking (Chong Un Pyon et al., 2011).

Risk management is a systematic, repetitive set of interconnected activities designed to control potential risks, i.e. limit the likelihood of their occurrence or reduce their impact (Juran, 2005). According to ISO 31000, the purpose of risk management is to avoid problems or negative phenomena, to avoid crisis management and to avoid problems. As well as in other fields of business, risk management in conditions of transport undertakings consists of interconnected phases, from risk identification, risk assessment, risk management (mitigation) and risk monitoring (ISO 31000, 2016). ISO 9001: 2015 has introduced the principle of risk management. In accordance with this standard, chapter 4.4 Quality management system and its processes, the organization shall establish, implement, maintain and continually improve a quality management system, including the processes needed and their interactions. The organization shall determine the processes needed for the quality management system and their application throughout the organization and shall determine the risks and opportunities in accordance with the requirements of chapter 6.1, and plan and implement the appropriate actions to address them.

In addition to ISO norms, customer´s view on the quality and risks of the provided services represent also quality criteria established by the standard EN 13816 "Transportation, Logistics and services, Public passenger transport; Definitions, Determination of the performance goals and measuring of the quality of the service"

and downstream standard EN 15140 “Public passenger transport. Basic requirements and recommendations for systems that measure delivered service quality”. According to these standards, this research was based on criteria usability, availability, information, time, customer care, comfort, safety and environmental impact (EN 13816, 2003). The logistics principles can also be applied in rail transport and ensure the connection between offer and demand in order to provide transport services with the required quality (Vojtek et al., 2017).

This paper highlights the methodology for the integration of quality and risk management, which can be applied to the specific frame of the transport undertakings. The example of application is shown for the processes in the passenger transport, thus the effect of relocation which has an intangible nature i.e. that is consumed during the transport process (Nedeliaková et al., 2013).

During this relocation, the customers evaluate the processes and this evaluation leads to their decision of reuse or non-use passenger transport by specific transport mean. If a transport undertaking wants to keep loyal customers, it has to deal with assessment and requirements of customers and reflect these requirements directly in the operation.

## 2. DYNAMIC MODELS AS AN INNOVATIVE TREND IN MONITORING QUALITY AND RISK

Effective measurement of the quality and risk in logistics processes cannot be bound only to a particular point in time. It is necessary to ensure continuous monitoring of quality and risks throughout the whole logistics chain. During the analysis of logistics processes in rail transport it is also necessary to examine synergistic effects (Abramović et al., 2017). One of the quality criteria specified in standard EN 13816 is "convenience". This criterion, in conditions of transport undertaking, involves several items such as setting of air condition, appropriate ventilation, adequate lighting, excessive noise, and others.

From the set of dynamic models, we can mention the first one, Boulding dynamic model useful in the assessment of quality and risk factors on logistic processes. It assumes that expectations and perceptions of quality among customers change over time. This may be the cause of varying behaviour during the logistic process (Boulding & Staelin, 1993).

The model focuses on the perception of quality affected by three basic factors, the expectations of a product not used yet, ideas of the customer about the product on the basis of information provided by the provider, and the actual level of quality of the product.

The first factor is called "will be" expectations, which indicate what level of performance is considered by the customer as probable before starting a process, since the process is preceded by emerging expectations in respect of quality in relation to: "what will happen?". The process is also preceded by "has to be" expectations about the quality of process in relation to the "what should happen?" (Boulding & Staelin, 1993).

In the case of each dimension of the process, the customer can have a certain set of expectations, which corresponds to a cumulative perception of the dimensions of process quality. Thus, a comprehensive perception of process quality arises which is an incentive for further conduct of the customer. In the course of providing a service which the customer uses for the first time or repeatedly, what happens is a revision, affirmation or disproof of the expectations arising from one's own experience, but also from information about the service from other users.

The model distinguishes between the real and the potential expectations and sets a challenge for management of raising those expectations which positively affect the perceived quality of process and thus direct the customer to an activity that meets the objectives of the undertaking. Research shows that the higher the "will be" expectations are about a product or process not used yet, the more the customer appreciates the perceived quality, if the customer's notions are about what "has to be", the less will the customer appreciate the perceived quality of process. This means that the management should try to increase what "will be" and to reduce or at least maintain the "has to be" expectations.

