

Krzysztof Wąsowicz

Assessment of the efficiency of municipal companies based on local collective transport

Abstract

The main objective of this article is to determine the effectiveness of enterprises providing municipal services and a model approach for processes related to the provision of local public transport services in Poland. In particular, the identification included methods of organisation and implementation of public utility tasks as well as organisational and legal forms and forms of ownership in the case of local collective transport. An attempt has been made to determine the effectiveness of enterprises providing urban transport services in cities in Poland, assessing their operational, financial, technical and social effectiveness.

The research design and methods used in this article are based on the assessment of the effectiveness of enterprises using taxonomic methods of grouping entities according to selected characteristics and efficiency measures. The use of the k-means method with the number of clusters determined on the basis of the hierarchical Ward method, in which the contribution of variables to the differentiation of clusters was determined on the basis of a one-way analysis of ANOVA variance, to obtain groups of companies with similar efficiency indicators.

The findings, based on the conducted research, present the relationship between the economic efficiency of public transport companies and their organisational and legal form as well as the type of ownership.

Recommendations from empirical studies indicate that public enterprises operating in the field of municipal services provide public utility services with a higher level of economic efficiency than other distinctive groups of carriers.

The added value is that the research methods presented in this work can be successfully applied to other sectors of the economy and other countries in order to verify the effectiveness of individual organizational, legal and ownership forms of enterprises.

Keywords: public utility services, municipal company, local collective transport, economic effectiveness, taxonomic methodology

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1. Introduction

In the set of entities that conduct business activities there is a group the proper operations

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of which are an essential condition for the proper functioning of both the national economy and individual households. They provide common services that share a constructive property, public authority entities ensure the appropriate quality and affordable prices of such services. Free access to public utility services, the volume of which undergoes constant transformations due to civilizational and economic development, is a basic condition for the appropriate existence

of an individual and for the conducting of business activity.

The theoretical aim of the article is to define the effectiveness of companies that provide utility services. The methodological process has been to elaborate on the methodology used for the research and an assessment concerning the effectiveness of companies, by distinguishing their operational, financial, and technical and social efficiency. To compare the efficiency of various structures of enterprises, taxonomic methods were proposed for group entities according to selected properties and measures of efficiency. The application character has a model consideration of the processes related to provision of services of local collective transport in Poland. In particular, identification included the methods of organisation and implementation of tasks of public utility and the organisational and legal forms and forms of ownership in the case of local collective transport. An attempt was made to determine the efficiency of enterprises that provide services of urban transportation in towns and cities in Poland. In order to compare all of the analysed enterprises in terms of efficiency, taxonomic methods were applied.

2. Local collective transport as an area of public utility

Public authorities often decide to interfere with those areas in which market mechanisms do not guarantee the appropriate (i.e. expected, from the point of view of public authority representing the citizens) allocation of common services. Public utility services should be identified through their peculiar goal, i.e. the ongoing and uninterrupted satisfaction of collective needs of the population via the provision of commonly available services characterised by the fact that public administrations are required to provide them based on the responsibility imposed by the legislative authority (Strzyczkowski, 2011, p. 333; Byjoch & Redel, 2000, p. 60; Bobińska, 2003, p. 27).

The basic, elementary feature of a public utility service is its continuity, i.e. its ongoing

and uninterrupted nature. The second feature is satisfaction of collective needs of the population. In this aspect public utility refers to common needs that are difficult to satisfy individually, at a specific level of economic development. Another feature is the common availability of provided services, which means both physical and economic availability. The specific nature of public utility services makes them hardly available or unavailable with regard to specific individual entities. To have a service qualified by public authorities as one of those the common availability of which is essential for the development of the country or to decrease the differences in the level of civilizational development of individual areas in a particular country and various social groups is of a discretionary nature. The described feature of public utility services would probably be impossible under market conditions within the range preferred by public authorities.

Local collective transport is an important type of public utility services. Human and economic activities relate to the necessity to transport people and cargo and to transfer information. Every day two million Poles move from one place to another in order to satisfy their basic needs related to going to work, school, a store, an office, a hospital or other facilities. For that purpose urbanised areas use local collective transport (the Act on Municipal Self-government, 1990), which is also referred to as urban transport. Our domestic legislature applies various names for this term, such as, *inter alia*, (Mazur, 2005, p. 38): municipal transportation, collective municipal transportation, municipal collective transport, urban transportation (the Act on Public Transport, 2010).

On the basis of the presented legal regulations and the understanding of local collective transport used in economic practice, the following synthetic definition can be proposed: local collective transport, as urban transport is public collective transport performed upon the order of the transport organiser (the competent body referred to in Regulation EC 1370/2007) only within the area of the municipality or neighbouring municipalities that has concluded an

appropriate agreement or established an association of municipalities.

