

PERSPECTIVES OF INCREASING THE QUALITY OF THE PUBLIC TRANSPORT SYSTEM - CASE STUDY ON THE EXAMPLE OF THE LUBIN DISTRICT

Kacper ŁAZOR¹, Katarzyna SIENKIEWICZ-MAŁYJUREK^{2*}

¹ Silesian University of Technology, Department of Management; kacplaz907@student.polsl.pl,
ORCID: 0000-0000-0000-0001

² Silesian University of Technology, Department of Management; katarzyna.sienkiewicz-malyjurek@polsl.pl,
ORCID: 0000-0002-0915-5776

* Correspondence author

Introduction/background: In the time of advancing urbanization and ever increasing intensity of the road traffic in urban areas, providing efficient mass transport is the responsibility of the local authorities. Effective management and organization of the public transport system is a complex task. A public transport system that is attractive and responds to the needs of the passengers can become one of the key factors influencing the quality of life in the city.

Aim of the paper: The main aim of the paper is to identify positive and negative aspects of the operation of Lubińskie Przewozy Pasażerskie (Lubin Passenger Transport) and to propose the potential improvements in this system.

Materials and methods: The paper was created on the basis of a literature review and the applicable legal acts. In order to determine strengths and weaknesses of the mass transport system, a Pareto-Lorenz diagram was used and the level of logistical customer service was calculated on the basis of passenger surveys. The article was created on the basis of the diploma thesis.

Results and conclusions: As the result of conducted research, it has been stated that the passenger transport services in the district of Lubin are provided on a satisfying level, however, the users report certain deficiencies in the functioning of the mass transport. Three main activities, which will result in a noticeable improvement in the quality of offered transport services, were suggested.

Keywords: mass transport, urban logistics, city, logistical customer service.

Introduction

In reality of the 21st century, the cities become a place to live for more and more people (UN DESA, 2014). Technological progress is driving the surge of people to the cities and, consecutively, results in traffic congestion in urban areas (Desroches, Taylor, 2018; Szymczak, Sienkiewicz-Małyjurek, 2011). Appropriate organization of urban area and management of

ever increasing number of people and vehicles creates a challenge for the experts from various fields, from city planners and architects to transport experts and logisticians.

Urban transport is an essential function of cities that allows their functioning and socio-economic development (Jonek-Kowalska, 2018; Liu et al., 2016). Demand for urban transport varies from city to city, but the issues and needs related to this process are similar. These include, first of all, delays, low quality of transport infrastructure, maladjustment to the needs of the inhabitants. Properly organized urban transport decreases traffic volume in the city centres, lowers the congestion level, and limits the emission of pollution to the environment (Chodyński, 2019; Sienkiewicz-Małyjurek, Szymczak, 2011; Elmqvist et al., 2019).

From an activity organization perspective, meeting the basic, collective needs of the community of people living in a given municipality, in accordance with the Act of 8 March 1990 on Municipal Self-Government, is a part of the municipality's own tasks. Municipality's own tasks include, among others: matters concerning spatial order, protection of environment, municipal roads, streets and squares, matters concerning sport and tourism, as well as those related to the local mass transport. This provision is complemented by the Act of 16 December 2010 on public mass transport, according to which the organizer of public transport is responsible for the entire process of managing this transport. In compliance with these regulations, the quality of public transport system is of a local nature, because it is determined by actions taken in municipalities, districts and voivodeships. However, considering increasing requirements of the customers in relation to the quality of provided services, a research problem arises: how to organize the public transport system, so that it meets passengers' expectations? This paper attempts to solve this research problem in the Lubin district. Its aim is to analyze the solutions used in the management of the public passenger transport system in the Lubin district, as well as to propose potential improvement actions in this system. The article was created on the basis of the diploma thesis.

