PERFORMANCE MEASUREMENT IN ROAD FREIGHT TRANSPORT

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Abstract

The purpose of this paper is to provide a review of the performance measurement of road freight transport. The performance measurement of road freight transport can be carried out using so-called key performance indicators (KPI). The focus of this paper is on the presentation of the limits of measurements based on weight. All this is based on the frequently applied measure, the utilisation of vehicle capacity, and illustrating with examples we analyse the factors that can exert influence on the reliability of the given measure.

Key Words: road freight transport, performance measurement, key performance indicators

Összefoglalás

A tanulmány célja, hogy áttekintést adjon a közúti fuvarozás teljesítményméréséről. A közúti fuvarozás teljesítményét úgynevezett kulcs teljesítménymutatókon keresztül végezhetjük el (key performance indicators, KPI). A tanulmány fókusza a tömegalapú mérések korlátainak bemutatása. Mindezt a leggyakrabban használt mutató, a fuvareszköz kapacitás kihasználtság alapján végezzük el, példákon keresztül elemezzük azt, hogy milyen tényezők befolyásolhatják az adott mutató megbízhatóságát.

Kulcsszavak: közúti árufuvarozás, teljesítménymérés, kulcs teljesítménymutatók

Introduction

Numerous key performance indicators are available to measure performance of road freight transport, however, the sheer abundance and diversity of choice in itself poses problems in the selection of the appropriate indicator to use for road transport companies. Official statistical surveys define the performance of road freight transport on a so-called tonne-kilometre[1] basis. In several industries, e.g. in car industry or food industry as well as in case of products with special features, weight-based measures do not provide an appropriate feedback on the given performance, considering the fact that in case of high-value-added products, weight is less relevant, measurements based on value and volume are more accurate. In their paper Punakivi-Hinkka (2006), call attention to the fact that performance measurement in freight transport based on weight or on value shows different distribution by transport mode (modal split). The analysis of the Finnish cross-border freight traffic shows that air freight transportation amounted to 13 % if distribution by transport mode was made on the basis of product value. In contrast, in the case of data acquired on the basis of weight, air freight transportation amounted to 0.1 % in Finland in 2002.

Santén (2017) called attention to following aspects. It is important to distinguish whether the performance of road freight transport is measured at national economic (macro) level or at business economic (micro) level. McKinnon (2015) discusses that at the macro level the main goal must be to improve the performance of the freight transport system. The term 'performance' can be defined in different ways, like (1) transport intensity, (2) modal split, (3) market diversity, (4) operational efficiency, (5) service quality, and (5) environmental impact.

The main purpose of this paper is to analyse measurement of road freight at the micro (business economic) level. This paper, with the help of a key indicator frequently applied for the performance measurement of road freight transport, the indicator of the utilisation of freight vehicle capacity, illustrates, with examples, the factors that can affect the application and evaluation of the given indicator. If is interpreted at the level of firms, then we have to emphasise that performance measurement is not only decisive in the case of road freight carriers, but it is also in the interest of the client who uses road freight transport services. The

[1] Tonne-kilometre means: the transport of one tonne of goods over a distance of one kilometre.

higher possible value of utilisation of road freight vehicle capacity presented in the paper is also affected by shippers since they can improve that by their own logistical activities, e.g. choosing appropriate packing (Santén, 2017).

Materials and Methods

This paper adopts a theoretical approach relying on literature, which is a synthesizing analysis of relevant sources. This is a narrative review, as the topic is evidently a research gap, so the presented results of the rare literature was prepared with the aim to give the theoretical foundations and context of the research topics and help to bring the research topics into focus. Its purpose is to reveal connections and trends, so it is also suitable to provide a foundation for primary research.

Results and Discussion

In order to determine the competitiveness of road freight transport as a service, it is indispensable to measure its performance. The evaluation of the performance of road freight transport can only be carried out if both quality and cost aspects can be measured. One way to perform measurement is to use appropriate so-called key performance indicators (KPI), and quantification methods. Wimmer (2014) notes that the choice of performance indicators is not an easy task since the decision is affected by what is being measured and, how and how frequently we carry out measurements. In addition, it should also be emphasised that the performance indicators chosen should serve corporate objectives, as well as offer explanation for corporate effectiveness, and they should be quantifiable (Simková et al. 2015). The latter approach is supported by the strategic Balanced Scorecard (BSc) developed by Kaplan-Norton, is the basis on which to assign operational indicators to strategic objectives (Kaplan-Atkinson, 2003).

The monitoring of the performance of road freight transport and the increase of its effectiveness by using key performance indicators are not a new field, there is extensive basic literature on logistics and supply chain management dealing with the subject (García-Arca et al. 2018). The purpose of this study is to present the different groupings of key indicators measuring performance in road freight transport and to highlight the context in which key

performance indicators are relevant, as well as the approaches that can affect their application and interpretation.

