

## Article

# The Relationship between Efficiency and Quality of Municipally Owned Corporations: Evidence from Local Public Transport and Waste Management in Poland

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**Abstract:** Sustainable development requires the intervention of public authorities in areas where market mechanisms do not guarantee the proper allocation of goods. Some of these goods include public services such as local collective transport and municipal waste management. In many countries, the process of remunicipalizing these service provisions is underway and, in the modern model used in providing these services, municipally owned corporations (MOCs) play a special role. The specific nature of these companies (i.e., the duality of their objectives and that they are required to run classic economic calculations while they are assessed in terms of the quality of their services) encouraged the authors to formulate the primary goal of the study, which was to assess the link between the financial and operational efficiency of MOCs and the quality of their services. The present study's authors developed a method for measuring the financial and operational efficiency of MOCs. In addition, a set of standards for assessing the quality of public service provision were defined, and opinion surveys were carried out to evaluate them. Subsequently, multi-criteria rankings of the efficiency and quality of services of the MOCs tested were drawn up using a synthetic variable based on the zero unitarization method (ZUM). A correlation of the analyzed variables was examined (Spearman's rank correlation coefficient) and simple line regression models were built. Our research showed that analyses of MOCs, when limited to their financial and operational aspects, are incomplete. According to the empirical analysis carried out, the financial and operational efficiency of MOCs does not translate to the quality of their services. Therefore, we believe that, in assessing the activities of MOCs, it is necessary to take into account criteria that measure the quality of meeting the needs of the local community in addition to financial criteria.

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## 1. Introduction

In today's urbanized world, sustainable socioeconomic development requires the involvement of public authorities in areas where market mechanisms do not guarantee the proper allocation of specific goods and services. Public services are a special type of service. These services should be identified by their specific objectives of an ongoing and uninterrupted meeting of the collective needs of the population through the provision of publicly available services, which are characterized by the state placing responsibility for their provision on public authorities [1,2]. Among public utility services, a special position is held by services provided at the local level, i.e., those for which local authorities are responsible. They may carry out the tasks imposed on them directly, through local bureaucracy, or by outsourcing them to other entities [3,4].

With the development and popularization of market concepts in the early 1980s, a strong trend emerged towards privatizing the provision of public services, resulting in many tasks being outsourced to private entities [5]. Since the beginning of the 21st century, however, the privatization trend has reversed and many countries have experienced a process of remunicipalization of local public service provision [6–8]. In today's model of providing these services, municipally owned corporations (MOCs) play a particular role. They are defined as “autonomous organizations owned by municipalities, used to produce or deliver local public services outside the local bureaucracy” [9]. The increasing importance and specific nature of these entities have led to increasing discussions in recent literature about how they function and operate [9–16].

In addition to their organizational and legal form, ownership structure, and the nature of the services provided, the specificity of MOCs is manifested in the duality of the objectives set before them. On the one hand, as economic entities operating in the form of commercial legal companies, they are required to include classic economic calculations (i.e., the pursuit of efficiency) in their activities. On the other hand, the specificity of the services they provide means that they are assessed in terms of the quality of those services. The quality requirements for local public services are placed by their consumers (i.e., residents) and enforced by local authorities chosen by those residents. Therefore, the correct assessment of the functioning of these MOCs should include both the efficiency criteria typical of market players and the qualitative criteria required of public services.

The relationship between economic efficiency and quality of services in typical enterprises has been widely discussed in the literature [17–21]. Findings formulated in these publications have indicated that, in order to pursue financial stability and profits, entities need to improve their performances, particularly in terms of quality. In the case of MOCs, however, this issue has thus far been underrepresented in the literature. To date, performance analyses of MOCs have been undertaken in only a few studies. Furthermore, these studies focused mainly on only one of the discussed aspects [9,14,22–26].

In view of the above, the following question was formulated as a basis for the research issues undertaken in the study:

- Does the financial and operational efficiency of municipal enterprises translate into the quality of the services they provide in the eyes of citizens?

In relation to this specific research problem, the main research hypothesis to be verified in this research project was formulated as follows:

- H0: the financial and operational efficiency of municipal enterprises is associated with the quality of their services.

Following the research hypothesis, the objectives of the study were formulated. Theoretical objectives included defining the characteristics of MOCs, determining how their financial and operational efficiency was measured, and the quality characteristics of services provided by those entities. The methodological objective was to develop a methodology for determining the financial and operational efficiency of MOCs and testing and evaluate the quality of their provision of public services. The primary research objective, on the other hand, was to assess the link between the financial and operational efficiency of municipal undertakings and the quality of their services.

Among the different types of local public services analyzed in the subject literature, the study examined, in detail, local public transport services and municipal waste management. First, we developed a method for measuring the financial and operational effectiveness of MOCs. Our method used measures common in financial analysis but proposed original indicators. The values of each measure were calculated on the basis of data published in public databases and information obtained from the analyzed MOCs. A set of 10 standards was then defined for assessing the quality of public services. An opinion survey was carried out on these standards among the inhabitants of the eleven largest cities in Poland. In the analytical phase of the study, in order to compare the financial and operational efficiency and quality of the services provided by the audited enterprises, multi-criteria rankings of the effectiveness and quality of the services provided by the audited

enterprises were created using a synthetic variable, the design of which was based on zero unitarization. Additionally, the correlation of the analyzed variables (Spearman rank correlation coefficient) was examined, and simple linear regression models were constructed.

The contribution of this study to theoretical discussions on the functioning of MOCs is to present the dissonance between their objectives as market players and the public interest prevailing in the delivery of public utility services. The study also sheds new light on how MOCs define and test financial and operational efficiency. The authors also present a new approach to the quality of public services, highlighting their reliability, social satisfaction, and impact on sustainable development. Empirically, the study presents the results of applying an original research model for MOCs performance synergies by using taxonomic methods to rank entities by selected characteristics and measures. Unlike most local public services studies, this study does not focus solely on a single industry but covers local public transport and municipal waste management.

## 2. Literature Review—Providing Local Public Services and Municipally Owned Corporations

### 2.1. Local Collective Transport and Municipal Waste Management as Local Public Services

The provision of public services is one of the main tasks of public administration. In general, public services are services designed to serve all members of a given community. Public services generally have the characteristics of typical public goods, common goods, club goods, or merit goods. Terminology discussions on how to define these types of goods in the context of public goods have already been the subject of theories in the early publications discussing public sector economics [27–31]. This issue is also present in many of the fundamental contemporary studies [1,32–34]. Thus, without adopting strict definitions of the concept of public goods and services, it is accepted that the majority of public services are services which, according to accepted social standards, are insufficiently provided by the market.

In the traditional core literature on the topic, public services include services that are provided by different public administrations within the welfare state. However, as a result of the development of the new public management concept, in many countries today, the state is no longer regarded as the only provider of public services [35–37]. It is accepted that authorities may provide such services both directly (within the public sector) and through private sector entities, non-government organizations (NGOs), or third-sector institutions, as well as in the form of public–private partnerships. As a result, the term “public services” is becoming increasingly ambiguous.

In this context, the contemporary understanding of the idea of public services seems to be accurately reflected by the European Commission’s approach [38], in which those services are referred to as services of general interest (SGIs). According to the Commission, SGIs are services, “which the public authorities of the EU Member States classify as services serving the general good and which are therefore subject to specific public service obligations” [38]. According to the Commission, these services support the European social system and social market economy model. SGIs are an essential aspect of promoting economic, social, and territorial cohesion and the development of a sustainable European Union. The main objective of providing these services is to protect citizens from harmful social consequences by seeking to guarantee universal access to basic goods and services and fundamental rights.

In this context, the European Commission distinguishes three categories of SGIs: (1) services of general economic interest (essential services provided on a fee basis); (2) non-economic services (provided for free); (3) social services of general interest, which meet the needs of citizens from the most vulnerable groups and are based on the principle of solidarity and equal access. The considerations presented in this study focus mainly on

the first of these categories, i.e., areas such as water and energy supply, waste water disposal, waste management, public transport, health, social services, telecommunication services, culture, radio, and television.

In the literature, SGIs are also referred to as key services, basic public services, or essential services [39]. In addition, some authors use the term “public services” when referring to the concept behind SGIs, which are defined as services to which all citizens have “equal rights to access and to enjoy” [40]. In order to avoid ambiguity and problems of interpretation, the concept of “public services” will also be used later in this article in the sense defined above.