The key is to define the entity responsible for the proper provision of public utility services. It is the public sector that is liable for and designates the area for the provision of public utility services, bearing in mind, on one hand, the significance of such services to society and the proper functioning of economy and, on the other hand, the economic balance. Depending on the organisational and legal form of the provision of public utility services designated on the basis of ownership of the economic infrastructure and the method for its management, the public sector designates an entity responsible for the provision of such services, having a simultaneous impact on associated revenues and costs.

In light of the conducted considerations, the term ‘enterprise’ appears, the immanent property of which is the provision of specific services defined as public utility services. Such a definition, although short and synthetic, is crucial, since in light of the development of social and economic life it rediscovers the meaning of the term of public utility enterprise. Current properties, various types of capital ownership, methods for the provision of services, and the (organisational, economic, legal, etc) environment define the modern term of enterprise that provides public utility services.

Bearing in mind the criterion of ownership, the following enterprises that provide public utility services (Strzyczkowski, 2011, p. 292) are distinguished: state enterprises, enterprises of self-government units, private enterprises, and mixed enterprises.

State enterprises include enterprises of the State Treasury, which operate under the act on state enterprises, and commercialised state enterprises transformed into single-shareholder companies of the State Treasury that base their activities on the provisions of the Commercial Companies Code (Sudoł, Godziszewski, Haffer & Staniekwičz, 2011, p. 49).

A significant group of public utility enterprises is formed by those owned by local self-governments.

These are considered as *sensu largo* municipal companies. The use of the term ‘municipal’ can result in ambiguity, since in this case it refers to ownership. Meanwhile, according to the definition of municipal goods, municipal companies can also include entities that provide such goods, regardless their type of ownership. The situation becomes even more complicated when the analysis of that term is based on the grounds of applicable law. Pursuant to Art. 14 section 1 of the Act on Municipal Economies, municipal companies in relation to which the municipal council did not decide on the choice of the organisational and legal form thereof or the privatisation thereof by 30 June 1997 shall be transformed into single-shareholder municipal companies (the Act on Municipal Economies, 1996). The result of that provision was that the common term ‘municipal companies’ is used for single-person municipality companies. Meanwhile, the category of municipal companies, as such, consists of enterprises given to municipalities due to the fact that they were not transformed into single-person municipality companies under the provisions of the Act on Municipal Economies.

According to the presented classification of public utility enterprises pursuant to the ownership criterion, one more group should be listed: private undertakings. It is commonly believed that privatisation leads to lower costs of public utility services, as well as better quality and management thereof. Meanwhile, the opponents of privatisation claim that the acquired savings are of a short-term nature while private undertakings pursue particular goals, neglecting the social dimension of the provision of public utility services, based on a proper standard and development in the long run (Sadowsy, 2010, p. 247). Although a solution to those issues is a point of interest later in this paper, it is undeniable that the performance of public utility task is in many cases reflected in private undertakings.

Private and public enterprises have defined organisational and legal forms. Apart from some state enterprises and municipal companies

