

# THE ISSUE OF MEASUREMENT THE IMPACTS OF QUALITY ON THE PERFORMANCE

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## Summary

The article will deal with examining relation and quantification of transport service quality impact in road freight transport. First of all, we need to know what the quality exactly means and then we are able to define the quality in transport field. It is important to evaluate quality characters for future of organizations and also to know how to improve their services and products and have a stable position in the transport business. The impact of transport service quality on the performance of road freight transport is necessary to quantify a level of service quality but also define and objectively evaluate the performance of road freight transport with help of an appropriate set of performance indicators and methods. For examining relation and quantification of transport service quality impact in road freight transport it is necessary to apply an appropriate method. The article includes also practical application of the method.

**Keywords:** quality, performance, impact, transport

## 1. Introduction

The performance of road freight transport may be established through Key Performance Indicators, also known as KPIs or Key Success Indicators (KSI), help an organization define and measure progress toward organizational goals. Key Performance Indicators are quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organization. They will differ depending on the organization. Performance of road freight transport.

## 2. Performance of road freight transport

Whatever Key Performance Indicators are selected, they must reflect the organization's goals, they must be key to its success, and they must be quantifiable (measurable). Key Performance Indicators usually are long-term considerations. The definition of what

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they are and how they are measured do not change often. The goals for a particular Key Performance Indicator may change as the organization's goals change, or as it gets closer to achieving a goal. [9]

The starting point for any performance improvement program should be to understand the current performance of your operation. This means collecting data on key aspects of your operation, and turning this information into specific measures that can help you to identify areas for improvement - for instance, how much it costs you to deliver products to your customers, how many miles your vehicles run empty or the number of late deliveries you make. These measures are known as key performance indicators, or KPIs. [10]

## 2.1. Transport KPIs

KPIs can show changes in performance over time. For this to happen it is essential to compare like-with-like data. It is easy to fall into the trap of comparing two drivers on different routes for time utilization or km per liter. If one route is more demanding than the other, this could be misleading. Similarly, comparing drivers when they drive vehicles of substantially different age or vehicle type can also be deceptive. There are ways you can get around these problems however, such as rotating drivers onto different vehicles and different routes and then monitoring both driver and vehicle performance, to spot consistently high and poor performers.

The frequency of monitoring is an important consideration. Weekly or monthly monitoring is recommended for many KPIs but this can depend on the measure and the needs of a particular business. If certain measures are not recorded and presented to the agreed timescales, the risk of changes in performance going unnoticed rises.

The size, type and management structure of a company is likely to influence the range and type of KPIs you might use. KPIs can be used to help managers develop strategy, plan and make decisions, while at the operational level they can show clearly the areas that need improvement, or a change in approach. [10]The transport KPIs are designed to be relevant and appropriate to small and medium – sized operations and focus on the most important aspects of vehicle operation. The transports KPIs cover six core areas:

- costs,
- operational,
- service,
- compliance,
- maintenance,
- environmental.

There were found three studies abroad that estimated KPIs in freight transport area. The KPIs were compared and made intersection of all the KPIs. The transport KPIs and their description for each area are shown in following table 1 and the results are used in chapter 3.

**Table 1: List of KPIs for six areas**

Area	KPI
Cost	Average cost per unit delivered (£)
	Average running cost (p per mile)
	Average standing cost (p per mile)
	Average driver cost (p per mile)
Operational	Total miles run ('000s)
	Total empty miles run ('000s)
	Average vehicle fill
Service	Percentage of late deliveries total
	Percentage of damages total
	Percentage of complaints total
Compliance	Total number of overloads
	Total number of vehicle traffic infringements
	Total number of drivers' hours infringements
	Total number of traffic accidents
Maintenance	Percentage of failed inspections total
	Percentage of defects rectified in 24 hours total

### 3. Quantification of service quality level

For the quantification of transport service quality it is necessary to know quality criteria. In nowadays there is not any norm which deals with service quality in the freight road transport as is the case in the urban transport which is defined in publication [2].

#### 3.1. Quality criteria

The general quality criteria and also specific criteria for each kind of goods will be proposed on the basis of norms in the urban transport.

There are many kind of good which are transported in freight road transport. Each kind requires the determination of specific quality criteria. The assumption is those kinds of goods will have some common criteria of quality. The most common criteria will be named the general criteria. They will be applicable in every type of goods. The following type of goods will be analyzed:

- dangerous goods,
- food,
- milk,

- water,
- concrete,
- animals,
- packages/ boxes,
- liquid goods,
- wood,
- oversized/ overweight goods,
- waste,
- bulk material,
- metallurgical material,
- vehicles,
- construction material.

