



Improving the service quality in public passenger transport by using information systems

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ABSTRACT

Modal split between individual automobile transport and public passenger transport represents a ratio to 70:30 for individual transport. Long-term trend in Slovak republic is decrease in the number of passenger using public passenger transport. One of the possible determinants of passenger demand is service quality. Information is one of the important quality criteria. Information systems in passenger transport companies and information systems for passengers can improve service quality and stimulate passenger demand. In the one way operator should identify the requirements of passengers and in the other way these requirements should be filled with the maximum possible levels. Quality criteria information and punctuality are closely related. Punctuality is important for management of the transport operations and for passenger within the meaning of information about accuracy timetable. Implementation of information systems for passengers and respect for the latest trends can increase the quality of public passenger transport services in the Slovak republic. Raise of customer satisfaction should be the goal of each company, to ensure the sustainability of demand for public transport services.

KEYWORDS: service quality, passengers, public transport, information systems, quality criteria, information, punctuality, customer satisfaction

1. Introduction

Modal split between individual automobile transport and public passenger transport represents a ratio to 70:30 for individual transport. Long-term trend in Slovak republic is decrease in the number of passenger using public passenger transport. One of the possible determinants of passenger demand is service quality. Information is one of the important quality criteria. Information systems in passenger transport companies and information systems for passengers can improve service quality and stimulate passenger demand.

2. Legislation

Law No 56/2012 collection of Laws about road transport in §21 (Service contract) in article 9 this law adds that part of this

contract are the requirements for quality standards i.e. STN EN 13816 and STN EN 15140.

STN EN 13816 – Transportation. Logistics and services. Public passenger transport. Service quality definition, targeting and measurement. This European Standard specifies the requirements to define, target and measure quality of service in public passenger transport and provides guidance for the selection of related measurement methods. The standard defines a set of eight quality criteria for public passenger transport-availability, accessibility, information, time, customer care, comfort, security, environmental impact. Each criterion standard in more detail classifies into sub-criteria. Services are determined by the quality loop.

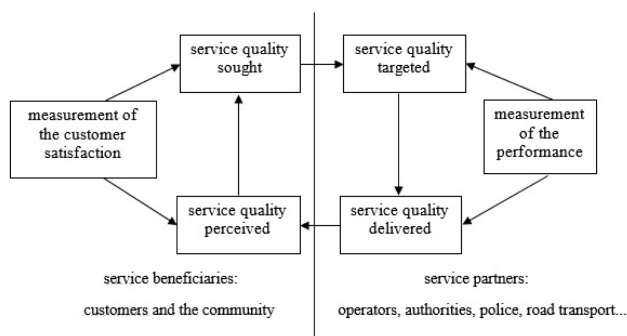


Fig. 1. The quality loop [9]

STN EN 15140 – Public passenger transport - Basic requirements and recommendations for systems that measure delivered service quality. This standard provides guidelines and recommendations for measuring the quality criteria defined by standard STN EN 13816.

Note: What we can see in other countries than in the European Union? For example in United States of America is the criterion information too. In USA are applied this transport cooperative research programs: TCRP 88 - A Guidebook for Developing a Transit Performance-Measurement System (information is called “community”), TCRP 47 - A Handbook for Measuring Customer Satisfaction (information is called “communication”) and Service Quality and TCPR 100 - Transit Capacity and Quality of Service Manual (information is called “community”).

3. Passenger quality requirements and providing of information

In the one way operator should identify the requirements of passengers and in the other way these requirements should be filled with the maximum possible levels.

Quality criteria information and punctuality are closely related. Punctuality is important for management of the transport operations and for passenger within the meaning of information about accuracy timetable.

Importance and focus on the criteria information and punctuality confirmed by the results of a survey of the passenger quality requirements by using public transport. In the months the October and November 2013 was performed the nationwide survey of passenger requirements on the quality in all modes of public passenger transport. The survey was conducted on a sample of 2,868 respondents. This survey confirmed the high importance of criteria information and punctuality, see Fig. 2. The possibility of using the information systems for improving the service quality in public passenger transport is justified.