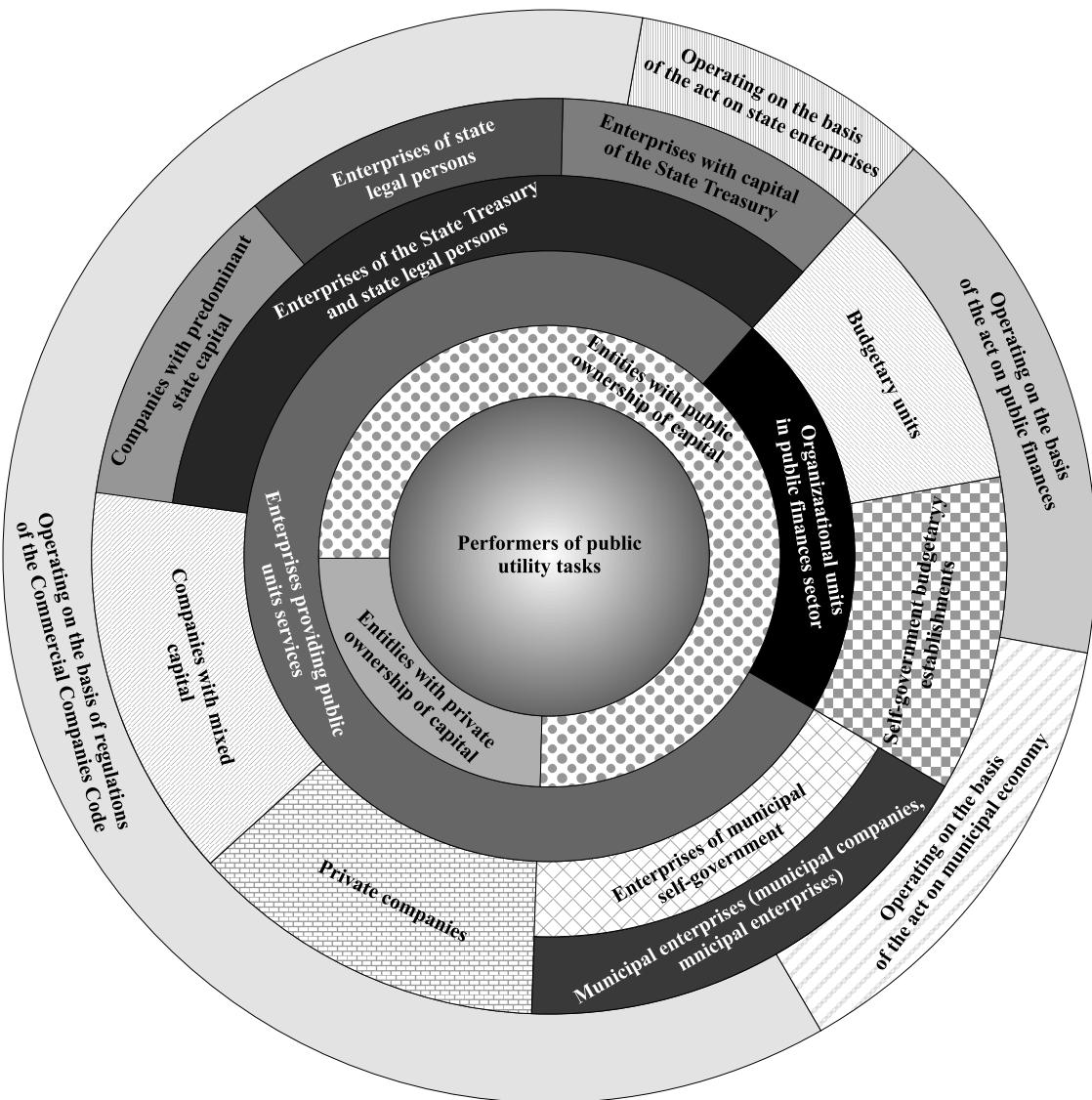


Figure 1. Enterprises in the model of the organisation of public utility services

Source: Own analysis based on: Sudoł *et al.*, 2011; Strzyczkowski, 2011; Grzymała, 2011; the Act dated 23 April 1964, the Civil Code, Polish Journal of Laws 1964, No. 16, item 93, as amended; the Act dated 25 September 1981 on State Enterprises, Polish Journal of Laws 2002, No. 112, item 981, as amended; the Act dated 8 March 1990 on Municipal Self-government, Polish Journal of Laws 2001, No. 142, item 1591, as amended; the Act dated 20 December 1996 on Municipal Economies, Polish Journal of Laws 1997, No. 9, item 43, as amended; the Act dated 15 September 2000, the Commercial Companies Code, Polish Journal of Laws 2000, No. 94, item 1307, as amended; the Act dated 27 August 2009 on Public Finances, Polish Journal of Laws 2009, No. 157, item 1240, as amended.

that operate under the Act on State Enterprises dated 1981, the activities of other entities that carry out the tasks of public utilities is regulated by commercial law. Commercial companies are divided into partnerships and share capital companies. Share capital companies in Poland include (according to the Commercial Companies Code dated 2000): limited liability companies and joint-stock companies. The form of single-shareholder limited liability companies (sp. z o.o.) and joint-stock companies (SA) are common parts of the organisation of municipal services by the public sector. The adopting of such solutions allows a peculiar commercialisation of business activity through the adopting of rules characteristic for organisations that operate according to market principles (Szewczuk, 2005, p. 487).

In the state economy there are entities similar to enterprises but, actually, are something different. Tasks with the nature of public utility in a local self-government unit can be carried out by such entities, self-government budgetary establishment that, however, do not meet the requirements necessary to be considered as enterprises.

Public utility services can be thus provided by various types of public and private enterprises as well as units of the financial sector that do have the properties of an enterprise. Consequently, a complex structure is formed, which is shown in Figure 1.

3. Methodological approach towards the efficiency of urban transport companies

An enterprise is driven by the principle of using owned resources in order to achieve possibly advantageous effects resulting from incurred expenses. The issue of efficiency is the basic field of research in many areas of economic activity. This issue also involves the aspect of the public utility of collective transport, where the provision of services is performed through entities functioning under various organisational, legal and ownership types.

The efficiency of enterprises is determined on the basis of the efficiency of their operations, which equates to the optimum utilisation of owned resources and efficiency of activities, understood as the ability to set and achieve specific goals (Frankowska & Jedliński, 2011, p. 69). It can be considered in terms of various aspects of the management process, i.e. technical, economic, social, environmental, etc. Conducted analyses concerning enterprises frequently apply the notion of enterprise effectiveness in general. That term can be understood as the actual capacity to improve market position and increase the financial results achieved. Unlike other enterprises, enterprises that provide public utility services are subject to additional liability with regard to a particular community. Therefore the notion of effectiveness of such entities involves the proficiency and efficiency of provision and selection of goals that also acknowledge the high quality of the services provided (see Figure 2).