Basics of urban transport functioning

The need for mobility and movement is an example of every human need. It is clear that urban area will become more attractive for settlement, if there is the possibility of comfortable and efficient travel within the area (Ejdys, 2014; Liu et al., 2016; Rasca, Saeed, 2022). It has to be remembered that cities are characterized by various density of buildings and the number of travellers using public transport, e.g. between the centre and the suburbs. Katarzyna Sosik claims that efficient and effective transport system conditions the attractiveness and competitiveness of the country, region, city. Due to a high population density and the character of spatial planning in the city, it is being noticed that the transport organization in urban areas becomes an important and difficult task (Sosik, 2020; Sienkiewicz-Małyjurek, 2010).

The transport system is part of the functional and spatial structure of the city and stimulates its development (Grondys et al., 2017; Żebrucki et al., 2020; Szulc et al., 2021). The concept of the transport system in the city consists of various subsystems, which show its quality from the point of view of all people using it (in this case, residents as well as visitors). Most often, it includes subsystems such as: linear infrastructure (all kinds of communication routes) and points infrastructure (parking lots, stops, stations), which together form the organizational and technical subsystem, as well as the regulatory and financial subsystem (Szołtysek, 2016; Szymczak, 2008; Tundys, 2008). Certain features are characteristic of the transport system. The main ones are: complexity and a significant number of interactions that take place within the system as well as between systems and the environment; probability related to the previous feature and the difficulty of predicting future relationships and phenomena, as well as situations taking place in the present time; the limited possibility of self-regulation and adaptation to new conditions (Brdulak et al., 2016; Tundys 2008).

In recent years, public transport is no longer just a means of enabling people to move around, but a factor influencing the ecological conditions in a city. Well-organized public transport reduces the risk of congestion and unnecessary expenses related to investments in road infrastructure. An efficient public transport system that meets the needs of residents creates at the same time good conditions for the social development of a given city, e.g. by closing the city centres to individual traffic. It is possible to revitalize the city centre and relieve the environment from the disastrous effects of road traffic (Szulc et al., 2021; Szymczak, 2008). Reducing congestion and the negative impact of the transport system on the environment are two concrete arguments for keeping public transport at the highest level.

In the subject literature, public transport is indicated as one of the subsystems of an entire logistic system created by the city (Szołtysek, 2016; Szymczak, 2008). An efficient public transport system is to primarily ensure an access to the transport services for the citizens when the need of travel appears. The components of public transport system are vehicles, carrier, public transport organizer (in literature the term of regulator also appears) and passengers (Szołtysek, 2007, 2016; Szymczak, 2008). Without any difficulties, the relations between the subjects of a system can also be defined. A carrier provides services for passengers, exploiting its vehicles and available infrastructure within the city, following the schedule provided by the organizer at the same time. Transport organizer is responsible for choosing a carrier according to the rules described in the Act of 16 December 2010 on public mass transport. If the contract is not fulfilled, it may be terminated. In a way, passengers influence the organizer's decisions. They can refuse to use lines that have been laid out in a way that does not meet their requirements or complain about decisions made by the organizer. Described relations are depicted by figure 1.