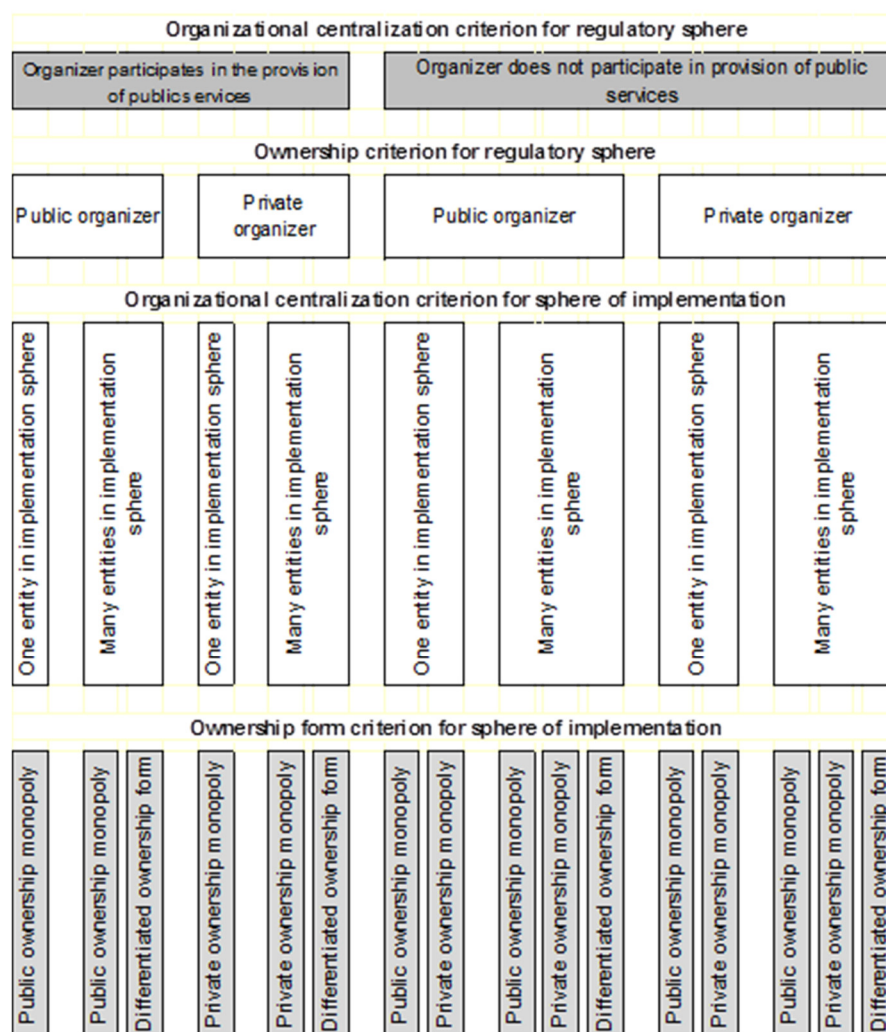
The organization of the public service system is the responsibility of the public administration. Depending on the nature of the service, this responsibility may lie with central administration (e.g., social security systems), government agencies (e.g., emergency services), or local government units (e.g., waste management). In this study, we addressed public services provided at the local level, which we further defined as “local public services”. Among the different types of such services, we examined, in detail, local public transport and municipal waste management services.

Much of local public transport is due to the nature of modern human and economic activities, which are associated with the need to move between locations. People move to meet their basic needs related to traveling to work, school, shop, office, hospital, etc. Local collective transport can be used in urban areas for this purpose. Public transport allows citizens of a given city to move effectively from one place to another. It has a direct impact on the quality of life, in particular for the most vulnerable who do not have the means to buy their own means of transport or cannot use it on grounds of disability. In addition, local collective transport, which gains customers from among those who own and can use cars, contributes to reducing noise and emissions, minimizing road congestion and accidents, generating additional positive externalities, and improving the overall quality of life in the city [41].

Municipal waste management is the foundation for the proper functioning of the community living in an area. The generation of individual waste by residents requires its collective handling (management). This service consists of the collection, transport, and treatment of such waste, as well as the supervision of these activities. Waste management is an indispensable area of activity that ensures the protection of human life and health and of the environment. In principle, without the existence of waste management, the development of modern civilization cannot be discussed in any aspect [42–44].

## *2.2. Municipally Owned Corporations as a Form of Provision of Local Public Services*

In recent decades, with increasing decentralization, the importance of public services provided at the local level has increased significantly. Forms of local public service provision can be classified based on the degree of demonopolization and privatization. On the basis of these two criteria, taking into account the organizational and ownership aspects, different possible models of organizing the provision of public services are distinguished (Figure 1), which, in current European practice, are limited to those where the leading role is played by public entities at all levels.



**Figure 1.** Examples of models of the organization of local public services.

From an organizational and legal point of view, the system for providing these services can take different forms. Local authorities providing public services may [15] have the following features:

- Provide certain services on their own (through the civil service);
- Privatize or outsource to private entities the provision of selected services;
- Provide services jointly with other entities, informally in the form of inter-municipal cooperation or public-private partnerships;
- Provide services through municipally owned corporations.

Issues related to various forms of public service provision, including local public services, are widely analyzed in the subject literature. One of the more popular topics concerns the form of public service provision [45]. The most common ways of providing such services are the independent provision of services by government bodies; contracts with other governments, private companies, or non-profit organizations; joint service-delivery arrangements. A mixed approach is also possible, in which local authorities decide to share public service obligations with private providers. Provision of services in this formula allows for the assessment of contractual form effectiveness while maintaining the

local government unit's own potential [46–48]. Research suggests that certain choices regarding the form of provision of public services show strong inertia [45].

The literature also raises the question of reforming the way in which public services are provided and highlights the dominant role of privatization in these reforms [49]. The question of institutional reform of public service provision goes beyond privatization and also includes other forms of provision of those services, such as municipal corporations, relational contracting, and dynamic market management. Other approaches discussed in the literature include comparing the economies of scale and efficiency of privatization and inter-municipality cooperation [50] and comparing contracts with for-profit and non-profit organizations [46]. The last studies show that in terms of cost, quality of work, response to decision-maker requirements, legality, and level of customer satisfaction, there are no significant differences in the performance of services provided by non-profit organizations and profit-oriented enterprises. Research is also being carried out on transaction costs as a criterion for choosing between different forms of provision of local public services [51,52,53].

From the perspective of the quality of service provided to members of the local community, the effects of its different forms have been analyzed by Cuadrado-Ballesteros, García-Sánchez, and Prado-Lorenzo [22]. Using empirical data, they found that quality of life is higher in municipalities where local government benefits from functional decentralization. At the same time, when the analysis took into account the private sector, the results were ambiguous, i.e., quality of life was higher in municipalities where public transport and healthcare services were provided by public undertakings and in those municipalities where urban services were provided by foundations (charities) or autonomous organizations. Moreover, resident quality of life was higher when water management services were provided by external entities or by mixed companies.

In more recent studies, Pérez-López, Prior, and Zafra-Gómez have analyzed the opportunities for municipalities to choose different methods of providing public services [25]. Looking at the effectiveness of the various forms of public service provision in Spain, they concluded that modern forms of service provision, such as agency creation, external contracting, and inter-municipality cooperation, reduce cost-effectiveness. At the same time, it was observed that during the global recession some of these forms were more effective than traditional ways of providing public services. Research carried out among Dutch local authorities, which analyzed factors affecting the choice of certain forms of public service provision, shows that a positive impact on the choice of service privatization, e.g., the right-wing political orientation of the municipal council, focuses on the model of municipality management (emphasis on performance indicators) and the weaker financial situation of the municipality [54].

In addition to the works discussed above, which are of a general nature and focus on comparing the different ways of providing local services, a large number of studies conduct detailed analyses of the advantages and disadvantages, efficiency, effectiveness, and costs associated with the chosen methods of providing these services. In earlier studies, other authors analyzed the issue of contracting the provision of local public services [46,53,55–57]. Other articles addressed the issue of privatization of local public services [58,59]. Public–private partnerships in the provision of public services have been studied using the examples of transport infrastructure in the Netherlands [60], Italian solutions [61], and US wireless broadband [62]. Among research threads, there are also issues regarding the importance of nonprofit organizations in providing local public services [63] and inter-municipal cooperation [64–67].

Decision making on how to provide local public services has also been studied in a number of other studies [23,68–70]. A comprehensive overview of studies on the different methods of providing public services, as well as other studies not mentioned here, includes publications based on meta-analyses [71,72]. Voorn [15] also carried out a notable literature review. Moreover, it is also worth noting the study by Bel and Gradus [73], in which the authors extensively discussed the results of the latest studies on contracting

out, privatization, and inter-municipal cooperation and identified factors influencing the choice of a specific form of public service provision.

The undertaken literature review allows for the conclusion that the issue of forms of provision of public services at the local level is relatively well recognized in many different aspects (criteria for the choice of a particular form by local authorities, the efficiency and effectiveness of different forms, externalities and transaction costs associated with individual forms, the quality of services for citizens, etc.). Extensive knowledge regarding the provision of public services by local authorities on their own or through privatization, outsourcing to private entities and inter-municipal cooperation, and public–private partnerships is in stark contrast with knowledge regarding the provision of these services by municipal enterprises [15]. Of the same opinion are other authors who have recently called for in-depth research into the phenomenon of corporatization and MOCs in local authorities [9,12,74,75].

An underlying reason for the relatively low prevalence of MOCs in the literature is a widespread belief among many researchers that the provision of public services through them is not fundamentally different from the standard model for the provision of such services through the local civil service. This belief stems from a widespread tendency to focus on the analysis of different forms of public service provision on the dichotomy of the forms of service provider ownership (private property vs. public property). However, recent studies show that other factors are also relevant in such analyses, including competition-related issues, which significantly differentiate MOCs from traditional forms of public service provision [15].

The concept of municipally owned corporations is ambiguous, and several synonyms are used in parallel in the literature. Other authors, to name entities that we refer to as MOCs, use the terms “municipal enterprises” [11,76,77]; “municipal corporations” [10,78]; “municipal companies” [79,80]; “municipally owned companies” [81]; “municipally owned enterprises” [12,82]; “local government companies” [13]. In the past, the term “municipally owned firms” [83,84] was also used, which some authors also use today [85]. In the USA, entities of a MOC-like nature are the “public authority” [26]. A concept similar in nature to MOCs is that of the “public utility company”, which defines all entities providing a particular type of public service [5].