The type of goods were estimated based on data of Police Department in Slovak republic (PPZ SR).

PPZ sent the database "number of registered trucks by type of body and vehicle category" to the date 31.12.2013. The body of vehicle said which kind of goods is transported in and the type of goods was estimated. The vehicles which are not used for transportation of goods were filtered.

Filtered vehicles by body:

- semitrailer trucks,
- trailers for tractor,
- trailers for special tractor,
- caravans,
- trailers for motorbike,
- loaders.

There is no chance to find out for which kind of transport are the semitrailer trucks used; based on this fact they were filtered. Trailers for tractor or special tractor are used mainly at farms and not for transportation; they were filtered too. The rest of vehicles cannot be used for transportation as we know it.

Filtered vehicles by category of vehicle:

- N1G,
- O1,
- O2,
- N1- pick up.

The categories O1 and O2 are used as trailers for passenger vehicles, for this reason were filtered.

Also category N1G was filtered. From the category N1 were filtered "pick ups". Those vehicles are small and can be used for transportation of goods but also for private purpose; it's really difficult say for which purpose are used.

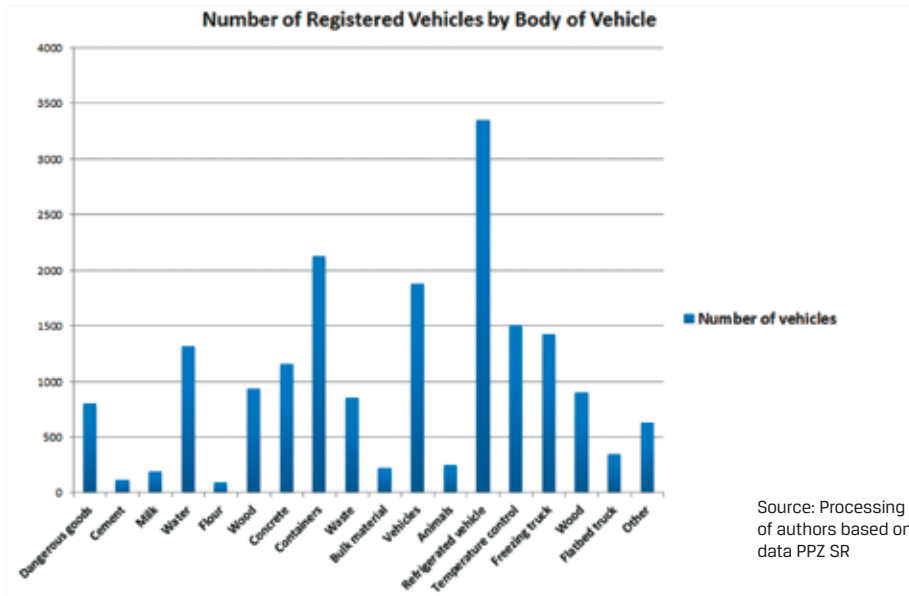


Fig. 1. Number of registered vehicles by body of vehicle to the date 31.12.2013 in Slovakia

The figure 1 shows number of specific vehicles which are used for transportation of different kind of goods. From this graph were deleted vehicles with box body and flatbed trucks. Number of those vehicles is very high compared to other vehicles and the differences between them wouldn't be much visible, if they were in one graph.

The vehicles with box body and flatbed trucks are shown in the following figure 2.

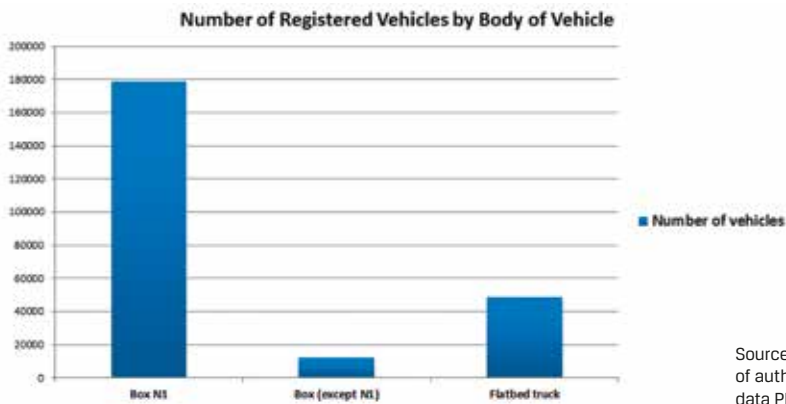


Fig. 2. Number of registered vehicles by body of vehicle to the date 31.12.2013 in Slovakia

Based on the previous research was created a questionnaire for transport, forwarding and logistics companies that is going to be distributed in Slovak republic, Czech republic, Croatia, the U.S. and Greece. The purpose of the questionnaire is to define the most transported kind of goods in freight road transport.