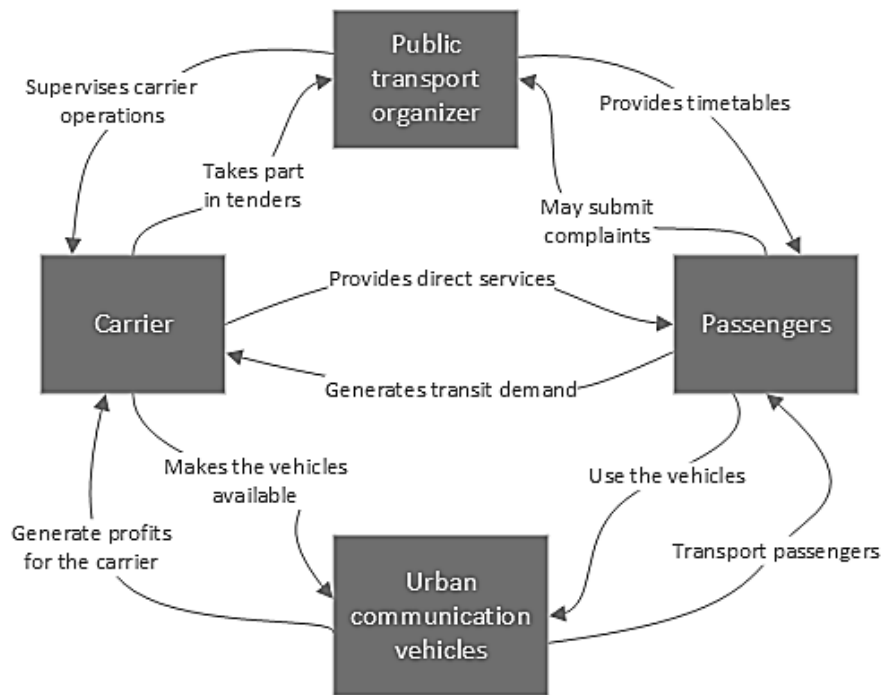


Figure 1. Scheme of relationships in urban transport system. Own work.

Public transport should be perceived as an organized system operating in an urban space, which main goals are efficient transport of the citizens to the final destination as well as prevention of transport congestion. Transport organizer has a regulatory function, its task is to manage the system. The transport system itself should be integrated and meet the requirements of its users.

Demand for public transport is also subject to fluctuations depending on the emergence of various external factors. They can be divided into positive ones, i.e. those that increase transport needs, and therefore the demand for them, and negative ones, i.e. those that reduce the need to use public transport. The following has a positive impact: the growing number of inhabitants of given areas, the growing number of older people and children, i.e. people who mostly do not have their cars, are of particular importance; changing income level; the location of new workplaces and public transport connection services or the development of the current transport network. For this reason, it is necessary to periodically verify the conditions for implementing the public transport system and the changing requirements and social preferences (Skowron and Cheba, 2019; Żebrucki et al., 2020).

Research methodology

The analyses conducted in presented paper are based on information obtained at the District Office in Lubin and from the transport operator, as well on the basis of a survey questionnaire conducted among the passengers using the service of Lubińskie Przewozy Pasażerskie.

Obtained information was used to characterize public transport offer and to analyze complaints of the passengers. These complaints were analyzed with the use of Pareto-Lorenz diagram and the ABC method (Detyna, 2011). The analyses became the basis for identification of necessary improvements.

The survey was conducted between September and November 2021 with the use of the CAWI (Computer-Assisted Web Interview) method. Respondents were asked to assign the weighting factors to 13 areas in assessing the quality of the public transport offer and to evaluate all of these areas from the perspective of the passenger of Lubińskie Przewozy Pasażerskie. These areas included: cleanliness of the buses, amenities for people with limited mobility, politeness of the drivers, neatness of the drivers' uniforms, safety of the travel, comfort of the travel and the driving style, ecological vehicles, timeliness of the bus routes, affordable ticket prices and ticket fares, timetable adapted to the needs of the passengers, accessibility of the bus stops, passenger information, integration of public transport with rail passenger transport. The evaluation questions used a five-point Likert scale, where number 1 meant dissatisfaction of the passenger and number 5 informed that the passenger perceives given aspect in a very good way. Distribution of the questionnaires took place through a variety of channels:

- via the Public Information Bulletin of the Lubin District Office,
- with the use of the social networking site Facebook; the questionnaire appeared on residents' groups: *Lubin – ogłoszenia – informacje* and *Polkowiczanie* :), as well as *Lubin – moja mała ojczyzna*,
- The students of secondary schools in Lubin were also asked to participate in the study.

A total of 100 completed questionnaires were received, however, 9 were rejected due to missing or incorrect answers. The answers given by 91 respondents were therefore taken into account.

Obtained results were analyzed with the use of CSI (Customer Satisfaction Index) and quality maps. CSI is a cross-sectional index measuring the core elements of logistical customer service. CSI was calculated on the basis of weighted average and relative weights. Such solution is advised in the literature concerning logistical customer service (Kauf, Tłuczak, 2018; Woźniak, Zimon, 2016; Detyna, 2011). A quality map, on the other hand, is a technique that enables clear, graphic presentation of the aspects of logistical customer service under study (Woźniak, Zimon, 2016). It allows to identify factors which should be improved immediately, those which improvement of should be considered next, factors on acceptable level and insignificant factors.