The term “municipally owned corporation” was first used in the work of Tavares and Camões [86] and currently is widely used and well established in the literature [4,9,14,16,87]. Similar to Voorn [15], we believe that this term best reflects the essence of the entities that are analyzed in this study. On the one hand, it emphasizes that their owners or co-owners are local authorities and independent corporate status. On the other hand, it does not suggest the full market nature of those entities, as in the case of the terms “enterprise”, “company”, or “firm”. The term also directly refers to the phenomenon known as the corporatization of public services, which is at the root of the growing popularity of MOCs [12,13,74].

The characteristics of MOCs that distinguish them from other forms of provision of local public services include [9,14,61,78,86] the following:

- Operating under private law and having independent corporate status (including the right to own property and right to sue or be sued);
- MOCs in carrying out public tasks have no right to impose taxes, and their financial management is based on revenues in the form of fees or transfers financed by local authorities;
- As a rule (but not in every country), MOCs can generate profits, but they can also suffer losses and face the risk of bankruptcy;
- In general, MOCs provide one type of service (usually transport, waste management, or water supply and wastewater disposal), although in some countries (including Poland), MOCs can provide many different public services at the same time.

An important feature of MOCs is also their control by one or more local government units in the form of ownership of majority stakes in the commercial law companies, whose form MOCs take. This does not mean that only local government units can be shareholders of those entities. On the contrary, part of the shares may also be held by private sector entities.

In view of the above, MOCs in this study are defined as entities with the following features:

- Providing a specific type of service to local communities;
- Operating on the basis of private law and having a separate legal personality;
- The majority of their shareholders are local authorities;
- Managed by a management board appointed by local authorities, which exercise ownership of those entities;
- Generating revenues from fees charged to the recipients of their services or framework contracts concluded with a local authority for the performance of specific tasks.

On the basis of these considerations, in Table 1, MOCs have been placed in the system for the provision of local public services in the fields of public transport and municipal waste management.

**Table 1.** Basic models for the organization of the provision of public services in Europe.

Contracting Model	Characteristics	The Role of the Public Party	The Role of a Private Party	Sample Place of Application
<b>Local Public Transport</b>				
Ordering transport services out from MOCs by way of direct entrusting	A closed market that excludes direct competition. The transport is carried out by a public carrier, i.e., MOCs (different rules of cooperation between it and the transport organizer are possible)	Setting tariffs, timetables, and routes, carrying out transport activities independently or through subordinate municipal enterprises (MOCs)	None	Paris, Madrid, Prague, Budapest, Athens
Competition in the market “on the road”	Deregulation of the market, abolished possibility of granting exclusive rights for the provision of services in the public bus sector (example of an open market in which MOC does not exist or is one of several entities)	Commissioning and subsidizing unprofitable but socially needed services	Operating, creating timetables and routes, having own fares	United Kingdom (except London)
Competition - the wholework of the so-called regulated competition, where the right of exclusivity is granted for a limited period after the necessary tender, in which the MOC competes, alongside private enterprises	The tendering procedure in the framework of the so-called regulated competition, where the right of exclusivity is granted for a limited period after the necessary tender, in which the MOC competes, alongside private enterprises	Determination of the basic shape of the tariff and transport offers, selection of MOC and/or private carrier, contracting services	Carrying out transport activities, management activities	Cities in France (except the Paris region), smaller cities in Finland, Sweden
Competition for the “off the road” market - Selected lines		Regulation of fares, timetables, stimulating competition between carriers	Carrying out transport activities	London, Helsinki, Copenhagen, Stockholm, Porto
<b>Municipal Waste Management</b>				
Commissioning municipal waste management services by directly entrusting own MOCs and organizing a competitive market for the collection and transport of waste	The entity responsible for waste management and sometimes for the waste management system is a MOC or MOCs. In addition, a tender procedure for the collection and transport of waste is organized in the framework of the so-called regulated competition, where the exclusivity right is granted for a limited period after the necessary tender has been conducted throughout the city or in the separate zones.	Setting of fees, method of collection, conducting self-management of waste through subordinate municipal enterprises (MOCs), selection and contracting (sometimes with and through the MOCs acting as operators) of companies responsible for the reception of waste (it can also be the MOCs).	Carrying out municipal waste collection and transport activities	Paris, Vienna, Prague, Frankfurt (Oder), Vienna, Amsterdam, Vilnius, Krakow



Competition for the municipal waste management and collection market	A tender procedure is organized for the management of collection, transport of waste within the framework of the so-called regulated competition, where the right of exclusivity is granted for a limited period after the necessary tender has been carried out. Sometimes a MOC or a private entity is selected, operating on publicly owned equipment.	Setting of fees, method of collection, management, selection, and contracting of companies (including MOCs) responsible for the implementation of municipal waste management	Carrying out municipal waste management, collection, and transport activities	London, Valencia, Marseille, Eindhoven, Frankfurt am Main
Partial competition in the municipal waste management market	Municipalities organize waste management on the basis of a competitive market model, but large waste producers, such as housing associations, can exit the municipal system and contract directly with private operators or MOCs	Setting of fees, method of collection, management, selection, and contracting of enterprises (including MOCs) responsible for the implementation of municipal waste management in a system without larger entities	Conducting municipal waste management activities in the organizational, financial, and operational areas	Sofia, Turku, Lahti, Cork

### 2.3. Efficiency of Municipally Owned Corporations

In a market economy, all entities must make effective use of their financial resources, personnel resources, maintain existing and acquire new customers, streamline their processes and technology and implement efficient management methods. This requires determining whether the undertaken activity is delivering the intended results. This approach is combined with the concept of efficiency, which should be understood as the best results for the production or distribution of goods and services at specified costs or as low as possible for the effects in question [88]. Classically computed economic efficiency is therefore the result of the actions described by the relationship of effects to expenditure. Various types of synthetic indicators are used to measure this efficiency, indicating the efficiency of the company (e.g., return on assets (ROA); return on equity (ROE)). However, it should be noted that efficiency can also be considered in relation to other aspects of the management process. In addition to financial efficiency, efficiency is also defined as organizational (technical production), operational, environmental, qualitative, social, ethical-cultural, etc.

In the literature, the issue of defining the concept of MOC efficiency and how it is measured has not been a priority thus far. In most studies, the understanding of these terms coincides with the way they are perceived in relation to typical market enterprises. Studies that have adopted such a way of understanding efficiency focus mainly on comparing the efficiency of different forms of public service provision, with particular regard to the distinction between public and private forms of ownership of service providers [14]. The key success factors of MOCs from the perspective of surveying the opinions of professionals were studied by Daiser and Wirtz [81]. Cuadrado-Ballesteros, García-Sánchez, and Prado-Lorenzo [22] analyzed the impact of MOCs on resident quality of life. In a multi-criteria sense, the effectiveness of MOCs was analyzed by Voorm, van Genugten, and van Thiel [14]. In their opinion, MOC performance consists of effectiveness, efficiency, and quality, which are subjectively perceived by the managers of these entities.

An extensive meta-analysis of the results of the studies carried out in the field of MOC efficiency was presented by Voorn, van Genugten, and van Thiel [9]. The main conclusion of this research is that MOCs are more efficient than local bureaucracies in providing typical public services (waste management, local transport, water management). Among studies supporting this thesis are [22,23]. Albalade, Bel, and Calzada [24] found that Spanish MOCs are only effective if they operate in a competitive market and feel pressure from other operators. On the other hand, according to Pérez-López, Prior, and Zafra-Gómez [25], depending on the industry, MOCs are more (e.g., waste management, water management) or less (e.g., public transport) effective than traditional forms of public service provision. Da Cruz and Marques [79], in their analysis of MOCs in Portugal,

arrived at the opposite conclusion, that MOCs are less efficient than local bureaucracies. The second important conclusion of MOC efficiency research is that, when compared to other forms of public service provision, they have a high initial failure rate [26,79].

### 3. Materials and Methods

Compared to other businesses, municipally owned corporations (MOCs) have additional responsibilities towards local communities, which arise from the ownership structure of those entities and from the specific nature of the local public services they provide. MOCs are required to be viable and effective in achieving the objectives set before them, which take into consideration issues such as the quality of the services provided. In particular, the functioning of local public transport enterprises and municipal waste management undertakings should focus on both maximizing financial and operational efficiency, and improving the quality of life of society. Therefore, when analyzing the effectiveness of their activities, it is necessary to move beyond the framework of typical economic analyses.

In our view, proper assessment of the functioning of MOCs required simultaneous consideration of financial and operational criteria together with quality criteria, which relate to the degree of satisfaction in fulfilling the needs of the local community. Importantly, the quality of services provided by MOCs should be assessed directly from the perspective of the recipients of their services (residents) and not from the perspective of artificial measures created from the perspective of desk-bound analysis.

In view of the above, the analysis of the effectiveness of MOCs was carried out on a multidimensional basis, simultaneously analyzing their financial and operational efficiency and the quality of the services they provide assessed by their customers (Table 2). This approach, therefore, covers both the business-provider perspective (operational and financial efficiency) and the consumer-residents' perspective (quality). The accepted test methodology is expressed in two specific hypotheses that correspond to the main research hypothesis (H0) set out in the introduction and were formulated for MOCs operating in the analyzed industries as follows:

H1: measured by indicators of operational and financial efficiency, the efficiency of municipal enterprises providing local public transport services is associated with the quality of these services perceived by residents.