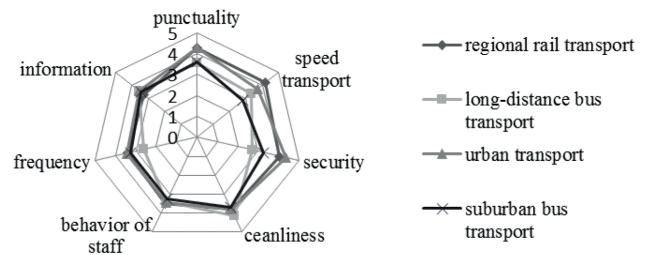


Fig. 2. Importance of selected passenger requirements (or their expectations) on the quality of public passenger transport by mode [own study]

Table 1. Values of given criteria in all public transport modes [own study]

Variation	regional rail transport		suburban bus transport		long-distance bus transport		urban transport	
	average	σ	average	σ	average	σ	average	σ
punctuality	4,28	-	3,61	0,619	3,55	0,803	4,29	0,728
information	3,29	0,595	3,45	0,578	3,55	1,045	3,53	0,664

The indicator says about the level of customer requirements which should be on the basis of their legitimacy. This specified level should respect the opinion of the majority, i.e. have to be set the mean value. In our case, it is the weighted arithmetic average. Table 1 includes a variability that is expressed of passenger requests by using standard deviation too. For determining the dispersion of individual criteria values we used the standard deviation (see the formula above). As an evaluation tool of respondents view was used the point scale with a range of 0-5 points, 0 - minimal importance, 5 - maximum importance.

The average importance of information has a range from 3.29 points in rail transport to 3.55 points in long-distance bus transport. For criterion punctuality are the values in range from 3.55 points in long-distance bus transport to 4.28 points in rail transport.

At the same time the survey of passenger requirements was conducted the passenger satisfaction survey with the implementation of selected quality criteria by the operators. The survey was carried out on a sample of 2,742 respondents. The selected parameters for which passengers considered the level of satisfaction are shown in Table 2, it also includes perception variability of the quality level expressed by standard deviation.

The average perception of compliance the quality criterion information is in the range from 2.80 points in urban transport to 3.35 points in rail transport. For criterion punctuality the values are in the range from 2.78 points in the rail transport to 3.27 points in urban transport. For determining the dispersion of individual criteria values we used the standard deviation. Based on the calculation we found the following facts. The criterion punctuality starts at 0,010 in long - distance bus transport and it ends at 0.645

in suburban bus transport. Information has the lowest deviation 0,523 in long - distance bus transport and the highest deviation 0,830 in rail transport.

Table 2. Perception the compliance of selected quality criteria by mode of transport [own study]

Variation	regional rail transport		suburban bus transport		long-distance bus transport		urban transport	
	average	σ	average	σ	average	σ	average	σ
information	3,35	0,830	2,80	0,642	2,95	0,523	3,33	0,681
punctuality	2,78	-	3,20	0,645	3,15	0,010	3,27	0,589

4. The relationship between expected and perceived service quality in public transport

Assessment of perceived quality and expected quality by passengers we can use absolute and relative indicators. Absolute indicator is for example *the Customer Satisfaction Value*. It is the absolute difference between perceived value and expected value. If it achieved positive value the operator provides a level of service that exceeds customer expectations. A negative value indicates the customer dissatisfaction. Measuring the satisfaction of a set of quality criteria usually consists of more than one criterion; this indicator should be relativized through theory of indices. This indicator:

$$CSV = \bar{x}_{QP} - \bar{x}_{EQ} \tag{1}$$

Where

\bar{x}_{QP} – is the average value of quality perception by passengers

\bar{x}_{EQ} – is the average value of expected quality by passengers

Relationship between what the customer perceives and what he expects we can express by *Customer Satisfaction Index*:

$$CSI = \frac{\bar{x}_{QP}}{\bar{x}_{EQ}} \tag{2}$$

If a value is more than 1 the level of quality perception by passenger is higher than his expectations. If a value is less than 1, there are not met the customer expectations by operator. The equation (2) is used to calculate the degree of passenger satisfaction.

Table 3. Comparison the importance of passenger requirements and their perception by the performance of operator [own study]

quality criteria	the mode of transport			
	regional rail transport	long-distance bus transport	urban transport	suburban transport
punctuality	0,65	0,89	0,76	0,89
information	1,02	0,83	0,94	0,81

Note: The grey cells represent the values where passengers have higher expectations than their actual performance by operators. White cells represent the opposite when the fulfillment of quality criteria from operators is higher than the passenger requirement.