Measures of effectiveness in the case of public utility enterprises of local collective transport are those that indicate the achievement of effects adequate to the incurred expenses, minimisation of costs, increasing productivity, and the provision of services with the expected quality, in the appropriate amount thereof. That is why this paper analysed operating, technical and social as well as financial effectiveness. Table 1 is used to synthetically present measures of the effectiveness of local collective transport enterprises functioning in city transport systems.

Operational effectiveness is explained through relationships between various forms of effects and expenses incurred to achieve them. Among the many measures of that effectiveness, productivity and labour intensity have been distinguished with the use of the measures:

That specify the amount of work performed in a local collective transport enterprise: the number of vehicle-kilometres. Exploitation work expressed in vehicle-kilometres makes an assessment of the work of a transport fleet; it shows the distance travelled by urban transportation vehicles and

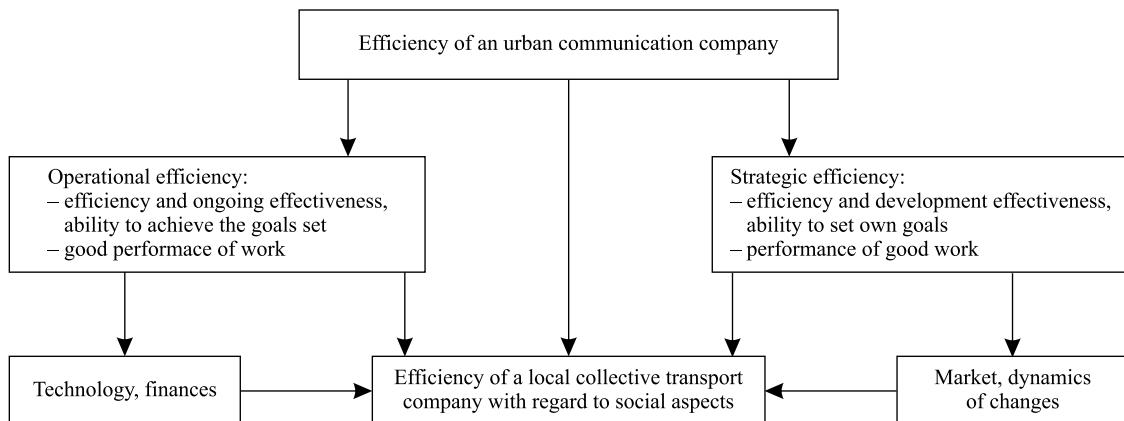


Figure 2. Efficiency in a local collective transport company

Source: Own analysis based on: Stoner, J.A.F. and Winkel, C., *Kierowanie*, PWE, Warsaw, 1992, p. 29; as cited in: Szewc-Rogalska, 2004, p. 53.

Table 1. Performance measures for a public utility enterprise in the sector of local collective transport

Performance measures for an urban transportation company		
Measures for financial performance	Measures for operational performance	Measures for technical and social performance
	– acknowledgment of the interests of the municipality as the entity responsible for provision of municipal services as public utility	– acknowledgment of the expectations of the inhabitants of the municipality as consumers of municipal services
– degree of utilisation of production capacity	– amount of exploitation work performed	– measure of time, spatial, demographic, and functional availability
– work efficiency ratios	– amount of transport work performed	marketing research concerning:
– productivity ratios	– amount of employment	– availability of the transportation network
– profitability (i.e. return on sales) ratios	– intensity ratios for fleet use	– frequency
– operational efficiency ratios	– transport efficiency ratios	– punctuality
– liquidity ratios	– labour intensity ratios	– safety
– debt ratios		– certainty of completion of planned travel (i.e. reliability)
– size of inflows on sales of public utility services		– direct character of the travel
– level of costs for operations of the enterprise		– speed
– technical and financial industry-related ratios		– cost
		– convenience
		– information

Source: Own analysis.

can also be presented as its mileage in all runs of a transportation line. Exploitation work for any transportation line can be designated as the total length of runs made by all vehicles in all runs (Bryniarski & Starowicz, 2011, p. 109):

$$P_{wzkm_i}^q = \sum_{j=1}^{m_i^q} dk_{ij}^q, \quad (1)$$

where:

$P_{wzkm_i}^q$ exploitation work of transport line i on day of the week q (vehicle-km); dk_{ij}^q – distance j of that run of transport line i on day of the week q (km); m_i^q – number of runs of transport line i on day of the week q ; q – day type (i.e. typical working day, Saturday or Sunday).