### 3.2. Methods of quality quantification

The quality evaluation and measurement represents a tool for objectification and quantification of quality level of provided services level. The most important economic reason for measurement and evaluation of quality is checking of the requirements for the quality of transport services.

The organization can establish its own methods of evaluation adopt or edit methods adopted by importance of selected requirements. There are two methods for measurement and evaluation of quality criteria: one-criteria and multi-criteria.

In the one - criteria evaluation of quality, the result is a quality value based on monitoring and measurement of one from the selected quality characteristics.

The advantage of this method is simplicity in monitoring only one characteristic, which was selected.

The disadvantages are:

- showing a lower meaning of quality service character,
- possibility of obtaining positive results of the evaluation also for non-compliance certain quality requirements (hidden poor quality).

The result of the multi-criteria evaluation of quality is the value based on monitoring and measurement of a group of quality characteristics which are characteristic for freight transport quality.

This method shows us more clearly characteristics of transport quality. Monitoring of criteria group allows a complex view at the transport services provided. It respects interrelationships among selected characteristics.

Each of importance weights must respect priorities of an individual criterion. The total evaluation of importance is measured based on arranged pairs, which are importance weights of the specific criterion and level of requirements fulfillment for the specific criterion. [5]

An evaluator determines weights importance of criteria, the values can be determined applying a number of methods, such as:

- **point scale:** an evaluator assigns to each criterion a score according to their relevance,
- **100 points:** an evaluator assigns 100 points to each criterion,
- **ranking method:** criterions are ranked from at least to the most important,

- **method of pairwise comparisons:** the number of preferences is determined for each criterion with regard to all other criteria,
- **Saaty method.**

### 3.3. Presumption of transport service quality

There is main management system in the freight road transport; Quality Management System (QMS) by STN EN ISO 9 000 series. This norm should be a guarantee of quality.

*Quality Management System (QMS) by STN EN ISO 9 000*

The QMS specifies the requirements for quality management system in companies. The QMS specifies the requirements for quality management system in companies which want to and need to show ability to provide products in accordance with the relevant regulations and requirements of customers. Basic requirement: implement, document and maintain the quality management system and continually improve it.

More about benefits of implementing QMS is defined in publication [3].

## 4. Examination of the QMS impact on the performance in freight road transport

For purpose of examination of QMS impact on the performance in freight road transport was created questionnaire. Objective of the survey was to determine an effect of QMS on performance indicators but also to determine the time which is necessary to see a QMS impact.

The effect of QMS was measured with Likert scale. Likert scale is able very easy way to express and measure opinion of respondents. Likert scale assumes that the strength / intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre - coded responses with the neutral point being neither agree nor disagree.

The Likert scale is used to allow the individual to express how much they agree or disagree with a particular statement. [8]

The questionnaire is divided to the following parts:

- general information about company,
- structural indicators,
- operational indicators,
- indicators of quality and service,
- economic indicators,
- indicators of effectiveness and time.

The questionnaire was sent to companies which have certificate EN ISO 9001. Based on ERRU, association of road transport operators of the Slovak Republic (ČESMAD) and European databank more than 3 000 companies of road transport was checked. The results showed that only 74 companies have QMS and only half of them have certificate EN ISO 9001.

The minimum sample was determined with help of "Sample size calculator". Where the confidence level was 95%, confidence interval was 5% and population was 74; a result of those parameters is that 62 samples are needed.

The survey was attended in total 33 organizations:

- 6 micro companies (up to 19 employees),
- 10 small companies (from 20 up to 49 employees),
- 16 medium company (from 50 up to 249 employees),
- 1 big company (more than 250 employees).

#### **4.1. Determine the time shift**

Objective of the survey was also to determine the time which is necessary to see a QMS impact.

First, it is necessary to assess if the companies have the certificate since a long time or no. The companies with a long history of the certificate are able to evaluate more properly the impact of QMS. The meaning of "impact of QMS" is evaluation, when the most significant changes happened after implementation of QMS.