For criterion punctuality passengers have higher expectations than the actual performance by operators. This situation is the same for all transport modes. For criterion information is the value of passenger perception higher than his expectation only in regional rail transport.

5. The possibilities of using the information systems for improving of passenger satisfaction

The survey of using information systems by operators of urban transport and suburban bus transport in Slovakia shows that in this country the operators use two information systems: Emtest and R&G Mielec. Fig. 3 shows the percentage of utilization of information systems in given transport modes.

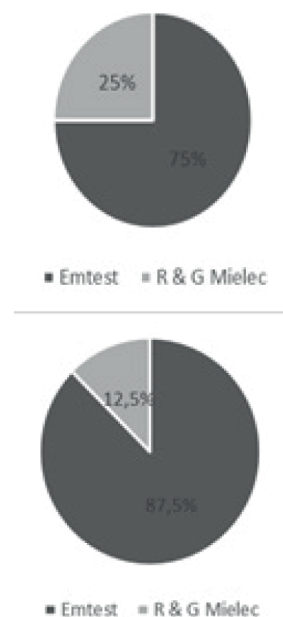


Fig. 3. The percentage of utilization of information systems in urban transport (left figure) and suburban transport (right figure), [own study]

In Table 4 we can see the features of both information systems and their comparison. To the functions of systems are assigned their corresponding quality criteria.

Table 4. Function of information systems EMtest and R&G Mielec and their corresponding quality criteria [own study]

function	quality criteria
fast and flexible passenger check	suitability, dependability, internal interface, customer orientation, innovation and initiative, customer interface, usability of passenger facilities, furniture design
smart cards	suitability, dependability, internal and external interface, customer orientation, innovation and initiative, customer interface, usability of passenger facilities, furniture design
communication with other vehicles	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, customer interface, congestion, information about alternatives available, information about road
communication with dispatching centre	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time, ticketing options
connectivity to other systems	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time, ticketing options
GPS monitoring	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, congestion, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time
online information transfer	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, congestion, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time
get on of front door	suitability, dependability, customer orientation, innovation and initiative
get on of all doors	suitability, dependability, customer orientation, innovation and initiative
stationary information system	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time
internet a mobile applications	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, information about travelling time, travel information (normal and abnormal conditions), time, ticketing options
real time passenger information	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, frequency, information about travelling time, travel information (normal and abnormal conditions), time
external board of vehicle	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, travel information (normal and abnormal conditions), time
internal board of vehicle	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, travel information (normal and abnormal conditions), time
dispatching management	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, congestion, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time
electronic cash	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, operating hours, information about travelling time, travel information (normal and abnormal conditions), time

planning and management of operation	suitability, dependability, area covered, internal and external interface, customer orientation, innovation and initiative, congestion, infrastructure, operating hours, frequency, information about travelling time, travel information (normal and abnormal conditions), time, ticketing options
elimination of errors	suitability, dependability, internal and external interface, customer orientation, innovation and initiative, infrastructure
low-floor buses	suitability, dependability, customer orientation, innovation and initiative, customer interface, useability for passenger facilities, furniture design
acoustic detectors in the vehicle	suitability, dependability, internal interface, customer orientation, innovation and initiative, customer interface, useability for passenger facilities, furniture design

Note: dark grey cells is only EMtest, grey cells is only R&G Mielec, white cells include both.

Information and electronic check-in system of passengers consists of several parts:

- Information systems of vehicle includes check-in system of passengers and internal and external information boards
- Dispatches information system for operation of vehicles and communication between centre of dispatching and drivers. This system uses online GPS monitoring of vehicles because centre of dispatching and providing of services are located in two different places. The system for GPS monitoring is used to control the operation.
- Stable information system – set of information boards that are located on individual bus stops, platforms and big transfer hubs. Their role is to inform the passengers about arrival and departure in actual time.