- Comparison of exploitation work expressed in vehicle-kilometres and vehicle-hours that allows the obtaining of the efficiency measures of operations conducted by an urban transportation company:

$$\begin{aligned} \text{Intensity of fleet exploitation} = \\ = \frac{\text{Number of vehicle-kilometres}}{\text{Number of vehicle-hours}}. \end{aligned} \quad (2)$$

- Efficiency within a particular area, presented as the ratio of the number of passengers transported by all transportation lines launched within the same area in terms of exploitation work, in vehicle-kilometres:

$$\begin{aligned} \text{Transport efficiency} = \\ = \frac{\text{Number of passengers}}{\text{Number of vehicle-kilometers}}. \end{aligned} \quad (3)$$

- Labour intensity, i.e. the amount of performed transport work per employee, calculated as the quotient of the number of performed vehicle-kilometres and the average employment:

$$\begin{aligned} \text{Labour intensity} = \\ = \frac{\text{Number of vehicle-kilometres}}{\text{Number of employees}}. \end{aligned} \quad (4)$$

The assessment of technical and social effectiveness of enterprises that function in various organisational, legal and ownership forms was made through the application of the demographic density ratio of the given public transport network, where such ratio determines the saturation of the area with the transport network attributable to the area per 10,000 inhabitants:

$$G_{Kd} = \frac{K}{b}, \quad (5)$$

where:

G_{Kd} – demographic density of the network of public transport (km/inhabitants); K – length of the network of public transport (km); b – number of inhabitants of a particular area.

With regard to enterprises analysed by the author on the basis of particular measures of passenger satisfaction, assessments of ten postulates from table 1 were compared in a five-level scale, where five was the highest mark. For each of the quality features, the basic measurement tool was an original questionnaire addressed to passengers of local collective transport enterprises, who assessed each of the measures of social and technical effectiveness. The assessment also applied the five-level Likert scale (Gamst, 2008, p. 10): one = very bad; two = bad; three = average; four = good; five = very good.

Availability of a transportation network is the quality determinant correlated not only with activities of the carrier but also with the activities of the organiser of local collective transport in a particular city. The postulate was assigned, apart from the average satisfaction of customers who use the given urban transport, with the assessment arising from the value of the demographic density ratio of the public transport network (5). In order to do that, five groups of those ratios were created and given marks from one to five. The lowest level of those ratios relates to enterprises for which the quotient of the distance of travelled routes per 10,000 inhabitants is lower than 1. Those with a demographic density ratio from 1 to 3 were given a mark of two, from 3 to 5 were given a mark of three, for 5 to 8 the mark was four, while a ratio higher than 8 was give the highest mark (i.e. five).

In order to determine the financial effectiveness of various types of local collective transportation companies, an analysis was made with regard to revenues, costs, financial results, equity and capital structure, as well as financial matters such as profitability, proficiency of operations, liquidity, capacity to handle debts, and the level of revenues and costs of conducted activities.

In order to compare enterprises in terms of effectiveness, taxonomic methods were applied. The method of k -means was applied to a number of clusters determined on the basis of the hierarchical Ward method in order to obtain groups of enterprises with similar effectiveness ratios.

The Ward method is one of the more important hierarchical agglomeration methods. It applies an approach based on variance analysis, the goal of which is to minimise the total of squares of two clusters that can be formed in individual stages of the analysis. Thanks to that, it is possible to calculate the effect of homogeneity inside clusters and homogeneity between clusters. The efficiency of this method has been confirmed in many analyses (Grabiński, Sokołowski, 1984, p. 63)

Among non-hierarchical methods of analysing clusters, the most well-known is the k -means method. The k -means method is an iterative procedure and it applies the division of a set of n objects into k sub-groups, whereby the number of divisions C is determined in an arbitrary or random way. The idea of the method is to minimise the total of intra-group distances calculated from centres of individual clusters Z ($i = 1, 2, \dots, k$), which can be, for instance, centroids that belong to individual groups or arithmetic means calculated from the value of features describing the objects in the sub-groups. The function of the k -means method can be presented in the following way (Bock, 2008, p. 4):

$$g_n(C, Z) = \sum_{i=1}^k \sum_{l \in C_i} \|x_l - z_i\|^2 \rightarrow \min_{C, Z} \quad (6)$$

In the first stage of iteration, the objects are moved to groups other than those, in which they are included at the time, in order to minimise

the general intra-group variance. If further shifts of the object do not improve the criterion of k -means, further objects (points) are tested in an analogous way. After the initial division, further iterations involve changes in other centres of clusters so that the value of the function of k -means method can be decreased. The criterion of the lowest total of squares can be presented as one-parameter optimisation of the matter (Bock, 2008, p. 10):

$$g_n(C) = \sum_{i=1}^k \sum_{l \in C_i} \|x_l - \bar{x}_{C_i}\|^2 \rightarrow \min_C \quad (7)$$

Application of the presented taxonomic methods enables the identification of groups of public utility companies of local collective transport with similar effectiveness ratios. Thanks to that it is possible to check whether public and private enterprises, having various organisational and legal forms, differ from each other in terms of effectiveness.

4. Taxonomic assessment of the efficiency of local collective communication

The analysis covered 77 entities of local collective transport with various organisational, legal, and ownership forms (table 2). In order to do that a selection was made in terms of carriers providing urban transportation services in 2015 in the largest cities in Poland and regarding carriers representing rare organisational and legal forms or entities that use uncommon solutions concerning the organisation and functioning of operating activities.