Another dynamic model is the relationship quality model by Liljander and Strandvik. In this model, it is the customer-service relationship which is underlined. The major determinants of success in business is a positive quality and customer satisfaction, which leads to a stronger bond with the customer. Here the quality of service from an external perspective can be distinguished, which means that quality can be assessed in the event that the customer requires no performance, without it taking place. An internal perspective is based on the condition that satisfaction may arise only on the basis of some kind of contact with the customer and the provider.
This contact between the offerer and the customer may take place in the two fundamental planes, as episodes and relationships. An episode is an interaction between a customer and an offerer and represents the entire act of process creation. The relationship consists of at least two episodes, and depending on continuity and frequency, it can be created in different ways. The model employs the disconfirmation paradigm principle, hence the emergence of satisfaction or dissatisfaction through the comparison of individual expectations with experience of product use (Liljander & Strandvik, 1993)

The quality of the relationship is an essential determinant of a customer's behaviour, which is manifested through his or her bond and loyalty. The bond, also known as commitment, represents the attitude of a person towards an interaction and the intentions of actions derived therefrom. Associated with behaviour are then the bonds to the undertaking perceived by the customer which the provider may influence to a certain extent, but some of the bonds cannot be influenced by the provider.

In addition to customer relationship, one must take into account the attitudes towards the relationship on the part of the provider, which can also be identified as positive, negative or indifferent. This means that the undertaking may have different relationships with the customer too, which affects its conduct, which undertaking then transfer into practice. For undertakings, it is important to strengthen relationships with customers who bring profit, but also to deal with customers with indifferent relationships.

Especially in the conditions of freight transport, it is appropriate to take this model into account, as the transport operator encounters various carriers who require different operations, given the specificity of transported commodities, or the amount of carriage. The principle of the model is to include the right definition of relations between an undertaking and all customers, large and small. Undertakings tend to focus on the large carriers, which is natural in terms of benefits as regards income. Contracts "tailored" directly for the customer, with optional rebates, agreements on price and so on. It is important, however, to create a positive attitude to all customers.

In one episode, meaning the whole act of creating a process, it is difficult to explain the quality of a relationship using one measurement only. Transport conditions, even if they have their principles and rules laid down by national transport policy or international conventions, change every day, and entering into a contract is also influenced by the human factor, either on the part of the customer or the carrier. On the other hand, the definition of relationships in the future may affect the conduct of the first contact employees to the customer if he or she is aware of the results of the previous relationships. Thus, the dynamic nature of the model is also manifested in the fact that episodes are interrelated and affect each other.

It may, of course, be the case that a number of customers perceive the same quality of relationships, although the past of the relationships was different. In this case, it depends on at what level the relationships were present, that is to say, whether they were positive (valuable), indifferent or negative, sometimes referred to as forced.

The third dynamic model, useful for the settings of logistics processes in transport undertakings, is the Stauss and Neuhaus satisfaction model. This model denies the claim that a high degree of satisfaction leads automatically to a high customer loyalty. The underlying causes of this condition are considered the situational factors, the attractiveness of other alternatives and the diversity of customer needs, which may change over time.

Relying on the principles of this model a research study in the field of transport of carloads in rail freight transport was undertaken, approaching 42 respondents in the regions of Slovakia and Czechia, which surveyed among other things an association with a particular type of satisfied or dissatisfied customers.

A satisfied customer with growing demands is characterised by a high level of satisfaction with the logistics process, but this means that the undertaking must strive constantly to fulfil the customer's requirements.

A consistently satisfied customer is characterised by passive behaviour. Such a customer does not force the undertaking to improve performance, on the other hand, he or she never complains.

A resigned satisfied customer expresses a certain indifference in the respect of the undertaking, which may be due to lack of alternative transport.