Weaknesses of Lubińskie Przewozy Pasażerskie

Lubińskie Przewozy Pasażerskie operate in five municipalities within two districts of the Lower Silesia Voivodship. Bus services connect 52 towns. The buses cover around 2,300,000 vehicle kilometres per year. The carrier's fleet consists of 55 vehicles, with an average age of 5 years.

In the light of the Act of 16 December 2010 on public mass transport, Lubińskie Przewozy Pasażerskie is a district passenger transport service, as it carries people within the framework of public mass transport, operated within the administrative limits of neighbouring districts which have concluded relevant agreement. The operator providing transport services, selected by means of a tender, is PKS Lubin S.A.

Since 1 June 2016, district transport service is provided de facto free of charge to all persons. Three main reasons for introducing free transport are: willingness to improve the quality of citizens' life, supporting the most disadvantaged residents and strengthening the public character of a mass transport. However, despite many initiatives aimed at satisfying the inhabitants of the district and encouraging them to use the transport services, the District Office in Lubin or the transport operator receive complaints. They have been analyzed and pictured with the use of Pareto-Lorenz diagram (tab. 1 and fig. 2).

Table 1.

Numbers of complaints of specific subject and their accumulated values

Subject of complaint	Number of recorded complaints	Percentage of complaints of a given subject	Accumulated number of complaints	Accumulated percentage of complaints of a given subject
Delays and failures of the transit	67	31,9%	67	31,9%
Failure to adapt the timetable to the passengers' needs	67	31,9%	134	63,8%
Inadequate behaviour of a driver	42	20,0%	176	83,8%
Failure to respect the obligation to cover mouth and nose in public transport	11	5,2%	187	89,0%
Non-correlation of bus timetables with passenger trains	9	4,3%	196	93,3%
Carriage of animals and bicycles in vehicles	7	3,3%	203	96,7%
Lack of assistance from the driver when boarding people with disabilities	7	3,3%	210	100%
Σ	210	100%	-	-

Source. Own work.

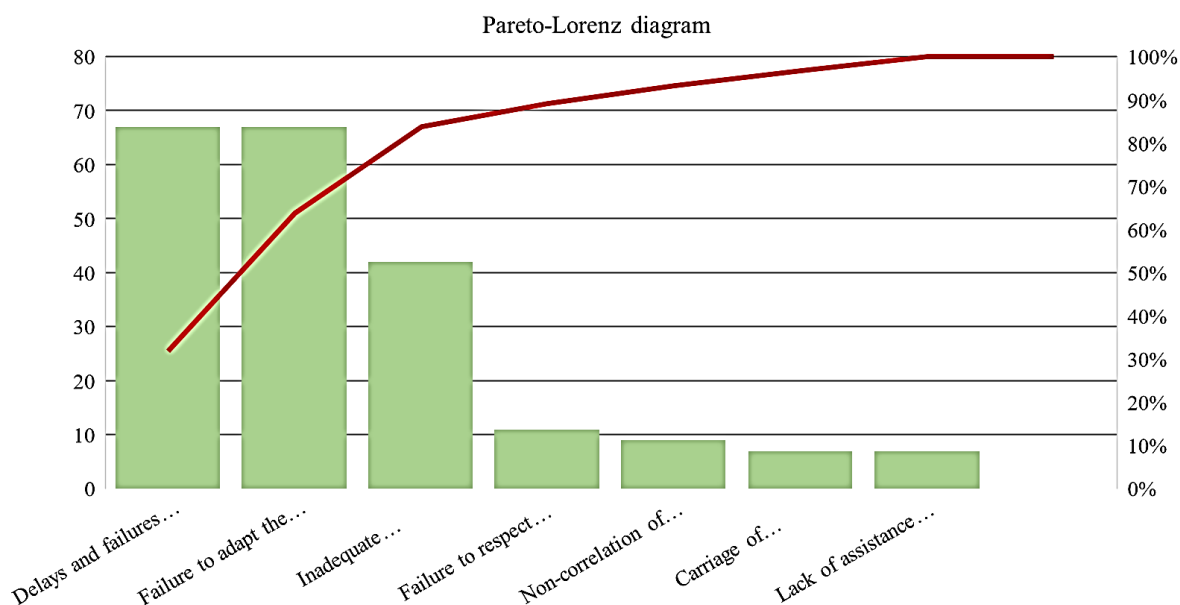


Figure 2. Pareto-Lorenz diagram for the system of Lubińskie Przewozy Pasażerskie. Own work.