The group of entities presented consists of carriers who perform their transport work by using one means of transport (66 entities) and two means of transport (11 enterprises). Among carriers that use only one means of transport, 44 entities (one subway, one using trolleybuses, three railways, four using trams and using buses) were under public ownership. The remaining 22 enterprises have private owners and use only diesel vehicles for transportation. The selected self-government budgetary establishments own only bus fleets. The final entity, using more than

one means of transport, that functioned in the form of a budgetary establishment in 2011 was, however, subsequently transformed into a limited liability company. All of the enterprises presented that use more than one type of means of transport are owned by public founders. Except for one carrier (that uses buses and trolleybuses for transportation), the other 10 entities provides services of urban transportation through the use of buses and trams.

Urban transportation companies have been subjected to an analysis of clusters individually, with regard to their operational, technical and social, and financial effectiveness. Its goal is to make a distinction in terms of the listed types of effectiveness of clusters that consist of possibly the most similar carriers that provide such types of services.

In the case of grouping of the analysed enterprises in terms of similarities regarding the area of operational effectiveness, the following features/ratios were taken into consideration: the number of vehicle-kilometres; the intensity of rolling-stock exploitation; transport efficiency; and labour intensity. The applied target method for the grouping of objects was the k -means method. The method requires a previous specification of the number of clusters within which the most similar objects will be grouped. The number of clusters was determined on the basis of grouping of those elements with the hierarchical method Ward. The optimum number of clusters can be determined here

by applying the criterion of the first clear increase of agglomeration distance in the dendrogram. On the basis of that criterion, the dendrogram can be cut at the height of merge 5, which would result in 10 clearly separable clusters consisting of local collective transport enterprises that are similar in terms of operational effectiveness.

The basic descriptive characteristic – the average – was applied to characterise the clusters obtained. The results of that descriptive characteristic are presented in table 3.

On the basis of conducted analyses, one can see that:

- Cluster 2 had the highest transport efficiency, was second in terms of number of vehicle-kilometres, and third in terms of intensity of fleet exploitation; all enterprises in that group have a public owner and operate in form of limited liability companies.
- Cluster 3 had the highest labour intensity and the highest intensity of fleet exploitation; four of the five limited liability companies in that group are public entities.
- Cluster 5 had the second highest intensity of fleet exploitation; this group consists of twelve public entities (ten limited liability companies and two self-government budgetary establishments).
- Cluster 6 had the lowest transport efficiency; this cluster includes five limited liability companies (three of which are private) and two joint-stock companies, which are under public ownership.

Table 2. Number of analysed entities of local collective transport by organisational and legal and ownership form

Organizational and legal form	Form of ownership	Public	Private	TOTAL
Limited liability companies		47	20	67
Joint-stock companies		4	2	6
Self-government budgetary establishments		4	–	4
TOTAL		55	22	77

Source: Own analysis.

- Cluster 7 had the highest number of vehicle-kilometres, it was second in terms of value and labour intensity and it was also second in terms of value and transport efficiency; this group only includes public enterprises that operate as capital companies.
- Cluster 8 was ninth in terms of value, labour intensity, transport efficiency, and intensity of fleet exploitation; this group includes four private carriers (two joint stock companies and two limited liability companies) and a company with a private minority shareholder.
- Cluster 9 had the lowest number of vehicle-kilometres; most of the companies in this group are private limited liability companies.
- Cluster 10 had the lowest number of vehicle-kilometres and the lowest labour intensity; in this cluster there are six limited liability companies (four public and two private).

The analysis concerning the operational effectiveness indicates a predominance of public

carriers. With regard to clusters that are characterised by high values of individual features of operational effectiveness the dominant role is played by public enterprises. Limited liability companies dominated groups of clusters that feature the highest values of individual properties. However, due to the number of limited liability companies in the analysed group, they can be found, along with companies of other forms, in groups with low intra-group average values.

When grouping enterprises that provide urban collective transport services in terms of similarity regarding technical and social effectiveness, the following features, values of which were obtained on the basis of the questionnaire conducted among passengers, were taken into consideration: availability of the transportation network; frequency of routes; travel safety; direct nature of travel; certainty of completion of planned travel; speed; cost; convenience; and information. The *k*-means method was applied, while the number of clusters

Table 3. Intra-group average values for clusters formed as a result of grouping by operational effectiveness of urban transportation companies in 2015

Cluster no.	Features			
	Labour intensity	Transport efficiency	Intensity of fleet exploitation	No. of vehicle-kilometres [in thousands of vehicle-kilometres]
Cluster 1	16.31	4.07	15.31	18261.67
Cluster 2	15.84	5.63	17.71	35115.80
Cluster 3	23.47	3.39	18.44	12959.80
Cluster 4	18.75	3.93	15.88	7405.08
Cluster 5	16.52	3.79	18.22	4590.83
Cluster 6	17.06	3.23	16.14	3012.43
Cluster 7	20.12	4.50	14.91	63337.00
Cluster 8	14.24	3.32	15.92	1592.33
Cluster 9	15.46	3.33	16.22	996.20
Cluster 10	11.10	3.33	17.58	546.17

Source: Own analysis.

was determined on the basis of the hierarchical method Ward. Based on the criterion of the first clear increase of agglomeration distance, the dendrogram was cut at the height of merge 8, which enabled the distinguishing of seven clusters of urban carriers consisting of enterprises that provide services of urban transportation that are similar to each other in terms of technical and social effectiveness. The results of the characteristics analysis for selected clusters are presented in table 4.