H2: measured by indicators of operational and financial efficiency, the efficiency of municipal enterprises providing municipal waste management services is associated with the quality of these services perceived by residents.

These hypotheses were verified in the course of the empirical studies and discussed in the following sections.

**Table 2.** Efficiency of MOCs from the perspective of the supplier and the consumer.

Perspective		Supplier (Efficiency)			Consumer (Quality)	
Performance Dimension		Operational Efficiency Measures		Financial Performance Measures		Quality Meters
MOC industry	Local public transport	Municipal waste management	Local public transport	Municipal waste management	Local public transport	Municipal waste management
Measurements			- profitability indicators (ROS, ROE, ROA)		- aggregated quality index of local transport services (AM-ULT)	- aggregated quality of waste management service index (AMUWM)
	- rate and intensity of rolling stock (vehicle use index, VUI)	- level of recycling (LR)	- financial performance indicators (TAT)	- financial ability and debt servicing ratios (CR, DR)		
			- cost per vehicle kilometer (truck cost index, CVK)	- Recycling cost index (RC) indicator		

### 3.1. Operational Efficiency

The operational efficiency assessment of the local public transport undertakings examined was carried out on the basis of the vehicles usage index (VUI). This indicator determines how many vehicle kilometers are completed by the rolling stock (transport vehicles) used by public transport companies in one vehicle hour. By juxtaposing within a single measure of the operating work expressed in vehicle kilometers and the operating work expressed in vehicle hours, the VUI indicator allows for a synthetic measurement of the efficiency of the public transport company.

$$VUI_i = \frac{TVC_i}{TVH_i} \quad (1)$$

where  $TVC_i$ —the numbers of vehicle kilometers driven by the organization's rolling stock (transport vehicles) during the period  $i$ ;  $TVH_i$ —the number of vehicle hours traveled by the rolling stock during the period  $i$ .

The number of vehicle kilometers in the counter of the formula for the value of the rolling stock intensity index is a measure indicating the amount of work carried out in a local public transport enterprise. The total number of vehicle kilometers driven over a given period ( $TVC_i$ ) determines the operational work of the transportation rolling stock—it measures the total distance traveled by all public transport vehicles. Hence,

$$TVC_i = \sum_{q=1}^n VC_i^q \quad (2)$$

where  $VC_i^q$ —presented in vehicle kilometers operation of the  $q$ -th transportation (transit) route during the period  $i$ ;  $n$ —the total number of transportation routes in the city.

The operational work for each transportation route shall be determined as the sum of the length of the trips completed by all vehicles in all trips as follows:

$$VC_i^q = \sum_{j=1}^{m_i^q} cl_{ij}^q \quad (3)$$

where  $cl_{ij}^q$ —the length of the  $j$ -th trip of the  $q$ -th transportation route during the period  $i$ ;  $m_i^q$ —the number of trips of the  $q$ -th transportation route in the period  $i$ .

The number of hours is a measure of operational work in transportation (transit) enterprises. Total number of hours traveled during a given period ( $TVH_i$ ) shows the sum of the journey times of public transport vehicles on all trips of the transport route.

$$TVH_i = \sum_{q=1}^n VH_i^q \quad (4)$$

where  $VH_i^q$ —the operating work of the  $q$ -th transportation route in the period  $i$ ;  $n$ — the total number of transport routes in the city expressed in vehicle hours.

The working hours expressed in vehicle hours for each transportation route shall be expressed as follows:

$$VH_i^q = \sum_{j=1}^{m_i^q} t_{ij}^q \quad (5)$$

where  $t_{ij}^q$ —the duration of the  $j$ -th trip of the  $q$ -th transport route during the period  $i$ ;  $m_i^q$ —the number of courses of the  $q$ -th transportation route during the period  $i$ .

When assessing the operational efficiency of municipal waste management companies, the concept of recycling levels is used. This concept is outlined in Directive 2008/98/EC of the European Parliament and is implemented into the Polish legal system by the Law on the Maintenance of Cleanliness and Order in Municipalities (Journal of Laws 2017, item 1289). Under current regulations, municipalities are required to calculate their own recycling rates for different waste fractions. Detailed guidelines in this area are provided by national law.

This article uses the recycling and preparation rate for reuse of paper, metal, plastics, and glass ( $LR$ ) calculated in these companies to determine the operational efficiency of municipal waste management companies. The value of this indicator is determined according to the following formula:

$$LR = \frac{MW_R}{MW_T} \cdot 100\% \quad (6)$$

where  $LR$ —level of recycling and preparation for reuse of municipal waste;  $MW_R$ —the total weight of waste of a particular type recycled and prepared for reuse by the enterprise concerned;  $MW_T$ —the total weight of the waste of a certain type collected by the enterprise concerned.

The study assumes that the recycling rate achieved in such a manner is the primary indicator of the operational efficiency of waste management in a given city. This is because high recycling levels are a challenge for municipal enterprises, which are in fact involved in waste management in the city. Therefore, a universal measure of the effectiveness and efficiency of these entities can be the level of recycling for the raw material fraction in a given city.

### 3.2. Financial Efficiency

Standard financial analysis indicators [89] were used in the assessment of MOC financial effectiveness. In particular, calculations centered on the values of the following measures:

- Profitability (return on net sales (ROS); return on equity (ROE); return on total assets (ROA));
- Total assets turnover (TAT);
- Current ratio (CR);
- Debt ratio (DR).

In addition, due to the specificity of the activities of local public transport companies, their financial efficiency was also assessed on the basis of the cost per vehicle-kilometer (CVK) index. This indicator synthetically shows the average cost of driving one kilometer by a public transport vehicle. The CVK indicator in economic practice is widely used by public transport operators. After a modification by the research authors, it takes the form of

$$CVK_i = \frac{TC_i}{TVC_i} \quad (7)$$

where  $TC_i$ —the total operating costs of the enterprise during the period  $i$ ;  $TVC_i$ —the number of vehicle kilometers traveled by the rolling stock of the enterprise during the period  $i$ .

Taking into account the specificities of municipal waste management companies and in the study of their financial efficiency, the cost of recycling (RC) indicator was used in addition to classical financial indicators. The design of this indicator is based on the assumption that a given level of recycling should be achieved with as few resources as possible. Hence, this indicator takes the form of

$$RC_i = \frac{TC_i/TW_i}{RR_i} \quad (8)$$

where  $TC_i$ —the total operating costs of the enterprise during the period  $i$ ;  $TW_i$ —the mass of the waste collected during the period  $i$ ;  $RR_i$ —the degree of recycling of municipal fractions achieved during the period  $i$ .

The RC ratio value, therefore, indicates what amount of money was required to achieve a specific level of recycling.

### 3.3. Quality of Local Public Services

The treatment of the concept of quality of municipal services as a set of characteristics describing that quality from the point of view of their recipient (resident) was the starting point for determining the set of characteristics for the quality level of services analyzed in this article—local public transport and municipal waste management. In view of the general expectations taken into account in assessing the quality of public services [90] and the conditions for collective transport and municipal waste management in urban areas [91–94], a set of standards was developed to define the quality of the municipal economy in the city (Table 3). These standards reflect the preferences reported by residents towards the municipal economy sectors surveyed. These characteristics are further referred to as quality standards for municipal services.

**Table 3.** Standards determining the quality of municipal services.

Qualitative Dimension of the Provision of Municipal Service	Local Public Transport	Municipal Waste Management
Accessibility/comprehensiveness	Availability of the transportation network	Comprehensive collection
Frequency	Frequency of running	Frequency of collection
Punctuality/timeliness	Punctuality of running	Timely collection
Safety	Travel safety	Winter infrastructure maintenance
Certainty	The certainty of completing a planned trip	Certainty of waste collection
Speed/effectiveness	Immediacy and speed of travel	Maintaining cleanliness in the city
Cost	The level of transport fees	The level of the collection fee
Convenience	The convenience of travel	Ease of waste segregation
Information	Information about the transport offer	Information about the waste collection offer
Modern technologies	Use of modern technologies	Use of modern technologies

In order to measure the quality of the provision of municipal services from the consumer point of view, a proprietary research questionnaire was developed, which included a set of questions on the distinguished standards for the provision of those services. The

full questionnaire consisted of 41 detailed questions regarding the quality of municipal services in two analyzed sectors (there were more than one question regarding some standards). To increase the relevance of the questionnaire research, the direct method used in similar studies (a general question about the quality assessment of a given type of service) was supplemented by an indirect method. Under this method, respondents were asked to answer detailed questions on each of the quality dimensions for the provision of municipal services indicated in Table 3. Respondents answered each question using a 5-point Likert scale (1 was the worst rating, and 5 was the best rating). In addition, respondents were asked about the use of new technologies.

To assure external validity, the research samples in each city were randomized (see Section 3.5. Data). To obtain the construct validity of the research questionnaire, we adopted a multi-step procedure of developing the research questionnaire. This procedure consisted of five essential steps as follows:

1. Preparation of the initial version of the questionnaire based on the study of the subject literature and the research experience of the authors;
2. Consultation of question content with academics specializing in research in the field of local government administration and the quality of services, as well as with the management staff at MOCs (see acknowledgments);
3. Development of an electronic questionnaire;
4. Pilot studies conducted on a non-random sample of people with a diverse demographic profile. The aim of the pilot was to test the research questionnaire. In particular, the comprehensibility of the questions and the accuracy of the suggested answers were checked. Additionally, in this stage, selected participants of the study were interviewed to provide insight into how they understood the questions and the process of answering;
5. Development of the final version of the research questionnaire.