The diagram shows that over 83% of passengers' complaints concern 42.9% of the individual complaint categories. Three reasons, i.e. delays and failure of the transit, failure to adapt the timetable to the passengers' needs and an inappropriate driver behaviour, should be included in group A, that is the aspects which the operator should pay special attention to in agreement with the carrier, in order to significantly improve the quality of the service provided.

Group B, that is a set of secondary causes of the complaints, includes: failure to respect the obligation to cover mouths and noses on public transport and to correlate bus timetables with passenger trains. These two categories together account for 9.5% of the recorded complaints.

Remaining two categories of complaints are the source of 6,6% of reported deficiencies and can be included in the group C, that is factors the elimination of which will not significantly improve the quality of transport service within Lubińskie Przewozy Pasażerskie.

Evaluation of the quality level of Lubińskie Przewozy Pasażerskie

For evaluation of the quality level of Lubińskie Przewozy Pasażerskie, the CSI - Customer Satisfaction Index method has been used (Zimon, Kruk, 2015; Skotnicka-Zasadzień, Wolniak, 2008; Tłuczak, Kauf, 2018). The analyses were based on conducted survey research. The first step in the analysis was to systematize collected data, which is shown in Table 2.

Table 2.

Results of the study among people using the buses of Lubińskie Przewozy Pasażerskie

Weighting factor					Results of the study									
1	2	3	4	5	Aspects of logistical customer service									
					Score									
1	2	3	4	5	1	2	3	4	5					
0	4	6	26	55	Cleanliness of the buses					0	9	27	39	16
2	7	13	17	52	Facilities for people with limited mobility					2	5	23	42	19
0	4	16	25	46	Politeness of the drivers					2	9	35	32	13
9	16	26	22	18	Neatness of the drivers' uniforms					1	1	17	39	33
0	1	8	16	66	Safety of travel					0	5	27	35	24
0	2	11	20	58	Travel comfort and the driving style of a driver					3	8	28	35	17
5	7	19	28	32	Ecological vehicles					2	7	18	32	32
2	4	4	5	76	Timeliness of the bus routes					4	18	26	28	15
3	3	4	18	63	Affordable ticket prices and ticket fare					0	2	5	8	76
4	5	5	18	59	Timetable adapted to the passengers' needs					16	19	22	23	11
1	2	7	26	55	Availability of the bus stops					3	12	19	39	18
1	3	5	24	58	Passenger information					1	4	24	40	22
2	4	20	15	50	Integration of public transport and railway passenger services					7	13	25	35	11

Source. Own work.

In the next step, an average weight and an average score for each of the aspects were determined. Weighted averages were used for this purpose and formulas (1) and (2) were used respectively:

$$w_{si} = \frac{\sum_{j=1}^j (n_{ij} \times w_{ij})}{\sum_{j=1}^j n_{ij}} \quad (1)$$

$$o_{si} = \frac{\sum_{j=1}^j (n_{ij} \times o_{ij})}{\sum_{j=1}^j n_{ij}} \quad (2)$$

where:

w_{si} – average weight of i -th aspect,

o_{si} – average score of i -th aspect,

n_{ij} – number of given answers j for i -th criterion,

w_{ij} – possible to indicate j -th weighting factor for i -th criterion,

o_{ij} – possible to indicate j -th score for i -th criterion.

Relative weighting factor for all aspects was then calculated in order to present real weighting factor of importance for each of the logistical customer service spheres studied. Formula (3) was used:

$$\mathbf{w}_{w_i} = \frac{\mathbf{w}_{s_i}}{\sum_{i=1}^i \mathbf{w}_{s_i}} \quad (3)$$

where:

w_{w_i} – relative weight for i -th aspect,

w_{s_i} – average weight of i -th aspect.