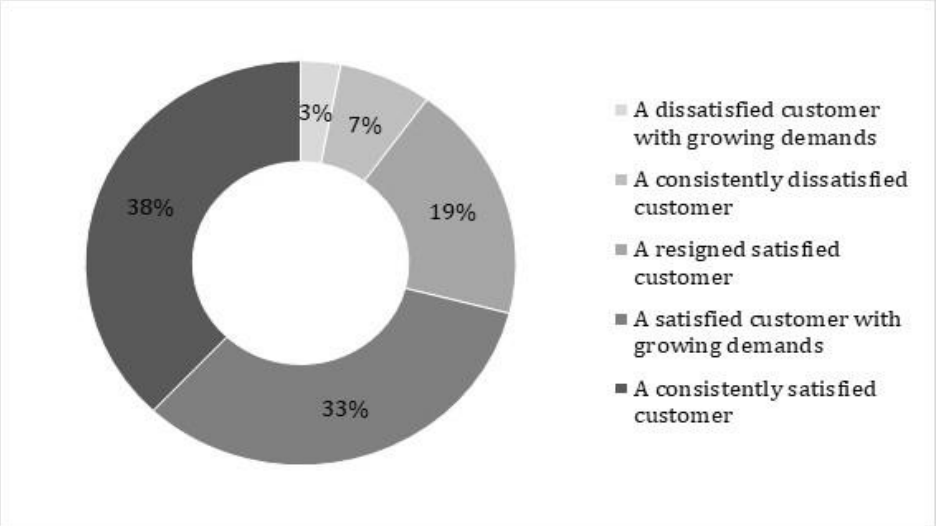
A consistently dissatisfied customer is passive too but expresses dissatisfaction with the performance of the undertaking.

A dissatisfied customer with growing demands expresses dissatisfaction and even would not choose the transport operator.

The customers' views about which group they belong to, were confronted with the views of the employees and a match was determined (where both customers and

employees identified types of customers with an overall match of 87 %). The types of customers in terms of satisfaction with service are documented in the figure 1.

**Figure 1.** The types of customers in terms of satisfaction with logistics process




Source: authors

The important thing was finding out which group of customers prevails and the link between global satisfaction and association with a type upon which a potential threat depends. Even if a customer belongs to the satisfied type, but is, so to say, satisfied with the growing demands or satisfied in a resigned way, such customer is more likely to consider changing the provider than a consistently satisfied customer who shows passive behaviour. This means that from the perspective of the provider a consistently satisfied customer type is the most advantageous one, although this statement may be relative because a customer satisfied with growing demands forces the transport operator to perform more and improve the quality of its processes.

This research is important in terms of the knowledge that it is not sufficient to assess global satisfaction or dissatisfaction only, but it is needed to find out the potential threats in the case of satisfied customers. The interest should therefore be focused on the threat to the relationship between customers and the undertaking.

A disadvantage of the original model is that customers do not assess specific characteristics of performance, and so the model does not consider setting evaluation criteria, and therefore it is questionable whether respondents assess performance against the same criteria. This gives rise to a problem because the provider obtains no particular support points from the research to indicate which parts of service performance should be modified based on the customer's expression of discontent.

This research answered the question whether it is possible to use modern ways of monitoring quality and risks in transport undertakings such as dynamic models. Models follow the procedural character of the logistics processes that are unique, unrepeatable and constantly changing (Nedeliaková et al., 2017).

Dynamic models which are shown in the article represent innovative trends in quality and risk management. Both Lynn Shostack and Berry model have been chosen for creating algorithm assessing qualitative strengths, weakness and risks.