In addition, to verify the reliability of the questionnaire, appropriate Cronbach's alpha [95] coefficients were calculated. In the case of questions about the quality of local public transport, the result was 0.897, and in the case of questions about the quality of waste management, it was 0.617.

In the next stage of the study, average consumer satisfaction assessments for each dimension and an aggregated average for assessing the quality of both types of local public services under analysis were set. Subsequently, these values formed the basis for further analysis.

### 3.4. Research Procedure

Thus far, in the empirical research covering the relationship between the effectiveness of the functioning of enterprises and the quality of their services, authors used various statistical methods, many of which favor correlation analysis [17,19,96] and regression analysis [20,97]. Therefore, in this study, correlation analysis and regression models were applied. In contrast to the previous studies, the variables in our analyses were of synthetic nature (i.e., they reflect the combined influence of various factors on efficiency and quality, respectively). These variables were determined based on the zero unitarization method (ZUM), which is usually used in the construction of aggregated rankings. As a result of this approach, Spearman's rank correlation method and univariate linear regression models were used to verify the research hypotheses.

The justification for the use of synthetic measures constructed on the basis of ZUM was the need to base on aggregated measures. It is because the aim of our research was not to examine the impact of various detailed variables determining the efficiency of MOCs on the quality of their services but to determine their relationship and possible interdependence. Such an approach is an important contribution to the literature, as it is

an innovative attempt to aggregate performance and quality measures in various industries. The rationale for the creation of synthetic indicators is also the need for transparency and readability of the obtained results.

The first phase of the study compared the researched companies in local public transport and municipal waste management (see Section 2) in terms of the discussed factors that determined their operational, financial, and quality efficiency (Table 2). A multi-criteria ranking method was applied to make direct comparisons of the companies examined. To develop the rankings of analyzed companies, synthetic variables were used, which were based on ZUM [98].

The ZUM method consists of three main steps. In the first step, diagnostic variables  $X_j$  are divided into stimulators, destimulators, and nominators. In the area of financial and operational efficiency, it was found that five of the variables tested were stimulators (the higher the value, the higher the efficiency), one variable was a destimulator (the lower the value, the higher the efficiency), and two were nominators (the greatest efficiency if the values are in a certain set). They comprised the following indicators:

- The stimulant in both types of analyzed companies included the following financial performance measures: return on net sales (ROS), return on equity (ROE), return on total assets (ROA), and rotation of assets (TAT). In addition, the stimulant was also a measure of operational efficiency. For local public transport, this was the intensity of the use of rolling stock and, in the case of municipal waste management, the level of recycling.
- Financial industry indicators were classified as destimulators. In local transport, it was the cost of making transport vehicles, and in the municipal economy, it was a synthetic cost indicator for obtaining a level of recycling.
- The nominators in both types of analyzed companies were financial indicators: current liquidity, CR (desired nominal values  $e$  in the range of 0.8–1.5), and debt ratio, DR (desired nominal values  $e$  in the range of 40–67%). The desired values forming the different ranges were determined according to the specificities of the industry concerned.

In the area of quality of service, it was found that nine of the characteristics in Table 3 were stimulators, and one feature was a destimulator. The following dimensions of the quality of the services provided were included in the stimulators: availability/complexity, frequency, punctuality/timeliness, safety, confidence, speed/efficiency, convenience, information, innovative technologies, and an overall assessment of the industry. The destimulator was the level of fees. In addition, the proportion of people using modern technologies was recognized as a nominator. In view of the natural limitations in this matter among the elderly, it was assumed that the optimal range for the indicated characteristic is from 30% to 70%.

The second step of the ZUM method is to convert each of the analyzed variables into normalized variables  $Z_j$  [99]. The normalizing formula for stimulators (S) takes the form of

$$z_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}}, \quad x_j \in S \quad (9)$$

where  $x_{ij}$ —diagnostic variable  $i$ -th feature determining the efficiency for the  $j$ -th object, i.e., the municipal enterprise.

For destimulators (D), this formula takes the form of

$$z_{ij} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}}, \quad x_j \in D \quad (10)$$

In the case of nominators (N), when the range of nominal values of  $\langle b_1; b_2 \rangle$  is known, the normalizing formula takes the form of

$$z_{ij} = \begin{cases} \frac{x_{ij} - \min_i x_{ij}}{b_{1j} - \min_i x_{ij}}, & \text{when } x_{ij} < b_{1j} \\ 1, & \text{when } x_{ij} \in [b_{1j}; b_{2j}] \\ \frac{x_{ij} - \max_i x_{ij}}{b_{2j} - \max_i x_{ij}}, & \text{when } x_{ij} > b_{2j} \end{cases} \quad (11)$$

$, x_j \in N$

The third step of the ZUM method involves the aggregation of normalized variables using arithmetic mean as follows:

$$Q_i = \frac{1}{k} \sum_{j=1}^k z_{ij} \quad (12)$$

The values of the synthetic variable  $Q_i$  are normalized in the range  $[0, 1]$  and allow them to be ordered according to the intensity of the test phenomenon (respectively, efficiency or quality). The higher the value of variable  $Q_i$  is achieved by a given object, the higher the position it occupies in the ranking of the test objects.

In the next stage of the study, based on the results of the ZUM method, two rankings of the surveyed companies were developed for both analyzed industries (local transport and waste management). For each industry, the first ranking was a multi-criteria assessment (using both financial efficiency measures and operational efficiency measures) that surveyed the financial and operational efficiency of the enterprises. The second ranking, on the other hand, covered the quality of the services provided by those enterprises. In order to examine whether the ordering (according to the multi-criteria ranking) of the financial and operational performance assessments of the companies examined was consistent with the order of quality assessments of these services, Spearman's rank correlation coefficients were calculated as follows:

$$r_s = 1 - \frac{6 \sum_{i=1}^n (d_x - d_y)^2}{n(n^2 - 1)} \quad (13)$$

where  $d_x$ —the numbers of the positions they occupy in the rankings of the quality of public services provided by the city concerned;  $d_y$ —the financial and operational efficiency of the enterprise operating in that city;  $n$ —number of enterprises surveyed.

The coefficient  $r_s$  takes values from  $-1$  to  $1$ . A positive value of Spearman's rank factor indicates compliance in the ordering of the examined objects. Obtaining a high positive value of this factor in the conducted study would, therefore, provide a basis for confirming the validity of the research hypotheses H1 and H2 (the level of financial and operational efficiency of municipal enterprise operations is associated with the level of quality of these services). A negative result would lead to the opposite conclusions (high financial and operational efficiency of municipal enterprises is associated with low quality of these services). On the other hand, a result hovering around zero would mean no direct link between financial and operational efficiency and the quality of the public services examined.

The final phase of the study included a linear regression analysis, which examined the extent to which the quality of services provided by MOCs influences their financial and operational efficiency. The study applied the basic linear regression model, which took the form of

$$QS_i = \beta_0 + \beta_1 FOE_{i1} \quad (14)$$

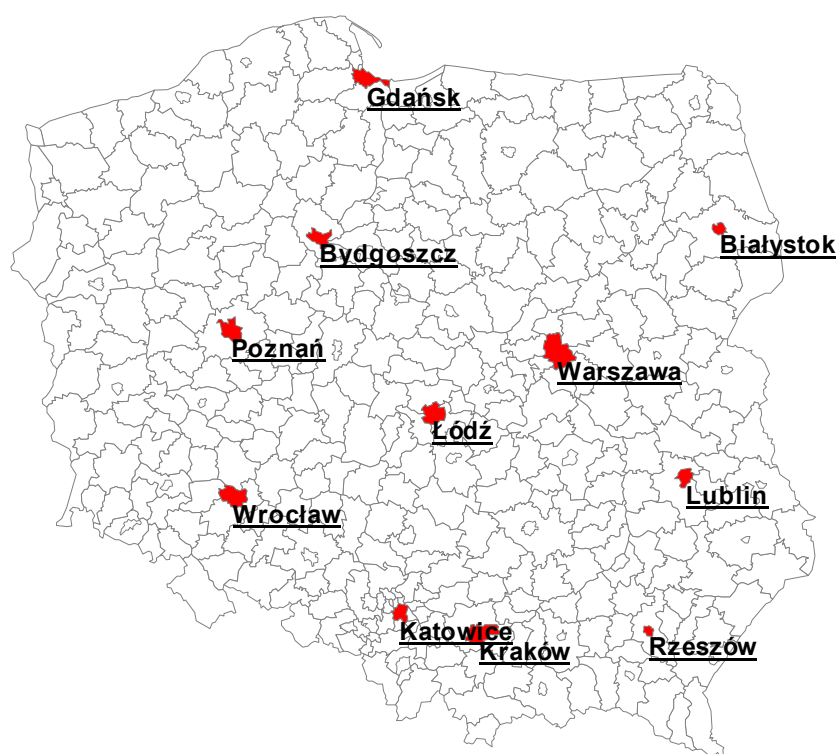


where  $QS_i$ —a synthetic assessment obtained by means of ZUM of the quality of the services provided by the enterprise  $i$ ;  $FOE_i$ —a synthetic assessment of the financial and operational efficiency of the enterprise  $i$  ( $Q_i$ );  $\beta_0$ —constant;  $\beta_1$ —directional coefficient.