On the basis of conducted analyses it can be seen that the following clusters are distinguished from the rest due to, according to passengers of urban transportation, the following.

- Cluster 1 had the second lowest marks for the following factors of traveling by urban transportation companies: frequency of routes, safety and convenience of travel. This group includes eleven limited liability companies (six public and five private) and one private joint-stock company.

- Cluster 2 had the second highest (in terms of value) marks for the following factors: frequency of routes, direct nature of travel, speed, cost, and information. This group is formed by only ten public enterprises, all functioning in form of limited liability companies.
- Cluster 3 had the lowest availability of transportation and the second (in terms of value) marks for certainty of completion of planned travel, speed, and information. This cluster consists of twelve private enterprises (including one joint-stock company) and seven public companies (six of which are limited liability companies).
- Cluster 4 had the highest mark for frequency of routes and the second highest (in terms of value) marks for the following: punctuality of routes; travel safety; certainty of completion of planned travel; and convenience. This group consists of seven public entities (six

Table 4. Intra-group average values for clusters formed as a result of grouping by technical and social effectiveness of local collective transport enterprises

Feature	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
Availability of the transportation network	2.819	3.781	2.009	2.644	2.376	4.172	4.306
Frequency of routes	3.254	3.646	3.398	3.846	3.558	3.199	3.532
Punctuality of routes	3.511	3.750	3.554	3.864	4.022	3.321	3.640
Travel safety	3.407	3.592	3.514	3.693	3.938	3.257	3.531
Direct nature of travel	3.531	3.633	3.494	3.660	3.428	3.294	3.814
Certainty of completion of planned travel	3.998	4.204	3.906	4.257	4.310	3.796	4.233
Speed	3.637	3.855	3.574	3.826	4.114	3.572	3.845
Cost	3.345	3.526	3.348	3.426	3.684	3.083	3.316
Convenience	3.377	3.608	3.406	3.617	3.732	3.315	3.553
Information	3.487	3.728	3.344	3.680	4.028	3.407	3.726

Source: Own analysis.

limited liability companies and one joint-stock company) and two private limited liability companies.

- Cluster 5 had the highest marks for: punctuality of routes; certainty of completion of planned travel; travel safety; speed; cost; convenience; and information. It also had the second lowest (in terms of value) mark for availability of transportation network. In this group there are five public enterprises (all limited liability companies).
- Cluster 6 had the second highest mark (in terms of value) for availability of transportation network. It also had the second lowest (in terms of value) mark for information and the lowest marks for all other factors. This group is made up of public entities (four self-government budgetary establishments, eight limited liability companies and one joint-stock company).
- Cluster 7 had the highest for the following: availability of transportation network and direct nature of travel. It also had the second lowest (in terms of value) mark for cost. This group mainly consists of public enterprises that operate in the form of commercial law companies.

The intra-group average values for clusters formed as a result of grouping by technical and social effectiveness indicate the advantage of public enterprises over private enterprises. In the case of clusters with the highest average values of qualitative features of local collective transport, public carriers play a significant role. In the case of grouping of the enterprises by similarity within that aspect, limited liability companies dominated groups of clusters with the highest but also the lowest marks for individual features. Other organisational and legal forms are in the group of clusters with low average values for individual qualitative features.

By combining enterprises providing urban collective transport services into groups similar in terms of financial efficiency, the focus was put on the following features: gross profitability of operations of the enterprises; profitability

of sales; profitability of assets; profitability of equity; profitability of employment; the cycle of collection of payments; the cycle of payment of liabilities; asset turnover; current financial liquidity; debt ratio; share of capital in financing of assets; amount of sales per passenger; and cost of performance of one vehicle-kilometre. As in the previous case, the *k*-means method was applied while the number of clusters was determined on the basis of the hierarchical Ward method. Based on the criterion of the first clear increase of agglomeration distance, the dendrogram was cut at the height of merge 9, which allowed the distinguishing of eight clusters of urban carriers consisting of enterprises that provide services of urban transportation that are similar to each other in terms of financial effectiveness. The values of the average for the formed clusters are presented in table 5.