## 2.1. The algorithm using model Shostack and Berry

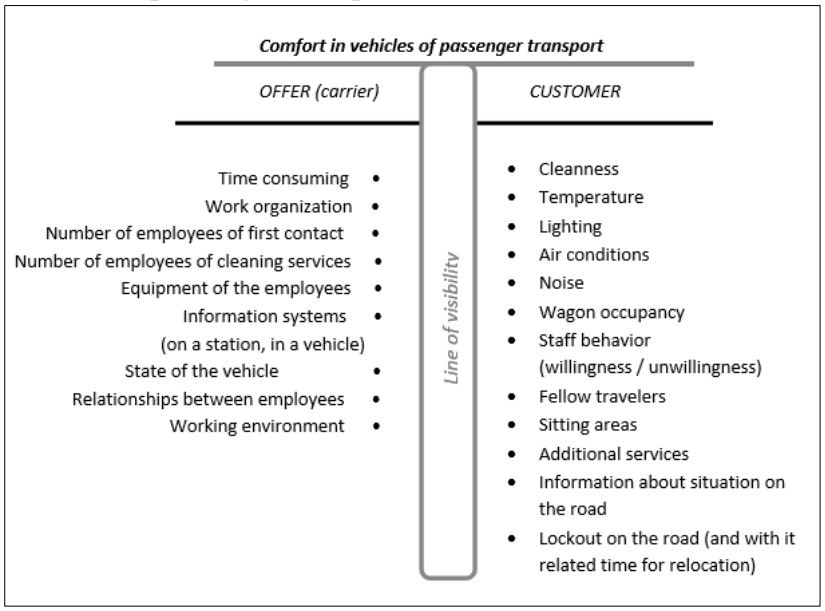
Model Lynn Shostack and Leonard Berry model represent these dynamic models which are helpful in monitoring risks and improving quality in transport undertakings.

Based on model Lynn Shostack quality criteria can be divided into the two groups by using so-called "line of visibility". The first group involves items which can be perceived by subjective senses of the customer and the second group contains items which customer can see only partially (he is not able to evaluate these kinds of items). Each of these criteria hides the possibility of risk.

This model is based on the principle of contact points and uses a method of "blueprinting". It means the determining of contact points, which represent the border, where the customer comes into contact with services respectively with the performance of the provided service (Sekulová & Nedeliak, 2013).

A customer can assess qualitative strengths and weaknesses connected with risks of provided services according to these contact points. The following figure 2 shows an example of a model Lynn Shostack for the criterion "comfort in vehicles of passenger transport as a result of a survey carried out under the conditions of twenty rail undertakings in practical operation.

**Figure 2.** Simplified figuration of the contact points for the criterion of comfort in vehicles of passenger transport




Source: authors

In Leonard Berry model is an effort to connect subjective and objective ways of quality and risk evaluation. There are rated two files of dimensions:

1. Routine dimension which represents a normal (common) operation (the customer expects that process of transportation will be the same as he knows it).
2. Exceptional dimension, which represents an extraordinary operation (in the case that it is necessary to use an unusual approach to the customer, or there is

need of incurring additional performance e.g. services after the transportation) (Nedeliaková, 2017).

In this model, it is necessary to choose a sign for normal (routine) and extraordinary (exceptional) operation (e.g. vehicle, employee). Then is necessary to choose criteria to measure (based on norms - reliability, safety ...) and define from which the quality of sign depends (from internal regulation, from norms, or according to customers´ needs).

The following figure 2 shows an example of Leonard Berry model, where the goal is to evaluate comfort in the vehicle of passenger transport and indicate the risks that can cause "discomfort".

These two models were shown only for one criterion “comfort”, as an example of an application in practice, but both of them can be used for all criteria mentioned above.

In the period September 2017 - October 2017 the research was conducted in various regions of Slovakia and Czechia. Two thousand respondents participated in this survey, and the results showed that the criterion of "comfort" is important or very important for passengers.

The task of the passengers was to assess the quality criteria through point scale, which was set from 1 to 5. A value of 1 meant that the criterion was the least important for the passenger and the value 5, the criterion was very important. In the case of the criterion "comfort" was value 4-5 the most frequently marked on the point scale (criterion was important or very important for passengers). However, only 35,5% of passengers marked that they are only moderately satisfied with the performance of this criterion.