The classic least squares test predicted the parameters of two regression models. The first model involved municipal enterprises providing local public transport services. The second model, on the other hand, included municipal waste management enterprises.

### 3.5. Data

The discussed methodology for examining the multi-level efficiency of municipal enterprises was used to examine the effectiveness of municipal enterprises operating in 11 largest Polish cities: Warsaw, Krakow, Poznan, Lodz, Gdansk, Wroclaw, Katowice, Lublin, Bydgoszcz, Bialystok, Rzeszow (which replaced Szczecin due to the availability of data) (Figure 2). As some cities had more than one MOC, the research sample included 16 local public transport companies and 12 municipal waste management companies. In 2019, these companies were monopolists or played a dominant role in the municipal economy of the selected cities.



**Figure 2.** Cities covered in the study.

The data necessary for the designation of the individual financial performance indicators of the MOC examined were obtained from a publicly available database maintained by the Ministry of Justice—National Court Register ([www.ekrs.ms.gov.pl](http://www.ekrs.ms.gov.pl), accessed on 17 April 2021). This database publishes, among others, financial statements of all companies (commercial law companies) registered in Poland.

Secondary data published by the Chamber of Commerce for Urban Transport, which is an independent organization of carriers and passenger transport operators in Polish cities [100], were used to calculate the operational performance indicators of public transport companies (vehicle kilometers, vehicle hours). In addition, in order to obtain

detailed information on the functioning of selected public transport enterprises, in September 2020, detailed questions were sent to the entities analyzed, regarding their functioning. Due to the public nature of the entities examined, questions were sent by way of a request for public information, which, by law, obliges public entities to provide information. The operational efficiency indicators of municipal waste management enterprises were calculated on the basis of data published in the official annual reports on the implementation of municipal waste management tasks in individual cities.

In order to obtain information on the quality of public services provided in the cities analyzed, original opinion surveys were carried out among the inhabitants of these cities. The study was conducted on a random sample of 1400 people, of whom 1247 gave complete responses (Table 4). The study was conducted using the computer-assisted web interview (CAWI) method, between September 2019 and December 2019.

**Table 4.** Structure of the research sample.

Characteristics	Number of Responses	Share (%)
<b>Total</b>	1247	100
<b>Gender</b>		
- woman	641	51.40
- man	606	48.60
<b>Age</b>		
- 18–24	88	7.06
- 25–34	215	17.24
- 35–44	299	23.98
- 45–54	297	23.82
- 55–64	235	18.85
- >65	113	9.05
<b>Occupational status</b>		
- working	874	70.09
- entrepreneurs	123	9.86
- out of work	102	8.18
- pensioner	148	11.87
<b>Education</b>		
- basic or professional	11	0.88
- professional	74	5.93
- averages	483	38.74
- higher	679	54.45
<b>Domicile</b>		
- single-family house	199	15.96
- terraced house	129	10.34
- multi-family construction	919	73.70
<b>City of residence</b>		
- Warsaw	144	11.55
- Krakow	140	11.23
- Poznan	133	10.67
- Lodz	107	8.58
- Gdansk	103	8.26
- Wroclaw	104	8.34
- Katowice	101	8.10
- Lublin	105	8.42
- Bydgoszcz	100	8.02
- Bialystok	108	8.66
- Rzeszow	102	8.17

#### 4. Results

The results regarding the financial and operational performance of the companies surveyed in accordance with the zero unitarization method (ZUM) are presented in Table 5. The table contains the ordered ranking according to the value of calculated synthetic variables  $Q_i$  of MOCs providing local public transport (left side of the table) and MOCs providing municipal waste management (right side of the table). The source data used to calculate the value of  $Q_i$  indicators for individual enterprises are given in Appendix A.

**Table 5.** Rankings of municipal enterprises surveyed in the area of financial and operational efficiency.

Ranking	Local Public Transport		Municipal Waste Management	
	Company Name (City)	$Q_i$	Company Name (City) <sup>a</sup>	$Q_i$
1	Municipal Transport Company—Rzeszow Ltd. (Rzeszow)	0.8389	Service and Commercial and Production Company “LECH” Ltd. in Bialystok (Bialystok)	0.7221
2	Municipal Public Transport Company Ltd. in Bialystok (Bialystok)	0.8202	REMONDIS Ltd. (Warsaw)	0.7193
3	Warsaw Metro Ltd. (Warsaw)	0.5946	KOM-EKO PLC. (Lublin)	0.7157
4	Municipal Transport Company Lublin Ltd. (Lublin)	0.5785	ENERIS Ecological Disposal Centre Ltd. (Poznan)	0.6731
5	Public Transport Company Katowice Ltd. (Katowice)	0.5745	Wroclaw Purification Company ALBA PLC (Wroclaw)	0.6712
6	Municipal Transport Company JSC in Krakow (Krakow)	0.5737	City Municipal Economy Company Ltd. in Katowice (Katowice)	0.6431
7	Gdansk Buses and Trams Ltd. (Gdansk)	0.5391	Municipal Cleaning Company Ltd. (Krakow)	0.5806
8	Municipal Bus Company Ltd. in Warsaw (Warsaw)	0.4993	Recycling Plant Ltd. in Gdansk (Gdansk)	0.5661
9	Municipal Transport Department Ltd. in Bialystok (Bialystok)	0.4989	City Municipal Economy Company—Rzeszów Ltd. (Rzeszow)	0.5648
10	Trams Warsaw Ltd. (Warsaw)	0.4792	ProNatura Ltd. (Bydgoszcz)	0.56177
11	Municipal Transport Company Ltd. in Bialystok (Bialystok)	0.4627	Municipal Cleaning Company Łódź Ltd. (Lodz)	0.5451
12	Silesian Trams PLC (Katowice)	0.4372	Municipal Purification Company in Warsaw Ltd. (Warsaw)	0.2101
13	Municipal Transport Company—Łódź Ltd. (Lodz)	0.4364	-	-
14	Municipal Transport Company Ltd. in Wroclaw (Wroclaw)	0.4193	-	-
15	Municipal Transport Company in Poznan Ltd. (Poznan)	0.3795	-	-
16	Municipal Transport Facilities Ltd. in Bydgoszcz (Bydgoszcz)	0.3730	-	-

(<sup>a</sup>) Formally, not all of the entities examined met all the criteria and the definition of MOCs (majority shares owned by local authorities). However, due to historical circumstances and the monopolistic or dominant position in the city concerned, it was decided to take them into account in the analysis.

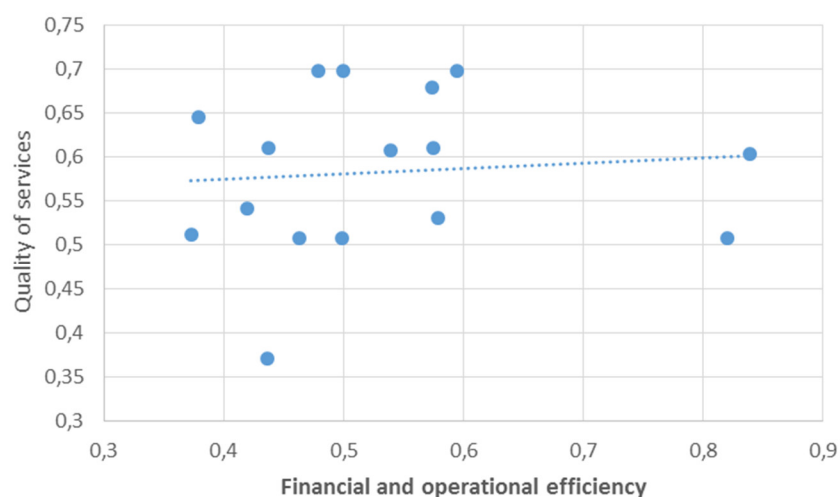
The results of researching the quality of services provided in the cities where the examined MOCs operate are presented in Table 6. The source data used to calculate the values of the synthetic  $Q_i$  city-specific indicators are in Appendix B.