It can be seen that the following clusters are distinguish from the rest due to the following:

- Cluster 1 had the second highest results in terms of gross profitability ratio of operations, profitability of assets, profitability of sales, profitability of equity, profitability of employment, as well as cycle for payment collection. This cluster includes seven limited liability companies (five public and two private enterprises).
- Cluster 2 had the second lowest results in terms of profitability ratios for assets and equity, and the lowest results for the gross profitability ratio regarding operations of enterprises, profitability of sales and employment, cycle for payment collection, ratio of asset turnover, current financial liquidity, amount of sales per passenger and cost of performance of one vehicle-kilometre. This is a one-element group: a private carrier that conducts business activities in form of a limited liability company.
- Cluster 3 had with the highest results in terms of gross profitability ratios regarding operations of enterprises, profitability of sales, assets, equity and employment, as well as the second highest results in terms of costs of performance

Table 5. Intra-group average values for clusters formed as a result of grouping by financial effectiveness of urban communication companies in 2015

Feature	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8
Gross profitability of enterprise operations [%]	5.231	-70.100	5.806	-2.520	-11.745	1.276	-1.385	1.689
Profitability of sales [%]	4.928	-73.380	4.950	-3.230	-19.760	1.079	-2.477	1.131
Profitability of assets [%]	2.354	-3.410	4.558	-0.810	-32.865	1.496	-0.320	1.850
Profitability of equity [%]	7.565	-18.600	15.082	-6.210	-347.210	4.810	0.672	3.550
Profitability of employment [%]	9.228	-24.950	11.555	-4.170	-7.140	1.980	8.720	2.545
Cycle for payment collection [in days]	56.248	8.410	43.194	62.330	21.960	23.146	80.345	18.913
Cycle for payment of liabilities [in days]	189.617	2210.700	106.997	634.530	173.335	66.093	64.527	39.570
Assets turnover	0.600	0.050	1.154	0.250	2.555	1.561	0.812	1.340
Current financial liquidity	1.132	0.010	0.999	0.250	0.555	1.170	2.145	2.492
Debt ratio [%]	72.717	81.670	69.844	86.890	90.465	66.742	32.135	27.710
Share of capital in financing of assets	0.272	0.180	0.315	0.130	0.095	0.332	0.680	0.706
Cost of performance of vehicle-kilometre	9.251	3.750	10.933	6.580	4.620	8.110	25.000	9.970
Size of sales per passenger	2.234	0.630	2.726	1.550	0.790	2.205	7.105	2.604

Source: Own analysis

of one vehicle-kilometre and the amount of sales per passenger. This group consists of nine public enterprises (seven limited liability companies and two joint-stock companies) and six private enterprises (five limited liability companies and one joint-stock company).

- Cluster 4 had the second highest results in terms of cycle of payment of liabilities and debt ratios, as well as had the second lowest results in terms of ratios of assets turnover, current financial liquidity, and ratio of capital share in financing of assets. This cluster includes

a limited liability company that is under public ownership.

- Cluster 5 had the highest results in terms of ratio of assets turnover and debt ratio, as well as the lowest results for ratio of assets profitability, ratio of equity profitability, share in capital for financing of assets, as well as with low (penultimate) gross profitability ratio of operations of enterprises, profitability ratio of sales, employment and the size of sales per passenger, and costs of performance of one vehicle-kilometre. The group is composed

of two limited liability companies: one from each analysed forms of ownership – although Chełmskie Linie Autobusowe, in addition to its public majority shareholder, has a private minority shareholder.

- Cluster 6 had the second highest results in terms of ratio of assets turnover. In this group there are ten public enterprises (one joint-stock company and nine limited liability companies) and three private enterprises (functioning as limited liability companies).
- Cluster 7 had the highest results in terms of: the cycle of payment collection, amount of sales per passenger and cost of performance of one vehicle-kilometre, and had the second highest ratios regarding the share of capital in financing of assets and current liquidity. It also had the second lowest results in terms of debt ratio and cycle of payment of liabilities. This cluster includes four limited liability companies (two private and two public).
- Cluster 8 had the highest ratios of current financial liquidity and share of capital in financing of assets, as well as the second lowest results in terms of cycle of payment collection, payment of liabilities, and debt ratio. This large group consists of twenty-one public carriers (four self-government budgetary establishments and seventeen limited liability companies) and two private limited liability companies.

As a result of grouping regarding the analysed enterprises according to financial effectiveness, it is difficult to indicate an advantage for any one group of entities. Limited liability companies belong to groups that feature high and low results for individual features.

5. Conclusion

In most cases, the distinguished measures of operational and technical and social efficiency indicate the advantage of public enterprises that operate in form of limited liability companies. In terms of financial efficiency it is difficult to pick

out one group of enterprises. It should also be noted that there is a large variation in efficiency between individual companies from the same groups (in terms of ownership and organisational and legal form). This may be explained by the organisational solutions inside a given enterprise, but also by the environment the functioning of which results from the organisation and handling of the market of local collective transport services. Many municipal enterprises in Poland use their leading position on the local market of passenger transport and the public nature of the origins of ownership capital. That can be connected with a set of behaviour that limits efficient operations in the aspect of own organisational and legal self-reliance. This has been confirmed by the fact that some of the applied efficiency ratios with regard to self-government budgetary establishment have higher results than in case of commercial code companies.

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