**Figure 3.** Application of the model Leonard Berry in terms of passenger transport

QUALITY CRITERION
Comfort in the vehicle

ROUTINE DIMENSION

| *Sign* | *Evaluation criteria* | *Quality of sign depends on:* | *Risk* |
|---|---|---|---|
| Cleanness | hygiene rules | norms, customer requirements | unwillingness of personnel, time-consuming, "culture" of passengers |
| Air condition | norms | norms, customer or employees requirements | technical condition of the vehicle, year period, technical problems |
| Place to sit | number of passengers to the number of seats in the vehicle | customer requirements | rush hour, improperly assembled vehicle |
| Helpful staff | number of complaints to the squad | customer requirements, internal regulations | relationships in the workplace, motivation, occupancy, level of the training |

EXTRAORDINARY DIMENSION

| *Sign* | *Evaluation criteria* | *Quality of sign depends on:* | *Risk* |
|---|---|---|---|
| Informing passengers about delays | reliability of the information, quick availability | customer requirements, internal regulations | staff awareness, reporting equipment |
| Getting on / output SD* people in wheelchair | the time required to ensure getting on / getting off | customer requirements, internal regulations | the need of advance notification, the technical condition, helpfulness of staff |
| Replacement vehicle connection / RS** | quick availability | customer requirements, internal regulations | waiting on train connection / RS, merging of the connections |

* SD- severely disabled
** RS - replacement service

Source: authors

It is necessary to connect the results of the measurement and evaluation of both types of methods to assess the final level of quality and occurrence of risks. All given principles of model have to come out from exactly-defined quality goals of the enterprise as well as from the expectations and needs of customers (Nedeliaková, 2017).