**Table 6.** Rankings of municipal enterprises surveyed in the area of quality of services provided.

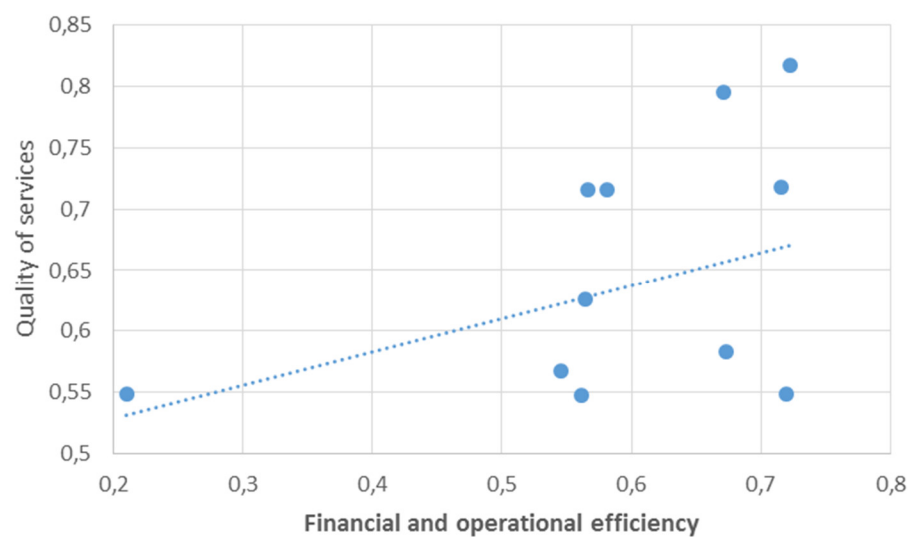
Ranking	Local Public Transport		Municipal Waste Management	
	City	$Q_i$	City	$Q_i$
1	Warsaw	0.6971	Bialystok	0.8174
2	Krakow	0.6786	Wroclaw	0.7948
3	Poznan	0.6450	Krakow	0.7161
4	Katowice	0.6108	Gdansk	0.7156
5	Gdansk	0.6076	Rzeszow	0.6256
6	Rzeszow	0.6040	Poznan	0.5825
7	Wroclaw	0.5420	Lodz	0.5670
8	Lublin	0.5306	Warsaw	0.5486
9	Bydgoszcz	0.5125	Bydgoszcz	0.5474
10	Bialystok	0.5078	Lublin	0.5457
11	Lodz	0.3708	Katowice	0.4607

When analyzing the results obtained, it should be stressed that they take into account the study of the quality of services provided by MOCs operating in a given city and not the quality of services provided by the MOCs concerned. This is important because for some cities services in a given area are provided by more than one MOC (e.g., in Warsaw, transport services are provided by three MOCs). The focus on analyzing the quality of services provided in a given city was due to methodological limitations. The pilot studies showed that without knowing that more than one operator was providing the service in question, residents were not able to differentiate their quality at the level of specific enterprises. If there were several MOCs in the city concerned, this approach, therefore, resulted in the quality assessment obtained being the result of the result for all these entities. In the following stages, where the study focused on the relationship between the financial and operational efficiency of MOCs and the quality of their services, each of the entities surveyed was assigned an assessment of the quality of services provided in a given city.

The relationship between financial and operational efficiency and the quality of services provided by the MOCs analyzed is presented in Figures 3 and 4. The general conclusion from the analysis of the two figures suggests that there is no link between the variables studied. This observation is confirmed by the results of the correlation analysis. For MOCs providing local public transport, the  $r_s$  factor was 0.1610 and statistically insignificant ( $p$ -value = 0.5328). For municipal waste MOCs, an  $r_s$  factor of 0.4633 suggests a moderate interdependence of the variables tested. However, this value is statistically insignificant ( $p$ -value = 0.1244), which makes it impossible to draw binding conclusions in this area. In conclusion, the results of the correlation analysis show that the consistency of the order (rankings) of financial and operational efficiency, and the quality of services of the companies surveyed is low. This observation is an argument against H1 and H2 hypotheses.



**Figure 3.** Scattering graph of variables tested for local public transport MOCs.



**Figure 4.** Scattering graph of variables tested for municipal waste management MOCs.

The hypothesis of the existence of a positive relationship between financial and operational effectiveness with the quality of services provided by MOCs is also challenged by the conclusions formulated based on regression analysis (Table 7).

**Table 7.** Relationship between financial and operational effectiveness and the quality of services provided by MOCs according to the line regression model

Parameter	Coefficient	Standard Error	95% Confidence Interval	t Statistic	p-Value
<b>MOCs providing local public transport services</b>					
(Constant)	0.5506	0.0985	[0.3394; 0.7619]	5.5904	0.0001
Financial and operational efficiency (FOE)	0.0608	0.1799	[−0.3250; 0.4466]	0.3379	0.7404
R-squared	0.0081	-	-	-	-
Adjusted R-squared	−0.0628	-	-	-	-
Overall model significance (F <i>p</i> -value test)	0.7404	-	-	-	-
<b>MOCs providing municipal waste management</b>					
(Constant)	0.4737	0.1469	[0.1463; 0.8011]	3.2234	0.0091
Financial and operational efficiency (FOE)	0.2729	0.2399	[−0.2616; 0.8075]	1.1376	0.2818
R-squared	0.1146	-	-	-	-
Adjusted R-squared	0.0260	-	-	-	-
Overall model significance (F- <i>p</i> -value test)	0.2818	-	-	-	-

The estimated values of regression model parameters for MOCs providing local public transport services and municipal waste management MOCs indicate that operational efficiency does not affect the quality of services provided by the enterprises analyzed. In both estimated models, the  $\beta$  coefficients, indicating how a change in quality is affected by a change in financial and operational efficiency, were statistically insignificant. Moreover, when interpreting the results obtained, attention should also be paid to the low degree of fit of both models (adjusted R<sup>2</sup>) and their overall statistical insignificance (F-test *p*-value).

## 5. Conclusions and Discussion

As a result of our analysis, we rejected both detailed research hypotheses (H1 and H2). The analyses carried out support the claim that, as measured by the indicators of operational and financial efficiency of municipal undertakings providing local public transport services, there is no correlation to the perceived quality of the services they provide to residents. Similarly, the efficiency of municipal enterprises providing municipal waste management services does not in any way translate into the quality of those services perceived by the residents. Both of these observations warrant the rejection of the main research hypothesis (H0). This means that the financial and operational efficiency of municipal enterprises is not associated with the quality of the services they provide.

It is difficult to relate the results of our research to other analyses because an attempt to assess the correlation between the operational and financial efficiency of public service providers and the quality of these services has not yet been undertaken. In the light of our considerations, this is surprising since the question of this relationship should be of fundamental importance in choosing how to provide municipal services. Previous studies have usually attempted to analyze the effectiveness of different models of public service provision in terms of ownership (public or private entity) or organizational (local bureaucracy versus corporations) [9].

In the scant research addressing the effectiveness of MOCs, the activities of these entities were mainly juxtaposed against the functioning of local bureaucracy in aspects such as failure rates, financial efficiency, cost efficiency, and labor costs [9]. Some studies also analyzed and compared the effectiveness of MOCs operating in different industries [22,25], as well as the effectiveness of singular MOCs (owned by a single locality) and joint

MOCs (owned by several localities) [9,23,71]. Even less frequently, studies were undertaken on the quality of services provided by MOCs. In examining the satisfaction with the services of MOCs, Cuadrado-Ballesteros, García-Sánchez, and Prado-Lorenzo [22] found that in all industries MOCs provide a higher quality of life than the local bureaucracy.

Contrary to previous studies, in this study, we did not compare the effectiveness of MOCs or the quality of their services with other forms of public service delivery. Instead, we focused on a different aspect of MOC functioning—we tried to verify whether there is a link between the financial objectives and the quality aspect of the services provided. The financial objectives are set for each undertaking in the competitive market. The quality of services, access to which determines the comfort of the life of every citizen, defines and constitutes the functioning of MOCs.

Although the studies carried out relate to Poland, their results are also useful on a global and, in particular, European scale. Theoretical considerations show that the analysis of MOCs limited only to the financial and operational aspects is incomplete and inadequate to the role currently played by the provision of services of general interest. In addition to efficiency, the quality of the services they provide depends on meeting the expectations of consumer-citizens and is a key determinant of the assessment of the functioning of MOCs. From the empirical analysis, it emerges that the financial and operational efficiency of MOCs does not translate into the quality of the services they provide. The objective of rational management in MOCs must therefore be to both increase financial efficiency and improve the quality of life of citizens using their services. This requires that other criteria for measuring the quality of meeting the needs of the local community be taken into account in the assessment of MOC activities, in addition to financial criteria.

Our research is part of a discussion already launched in the 1970s at the Strategic Planning Institute in Cambridge, USA, on the relationship between the quality of the products and services offered and the financial efficiency of the enterprise [101]. Today, this discussion is also continued by authors from European and Asian countries. It mainly concerns financial market entities, such as banks ([20,102]), new technology enterprises ([21]), service companies ([19]), as well as the health sector ([17,96,97]). The main result of these studies is the widespread belief that in a market economy, enterprises selling high-quality products and services are generally more profitable than competitors offering lower quality standards. Thus, in the modern economy, simple efficiency optimization is not adequate to ensure the successful operation of an enterprise. To be able to compete, entities should consider also external factors, such as the quality of the services provided. In this context, Zervopoulos and Palaskas [103] support the view that simultaneous assessment of both efficiency and quality is necessary. Our research broadens the scope of this discussion to an analysis of the relationship in question in MOCs, which provide a specific type of service and have a public owner (or co-owner). Our analysis shows that, unlike typical market players, this relationship does not exist in MOCs.

With regard to our research into the broader context, we point out that they are part of a broader discussion on the re-communalization of public services [6–8]. The trend, observed in many countries, is now to replace the privatization of the provision of public services that was dominant until the 1990s with a model in which these services are provided by municipal entities, including MOCs. This change is due to the observation that the cost criterion (financial efficiency) highlighted earlier is not the most important from the point of view of the provision of these services. For citizen-consumers, the quality of these services is more important and tangible, which is reflected in characteristics such as universality, accessibility, comfort, reliability, or cost of use. In other words, the average citizen is more interested in the frequency and timeliness of collecting his/her rubbish than the financial result of the company involved. On the other hand, at the level of the general public today, it is more important to demand sustainable development (e.g., recycling of waste) through MOCs than to maximize their profitability. The main distinguishing feature of the activities of those entities is the assumption of the paramount importance of the quality criterion in assessing their functioning.