Information of passengers involves:

- Information in the bus stop – timetable, tariff conditions, schedule of links
- Information in web of operator - timetable, tariff conditions, schedule of links, search for connection
- Information on the vehicle – number of links, first or final bus stop
- Information from driver (in suburban and long-distance bus transport) – it relates with quality criterion behaviour of driver

Passengers in the survey put the most importance aspect of information in the bus stops, then aspect of information on the vehicle and aspect of information in web of operator.

Quality criteria information and punctuality are closely related. Punctuality is most important for management of the transport operations and for passenger within the meaning of information about accuracy timetable. Collect information about the criterion punctuality can be ensured by applying the system for online GPS monitoring of public service vehicles. Information systems EMtest and R&G Mielec have this function. The essential reason for GPS vehicle tracking is overseeing the operation of the vehicles and improving of vehicle operation. Information about planned time of departures from bus stops (according to the timetable) are confronted with actual departure time of vehicles. Then we can find deviations from timetable for individual vehicles and bus stops. The deviations of links can be selected on punctual links, delayed links, links that leave from the bus stop before their planned departure or non-exist data (see Fig. 4). If are detected the recurrent delays of links, it can be a basis for adjustment of timetables.



Fig. 4. Deviation from timetable in bus transport (8.2.2012) – quality criterion punctuality [own study]

Note: ■ punctual links, ■ delayed links, ■ early departure, ■ cancelled links, ■ non-existent data

In suburban bus transport the majority of operators in Slovak Republic use the information system EMtest. On the Fig. 5 we can see the actual position of operator's suburban buses that have the function of GPS monitoring of vehicles. In the mountainous areas of northern and northeastern Slovak is the problem with the coverage of area with GPS and GSM signals or in these areas is interrupted signal.

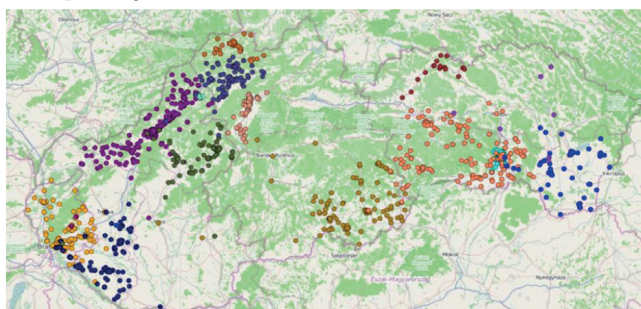


Fig. 5. Actual position of suburban buses in Slovak Republic – GPS monitoring of EMtest [own study]

Note: ■ punctual links, ■ delayed links, ■ early departure, ■ cancelled links, ■ non-existent data

6. Conclusion

In this area in Slovak Republic are differences in regional or local level. There are still operators who do not use standard applicable information sources. The level, availability and functionality of these information sources have to be controlled and evaluated by the public authorities.

Part of the passenger information systems should become step by step the internet applications and mobile applications. With the changing structure of public transport passengers begins to dominate group of pupils and students. For them are mobile and internet applications very close.

The trends in passenger information systems can include:

- Planner's routes from a source to a destination with a combination of different transport modes, including walking with support the applications Streetview.

- Information for passengers (timetables, tariff conditions, schedule of links) provided using two-dimensional QR codes with the possibility of their reading using mobile applications. Information are usually placed at the bus stops.

- Dynamic information on compliance with the timetable that are published on information boards at bus stops.

Trends in the area of GPS monitoring vehicle in public passenger transport with possibility of information the passengers:

- Monitoring of following links by operator with possibility of influence the transport process on basis of communication dispatcher - driver, guarantee of ensuring following links by operator for benefit of passenger.

- Internet applications available from passenger's mobile phone with information about of execution / non-execution the links or the bus stop was / was not served by links.

Implementation of information systems for passengers and respect the latest trends can improve the quality of public passenger transport services in the Slovak Republic. These things can also influence the decline of public passenger transport to the individual transport. The aim should be to increase of passenger satisfaction. Then the level of passenger satisfaction reaches positive values. The results of the satisfaction survey did not confirm this situation (see Table 1). These steps can also promote the sustainability of demand for public transport services. Improving of information in the Slovak Republic interpret for example planner's routers. These planners we can find on the internet. They are not dynamic but they provide lots of information about a route for passengers. One of these providers is Transport enterprise of the city of Žilina.

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