The scale for determination the time which is necessary to see a QMS impact includes following time periods:

- no change,
- during implementation,
- in the 1<sup>st</sup> year,
- in the 2<sup>nd</sup> year,
- in the 3<sup>rd</sup> year,
- in the 4<sup>th</sup> – 5<sup>th</sup> year,
- after 5<sup>th</sup> year.

In the case that performance indicators were changed it happened during the 1<sup>st</sup> or the 2<sup>nd</sup> year after implementation of QMS. The indicators of effectiveness was changed sooner; during the implementation of QMS.

#### **4.2. The effect of QMS on performance indicators**

The performance indicators were measured by Likert scale. The performance indicators were measured by Likert scale that means it is needed to transfer the scale to numbers (table 2).



Table 2. The range of Likert scale

Likert scale	Value	
	From	Up to
Very significant decrease	1	1,49
Significant decrease	1,5	2,49
Slight decrease	2,5	3,49
No change	3,5	4,49
Slight increase	4,5	5,49
Significant increase	5,5	6,49
Very significant increase	6,5	7

The results of survey in road transport companies				
Number of question	Indicator	Value	Likert scale	Standard deviation
5	Number of orders	4,91	Slight increase	0,712
6	Number of customers	4,82	Slight increase	0,672
7	Number of contracts	4,82	Slight increase	0,625
8	Volume of orders	4,70	Slight increase	0,521
9	Ability to satisfy customers	4,97	Slight increase	0,577
	<b>Structural indicators</b>	<b>4,84</b>	<b>Slight increase</b>	
10	Total number of km by your fleet	4,79	Slight increase	0,591
11	Number of km per one vehicle	4,82	Slight increase	0,575
12	Transport performance (total)	4,82	Slight increase	0,575
13	Transport performance per vehicle	4,82	Slight increase	0,575
14	Percentage average vehicle fill	4,73	Slight increase	0,617
15	Percentage average time utilization	4,70	Slight increase	0,577
16	Emission CO <sub>2</sub>	4,52	Slight increase	0,557
	<b>Operational indicators</b>	<b>4,74</b>	<b>Slight increase</b>	
17	Number of damages on goods	4,73	Slight increase	0,617
18	Timeless	4,45	No change	0,656
19	Other weaknesses	4,67	Slight increase	0,636
20	Number of adverse events	4,67	Slight increase	0,586
21	Number of satisfied customers	4,58	Slight increase	0,740
22	Numbers of complaints	4,79	Slight increase	0,591
	<b>Indicators of quality and service</b>	<b>4,65</b>	<b>Slight increase</b>	

23	Costs per unit delivered	3,64	No change	0,643
24	Costs to correct deficiencies	4,42	No change	0,552
25	Costs for fees	4,42	No change	0,552
26	Price	4,27	No change	0,509
27	Profit	4,79	Slight increase	0,686
	<b>Economic indicators</b>	<b>4,31</b>	<b>No change</b>	
28	Effectiveness of management	5,21	Slight increase	0,686
29	Competitiveness	5,15	Slight increase	0,657
30	Effectiveness of marketing	5,18	Slight increase	0,869
	<b>Indicators of effectiveness</b>	<b>5,18</b>	<b>Slight increase</b>	
	<b>Average value</b>	<b>4,74</b>	<b>Slight increase</b>	

From the results is possible to see that QMS has a positive effect at companies of road transport. The QMS has the greatest effect on indicators of effectiveness and the weakest effect on economic indicators.

The fastest effect of QMS was possible to see in small companies (20 - 49 employees); the most significant effect was in structural indicators, operational indicators and indicators of effectiveness.

The medium companies (from 50 up to 249 employees) have the fastest and significant effect in indicators of quality and service and economic indicators.

The QMS didn't have any effect in the micro companies (up to 19 employees).

The QMS has the greatest effect at effectiveness of management, effectiveness of marketing and competitiveness; the weakest effect has at costs.

## 5. Conclusion

The article confirmed that there exists a time difference between implementation of QMS and the impact of QMS on performance in company. In general the impact of QMS was visible between the 1<sup>st</sup> and the 2<sup>nd</sup> year after implementation of QMS. The research also shows that the time difference is shorter in micro companies. In those companies the time difference is already in the 1st year after implementation of QMS. In small and medium companies the time difference is in 2nd year but the impact of QMS is bigger on performance indicators.

It can be said that QMS has a positive effect at road transport companies. In the example was shown which indicators are affected by QMS the most. The QMS has the greatest effect on indicators of effectiveness and the weakest effect on economic indicators.

The quality management system did not have any bad impact on the performance indicators. Based on this fact quality management system by EN ISO 9001 can be recommended to the road transport companies.

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