In order to achieve a high level of road freight transport service, McKinnon (2009), the author of numerous publications on the subject, determined five key performance indicators that he classified into three main groups on the basis of the study by Caplice-Sheffi (1994) (Table 1).

Table 1. Classification of key performance indicators in road freight transport

Type	Key performance indicator
Utilisation	Utilisation of vehicle [2] capacity Empty running, a road vehicle without cargo Time utilisation of a road vehicle
Productivity	Fuel efficiency
Effectiveness	Deviations from schedule

Source: Simplified version on the basis of McKinnon (2009), pp. 646.

In contrast to the classification of McKinnon (2009), Simková et al. (2015) identified 5 main categories:

1. Cost

2. Operational indicators

3. Service indicators

4. Safety indicators

5. Maintenance indicators

[2] Definitions of road freight vehicles can be found in Governmental Decree 261/2011. (XII. 7.)

The authors identified 16 key performance indicators within the five main categories. They emphasised that they were mainly relevant in the case of small-, and medium-sized road transport companies.

In their review of literature, García-Arca et. al. (2018) analysed 28 publications and, based on these publications, determined 12 key indicators that they classified into 3 main categories:

1. The quality of transport service

2. Cost

3. Fleet management for road vehicles

Sources mentioned above show that numerous key performance indicators are available to measure performance, however, their sheer abundance and diversity of choice in itself poses problems in the selection of the appropriate indicator to use for road transport companies.

The following is one of the most frequently applied indicators, the utilisation of road freight vehicle capacity, which appears in all the three publications (in McKinnon (2009)'s article in the category of utilisation, in the article of Simková et. al. (2015) in the operational category, and in the article of García-Arca et. al. (2018) in the category of fleet management for road vehicles). Now, by using the indicator of the utilisation of road freight vehicle capacity, we are going to highlight that the measurement of the given indicator is not easy at all, as well as the factors that can exert influence on its interpretation.

Traditionally, the utilisation of road freight vehicle capacity is calculated with respect to weight, and the frequently used indicator is the ratio of the weight of the consignment to the load capacity officially permitted. Data to determine the performance of freight transport on national economic level are also weight-based, since data related to the performance of freight transport published by the Hungarian Central Statistical Office (KSH) are expressed in terms of tonne-kilometre (www.ksh.hu (b)). Weight-based measurements, however, do not always provide appropriate information since their calculations are affected by industry sectors, types of goods and other features.

It is known that companies carry many types of goods within the framework of road freight transport. As a consequence, the goods carried have different features which affect the application of the appropriate indicator of utilisation of vehicle capacity. Freight transport activity, nevertheless, can be described by general features, such as weight, volume, value, and special features (Halászné, 1998), on the basis of which the characteristics of the consignment can be classified.

In road freight traffic, the ratio of volume to weight can be determined for every consignment: this is called 'measure/weight' by experts. Traditionally, as it has already been mentioned, the utilisation of road freight vehicle capacity is calculated with respect to weight, but it is not sure whether this calculation provides appropriate information. In case of volumetric (bulky) goods, (measuring multiple times[3]) the utilisation of capacity should be evaluated not on the basis of weight but on the basis of volume, considering that volumetric (bulky) goods occupy volume capacity and not the load capacity permitted of road freight vehicle.

The ratio of value to weight, or that of value to volume, i.e. the value density also significantly affects logistical processes. The higher the value density of a consignment is, the less dominant the freight rate is among the total logistical costs. Therefore, in the course of the transport of consignments of high value density, utilisation of capacity is a less relevant indicator. (The use of other indicators such as safety or fast delivery is recommended.)

Special features can also affect the evaluation of utilisation of road freight vehicles capacity. The carriage of dangerous goods by road may constitute a speciality of the goods. Under ADR[4], there can be regulations that – with regard to the features of the goods – do not allow full utilisation of hold / load capacity, which also affects the evaluation of the indicator of utilisation of road freight vehicles capacity. Specific features of consignments transported under temperature control are also important factors. In this case – if the goods are volumetric (bulky) – that is the appropriate indicator would be utilisation of volume, but full utilisation cannot be achieved because of technological constraints (proper air circulation), i.e. the value

[3] The extent of measure/ weight varies in different modes of transport, but measuring one time usually means that the weight of the goods is 1 tonne and the volume is a cubic meter (1t = 1 m^3); measuring multiple times means that 1 tonne of goods exceeds a cubic meter.

[4] ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road

of the indicator cannot be compared with the utilisation of freight vehicle capacity without these constraints.