The main limitation of the research carried out was the number of MOCs tested. However, the selection of MOCs for the study was subject to three objective limitations. Firstly, in most Polish cities, there is one MOC in the industries analyzed. Secondly, it is difficult for studies in smaller localities to have the detailed data necessary to assess the effectiveness of MOCs. Thirdly, conducting research in more localities would require a significant increase in the survey sample. From a methodological point of view, the research limitation concerns our aggregated approach—this approach enabled a comprehensive (synthetic) assessment of the effectiveness of MOCs and the quality of their services, but on the other hand, it omitted certain nuances of the activities of the companies concerned.

The studies carried out may form the basis for further in-depth analyses. In particular, it is desirable to carry out analyses on a larger sample of MOCs and in other sectors of public service provision. It is also a natural extension of our research to carry out international comparisons. From a methodological perspective on interesting conclusions, the method we have proposed could be used outside the area of public service provision—in the area of market enterprises. On the other hand, given the limitations of our research method, it is desirable to improve the ways in which financial and operational efficiency and quality of services provided by MOCs are measured. No less important are studies involving the identification and evaluation of the impact of various factors on the effectiveness of MOCs and the quality of their services.

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## Appendix A

Table A1. Financial and operational performance indicators of local public transport MOCs tested.

Full Name of Municipally Owned Corporation	City	ROS (%)	ROE (%)	ROA (%)	TAT	CR	DR (%)	CVK (PLN/v km)	VUI (vkm/v h)
Municipal Public Transport Company Ltd. in Bialystok	Bialystok	−1.35	−2.66	−1.76	1.31	3.18	33.82	7.95	16.48
Municipal Transport Company Ltd. in Bialystok	Bialystok	2.27	12.32	5.24	2.31	1.45	57.50	9.50	15.89
Municipal Communication Department Ltd. in Bialystok	Bialystok	−1.35	−2.81	−2.01	1.49	2.00	28.21	7.24	15.88
Municipal Transport Facilities Ltd. in Bydgoszcz	Bydgoszcz	−8.37	−14.83	−9.70	1.16	1.38	34.60	8.04	16.32
Gdansk Buses and Trams Ltd.	Gdansk	0.81	2.39	0.49	0.61	1.32	79.37	11.79	16.63
Public Transport Company Katowice Ltd.	Katowice	−2.15	−4.95	−2.01	0.94	1.72	59.41	8.28	15.99
Silesian Trams PLC.	Katowice	0.54	0.71	0.12	0.23	1.03	82.77	13.79	14.00
Municipal Transport Company JSC in Krakow	Krakow	1.30	1.70	0.56	0.43	1.92	67.26	11.70	14.95
Municipal Transport Company Lublin Ltd.	Lublin	−0.13	−0.39	−0.12	0.96	0.86	68.47	11.53	13.86
Municipal Transport Company—Lodz Ltd.	Lodz	0.13	0.63	0.09	0.68	0.90	85.79	13.44	14.08
Municipal Transport Company in Poznan Ltd.	Poznan	−2.35	−2.13	−0.73	0.31	0.49	65.61	13.36	14.80
Municipal Transport Company—Rzeszow Ltd.	Rzeszow	1.87	10.30	5.90	3.15	1.12	42.73	10.41	16.37
Municipal Bus Companies Ltd. in Warsaw	Warsaw	0.05	0.07	0.05	1.04	1.33	26.91	10.67	15.70
Trams Warsaw Ltd.	Warsaw	1.41	1.02	0.34	0.24	2.10	66.94	16.45	14.00
Warsaw Metro Ltd.	Warsaw	2.28	1.79	0.83	0.36	3.35	53.64	12.55	28.84
Municipal Transport Company Ltd. in Wroclaw	Wroclaw	−2.17	−5.34	−0.92	0.42	1.69	82.79	9.98	14.33

Table A2. Financial and operational performance indicators of municipal waste MOCs tested.

Full Name of Municipally Owned Corporation	City	ROS (%)	ROE (%)	ROA (%)	TAT	CR	DR (%)	RC (p.p.u./%) *	LR (%)
Service and Commercial and Production Company “LECH” Ltd. in Bialystok	Bialystok	9.21	10.79	1.87	0.2	0.59	82.67	693.22	59
ProNatura Ltd.	Bydgoszcz	5.32	9.29	4.57	0.86	0.42	50.78	1502.76	44
Disposal Plant Ltd. in Gdansk	Gdansk	−6.01	−4.81	−1.62	0.27	0.44	66.41	776.42	50
City Municipal Economy Company Ltd. in Katowice	Katowice	1.07	0.99	0.61	0.57	0.5	38.86	806.11	42
Municipal Cleaning Company Ltd.	Krakow	1.24	4.88	1.67	1.34	0.42	65.76	1786.33	39
KOM-EKO PLC.	Lublin	3.72	10.53	3.47	0.93	0.39	67	1381.48	30
Municipal Cleaning Company Lodz Ltd.	Lodz	−0.68	−5.38	−0.98	1.45	0.3	81.78	1227.15	44
ENERIS Ecological Disposal Center Ltd.	Poznan	5.94	17.7	5.13	0.86	0.41	70.99	1323.17	41
City Municipal Economy Company—Rzeszow Ltd.	Rzeszow	−7.32	−64.65	−18.35	2.51	0.59	71.61	1296.16	59
Municipal Purification Company in Warsaw Ltd.	Warsaw	−40.16	−53.07	−17.65	0.44	0.42	66.75	1811.84	42
REMONDIS Ltd.	Warsaw	6.33	7.58	1.43	0.23	0.42	81.14	1187.22	42
Wroclaw Cleaning Company ALBA PLC.	Wroclaw	−1.99	−9.17	−3.48	1.74	0.44	62.1	1631.16	42

\* p.p.u.—price per unit.

**Table A3.** Quality of service tested MOCs offering local public transport.

City/ Quality Standards	Availability of the Communication Network	Frequency of Running	Punctuality of the Transport	Travel Safety	The certainty of a Planned Trip	Immediacy and Speed of Travel	The Convenience of Travel	Information about the Transport Offer	Use of Innovative Technologies	Cost	Percentage of Users of Modern Technologies (%)	Overall Rating
Bialystok	3.86	3.49	3.71	3.47	3.48	3.80	3.66	3.93	3.70	4.28	46.33	3.69
Bydgoszcz	3.77	3.5	3.56	3.61	3.46	3.84	3.50	4.06	3.80	4.14	45.67	3.58
Gdansk	3.96	3.59	3.59	3.59	3.40	3.55	3.55	4.05	3.86	4.03	55.00	3.63
Katowice	3.79	3.65	3.58	3.60	3.54	3.72	3.64	4.02	3.78	4.10	52.33	3.60
Krakow	3.96	3.58	3.70	3.55	3.50	3.56	3.60	4.03	3.82	3.94	54.33	3.61
Lublin	3.89	3.58	3.55	3.68	3.48	3.67	3.59	4.00	3.69	4.23	47.67	3.54
Lodz	3.72	3.57	3.62	3.57	3.41	3.69	3.48	3.97	3.67	4.21	50.00	3.56
Poznan	3.85	3.73	3.74	3.64	3.49	3.82	3.58	3.89	3.74	4.17	55.33	3.62
Rzeszow	3.77	3.70	3.52	3.69	3.53	3.67	3.68	3.87	3.74	4.00	45.00	3.53
Warsaw	3.99	3.60	3.75	3.56	3.47	3.85	3.47	3.92	3.79	3.86	57.33	3.59
Wroclaw	3.78	3.66	3.64	3.54	3.49	3.60	3.62	3.84	3.79	4.03	52.67	3.64

**Table A4.** Quality of service of tested MOCs dealing with municipal waste management.

City/ Quality Standards	Comprehensive Collection	Frequency of Collection	Timely Collection	Certainty of Waste Collection	Ease of Waste Segregation	Winter Infrastructure Maintenance	Ease of Segregation	Information about the Waste Collection Offer	Use of Modern Technologies	Cost	Percentage of Users of Modern Technologies (%)	Overall Rating
Bialystok	3.4	3.04	3.82	3.9	3.79	3.53	3.25	3.21	3.17	4.13	39.43	3.37
Bydgoszcz	3.28	3.01	3.74	3.86	3.64	3.40	3.29	3.13	3.05	4.04	41.43	3.02
Gdansk	3.34	2.99	3.74	3.63	3.76	3.48	3.40	3.25	3.08	4.11	37.00	3.21
Katowice	3.28	3.03	3.69	3.62	3.66	3.36	3.33	3.16	3.06	4.09	38.29	3.07
Krakow	3.33	3.05	3.82	3.86	3.82	3.53	3.26	3.22	3.18	4.14	33.86	3.18
Lublin	3.30	3.00	3.67	3.72	3.75	3.41	3.30	3.08	3.04	4.04	37.43	3.21
Lodz	3.24	2.90	3.75	3.56	3.72	3.36	3.32	3.19	3.12	4.07	35.14	3.12
Poznan	3.29	2.97	3.64	3.70	3.70	3.47	3.36	3.15	3.04	4.11	35.71	3.05
Rzeszow	3.28	2.98	3.73	3.82	3.71	3.48	3.31	3.14	3.04	4.05	40.00	3.12
Warsaw	3.21	2.93	3.68	3.60	3.79	3.40	3.34	3.20	3.10	4.12	36.43	3.10
Wroclaw	3.36	3.02	3.77	3.65	3.75	3.50	3.42	3.26	3.11	4.07	39.43	3.33

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