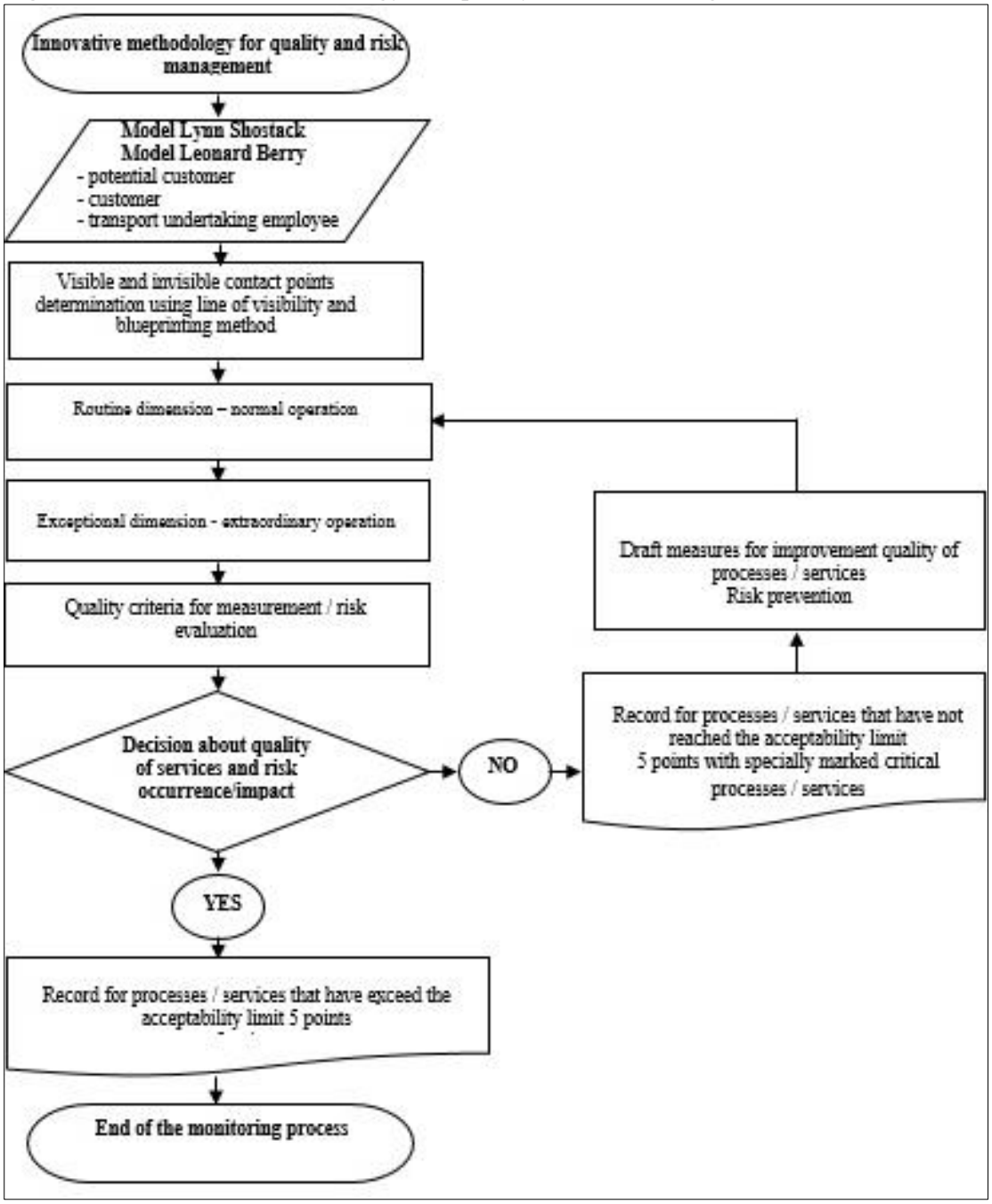
## 2.2. Results and discussion

An innovative methodology for quality and risk management uses dynamic models which can monitor the quality of processes and risks through whole transportation chain. It serves not only for current customers but also for potential customers and for employees and managers of transport undertakings. At the same time, it is necessary to focus on understanding the needs and requirements of customers and identifying quality criteria.

It is strongly important to define visible and invisible contact points in accordance with previously described model Lynn Shostack. After this step, it is obviously necessary to recognize routine operation and extraordinary operation when various incidents, accidents and gaps in providing services may occur. The research has shown that based on previous knowledge of individual dynamic models, they can be applied in the transport process environment as well. In accordance with the principles of process-oriented transport companies, it is necessary to continuously monitor the processes. The next step is to determine the performance of the process and analyse its capability, which reflects customer satisfaction with the required service. In relation to the actual performance of the process, it is decided whether it meets the customer's requirements or needs to do a risk analysis and detect its impacts. The quality criteria and risk evaluation will be realized following principles of European norms and described dynamic models.

Monitored processes and services which have not reached stated limit 5 (in this case from 1 to 10, when 5 is a critical point characterizes the limit between acceptable and not acceptable quality) need to improve, different report will be prepared for them and specific approach has to be achieved for drafting corrective action (Nedeliaková et al., 2015). These processes and services which have reached stated limit 5 will be continuously monitored and a specific report will be written for them. In the event of inaccuracies of the processes, the measures for improvement quality of processes or services are subsequently proposed. With regard to the prevention of unnecessary or foreseeable risks it is advisable to use the risk assessment techniques FMEA (Kudláč et al., 2017). The following figure 4 describes the algorithm using dynamic models.

**Figure 4.** Innovative methodology for quality and risk management




Source: authors

## 3. CONCLUSION

Based on research results, dynamic models represent an innovative method of evaluation services quality both with a connection to risk monitoring. These models allow taking into account a processed character of provided services respecting the expected and perceived quality from the customer's perspective. At the same time, they show potential risks which may occur in the field of relevant contact points stated

by models. It can be taken into account the time factor and define the expected and perceived quality in every moment of the transportation process through the application of these models in transport undertaking. Author´s previous research, based on the European norms and dynamic quality models, confirms the necessity of innovative approach to quality and risk management. The results of this research are important due to sustainable providing of transport services.

The algorithm using dynamic models listed in the contribution was applied in the terms of passenger transport. It is typical for universality, however, it can be used in any industry or organization. Models provide interesting and new perspective on service quality and show often hidden risks throughout the process of providing service. They have a character of prevention aspects.

The aim of the research was to point out the possibility of applying dynamic models in the conditions of the railway sector and creating an algorithm for the exact sequence in achieving the required quality of provided services. One of the great benefits of this innovative approach is that this unified system of quality assessment and risk monitoring is applicable to all services, industries and businesses. It is necessary in terms of strategic decisions in the practical operation of each undertaking. It can serve as a starting point for defining services whose improvement in quality is an urgent condition for keeping businesses in a competitive business environment.

## 4. ACKNOWLEDGEMENT

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