When evaluating the indicator of utilisation of freight vehicles capacity, in addition to the type of goods, the type of service rendered in international road freight transport is also an important factor. Currently, two basic service types are distinguished: transport of full truck load (FTL) and less than full truck load (LTL) (Horváth – Karmazin, 2014)[5]. Providing FTL service the road carrier sells his truck's full capacity to the shipper, i.e. its utilisation is based on the customer's decision; in this case utilisation is not relevant for the carrier since freight rate for the truck's full capacity is paid. In contrast, in case of LTL service, the customer buys a part of the truck load, so it is in the interest of the service provider to make up all the consignments to be delivered at one time so that the utilisation of the freight vehicle capacity is the highest possible. In this case the service provider can affect the utilisation of capacity by choosing a best-sized vehicle that is the most economical solution for him. In addition, it is also in the interest of LTL service provider business to have the highest utilisation of capacity since in this way, he can offer relatively lower freight rates to his clients. (Horváth – Karmazin, 2014).

Conclusion

The purpose of this short review is to call attention to the fact that the evaluation of a widely-used KPI, the level of utilisation of freight vehicle capacity, is affected by several factors. As a result we only measure and evaluate those ones from among other KPIs available that are important and relevant from the point of view of company operations as well as meet the basic objectives of performance measurement, i.e. give appropriate feedback about business operations that help to reveal problems and support decisions (Wimmer, 2014).

If we would like to carry out a comprehensive evaluation of utilisation of freight vehicle capacity, then, in addition to utilisation of capacity, we also have to determine the ratio of kilometres run to empty running as well as the time utilisation of the vehicle (McKinnon, 2009). Several other factors can also affect the evaluation of the indicator. Special consignments, such as carriage of cars or live animals, require special freight vehicles that are not suitable for the carriage of other type of goods; so the ratio of empty running might be higher compared to that of road freight vehicles which are suitable for the transport of general goods. When evaluating

[5] The detailed description of service types, and their features can be found in Horváth – Karmazin (2014).

time utilisation of a freight vehicle, we also need to take into consideration the economic impact of destinations, since there is a discrepancy in case of this indicator if the main part of transportation activity is performed within the EU or the Commonwealth of Independent States.

References

Caplice, C. and Sheffi, Y. (1994), "A review and evaluation of logistics metrics", International Journal of Logistics Management, Vol. 5 No. 2, pp. 11-28

García-Arca, Jesús - Prado-Prado, J. Carlos - Fernández-González, Arturo J. (2018): "Integrating KPIsfor improving efficiency in road transport", International Journal of Physical Distribution & LogisticsManagement, Vol. 48 Issue: 9, pp. 931-951, https://doi.org/10.1108/IJPDLM-05-2017-0199

Halászné Sipos Erzsébet (1998): Logisztika – Szolgáltatások, versenyképesség, Logisztikai Fejlesztési Központ, Magyar Világ Kiadó, ISBN 963 9075 01 9

Horváth Annamária – Karmazin György (2014): Nemzetközi közúti fuvarozás és szállítmányozás, Akadémia Kiadó, ISBN 978 963 05 9573 5

Kaplan, Robert S. –Atkinson, Anthony A. (2003): Vezetői üzleti gazdaságtan, Haladó vezetői számvitel, Panem – Business Kft., ISBN 963 545 375 2

McKinnon, Alan C. (2009): Benchmarking road freight transport - Review of a government-sponsored programme, Benchmarking: An International Journal, Vol. 16 No. 5, 2009, pp. 640-656, DOI 10.1108/14635770910987850

McKinnon, Alan C. (2015). Performance measurement in freight transport. In International Transport Forum, Paris. https://www.itf-oecd.org/sites/default/files/docs/mckinnon.pdf

Punakivi, Mikko – Hinkka, Ville (2006): Selection Criteria of Transport Mode: A Case Study in Four Finnish Industry Sectors, Transport Review, 26:2, pp. 207-219

Santén, Vendela (2017): "Towards more efficient logistics: increasing load factor in a shipper's road transport", The International Journal of Logistics Management, Vol. 28 Issue: 2, pp.228-250, https:/doi.org/10.1108/IJLM-04-2015-0071

Šimková, Ivana - Konečný, Vladimír - Liščák, Štefan – Stopka, Ondrej (2015): Measuring the quality impacts on the performance in transport company, TRANSPORT PROBLEMS, Volume 10 Issue 3, pp. 113-124.

Wimmer Ágnes (2014): Teljesítménymenedzsment, in Demeter Krisztina (szerk): Termelés, szolgáltatás, logisztika – Az értékteremtés folyamatai, Complex Kiadó, ISBN 978 963 295 384 7

https://www.ksh.hu/docs/hun/xftp/gyor/sza/sza1812.pdf (a) (accessed: 12.09.2019.)

https://www.ksh.hu/docs/hun/modsz/modsz46.html (b) (accessed: 12.09.2019.)

261/2011. (XII. 7.) Kormányrendelet (Governmental Decree 261/2011. (XII. 7.))