The following step was to calculate the CSI using formula (4):

$$\mathbf{CSI} = \sum_{i=1}^i (\mathbf{w}_{w_i} \times \mathbf{o}_{s_i}) \quad (4)$$

where:

CSI – CSI,

w_{w_i} – relative weight for i -th aspect,

o_{s_i} – average score of i -th aspect.

In order to depict the CSI in a percentage form, as to enable its easier interpretation, following formulas were used:

$$\mathbf{CSI}_{max} = \sum_{i=1}^i (\mathbf{w}_{w_i} \times \mathbf{o}_{max_i}) \quad (5)$$

where:

CSI_{max} – maximum CSI,

w_{w_i} – relative weight for i -th aspect,

o_{max_i} – maximum score of i -th aspect.

$$\mathbf{CSI}_{\%} = \frac{\sum_{i=1}^i (\mathbf{w}_{w_i} \times \mathbf{o}_{s_i})}{\sum_{i=1}^i (\mathbf{w}_{w_i} \times \mathbf{o}_{max_i})} \times 100\% = \frac{\mathbf{CSI}}{\mathbf{CSI}_{max}} \times 100\% \quad (6)$$

where:

$CSI_{\%}$ – percentage CSI,

CSI – CSI,

CSI_{max} – maximum CSI.

All calculations using the formulas (1) to (6) are presented in table 3.

Table 3.
Calculating CSI

Aspects of logistical customer service	Average weight of the aspect w_s	Relative weight w_w	Average score of the aspect o_s	$w_w \times o_s$	o_{max}	$w_w \times o_{max}$
Cleanliness of the buses	4.451	0.080	3.681	0.294	5.000	0.400
Facilities for people with limited mobility	4.209	0.076	3.780	0.286	5.000	0.378
Politeness of the drivers	4.242	0.076	3.495	0.266	5.000	0.381
Neatness of the drivers' uniforms	3.264	0.059	4.121	0.242	5.000	0.293
Safety of travel	4.615	0.083	3.857	0.320	5.000	0.415
Travel comfort and the driving style of a driver	4.473	0.080	3.604	0.290	5.000	0.402
Ecological vehicles	3.824	0.069	3.934	0.270	5.000	0.344
Timeliness of the bus routes	4.637	0.083	3.352	0.279	5.000	0.417
Affordable ticket prices and ticket fare	4.484	0.081	4.736	0.382	5.000	0.403
Timetable adapted to the passengers' needs	4.352	0.078	2.934	0.229	5.000	0.391
Availability of the bus stops	4.451	0.080	3.626	0.290	5.000	0.400
Passenger information	4.484	0.081	3.857	0.311	5.000	0.403
Integration of public transport and railway passenger services	4.176	0.075	3.330	0.250	5.000	0.375
Σ	55.659	1		3.709		5

Source. Own work.

As a result, the value CSI on level 3,709, CSI_{max} equal to 5,000 has been obtained. Logistical customer service index totalled 74%. Obtained result informs that there are certain disruptions which are the source of the passengers' dissatisfaction (Skotnicka-Zasadzień, Wolniak, 2008). They have been verified with the use of a quality map (fig. 3).

In the analyses, it has been assumed that a satisfying score is a result equal or higher than 80% of all possible points. Hence the map shows in red a score of 4 and a weighting factor of 4. These values determine specific areas of logistical customer service and indicate where improvements to the transport system should be sought in the first place.

From thirteen examined aspects of logistical customer service, ten of them requires improvements which should be implemented in the nearest future, as they were rated low by the passengers while being given high weighting factors. These aspects include: timetable adapted to the passengers' needs, integration of public transport and railway passenger services, timeliness of the bus routes, politeness of drivers, availability of the bus stops, travel comfort and the driving style of a driver, cleanliness of the buses, facilities for people with limited mobility, safety of travel, passenger information. Ticket prices and ticket fare, both in terms of score and weight, have been classified on a high level. This is due to the free provision of transport.

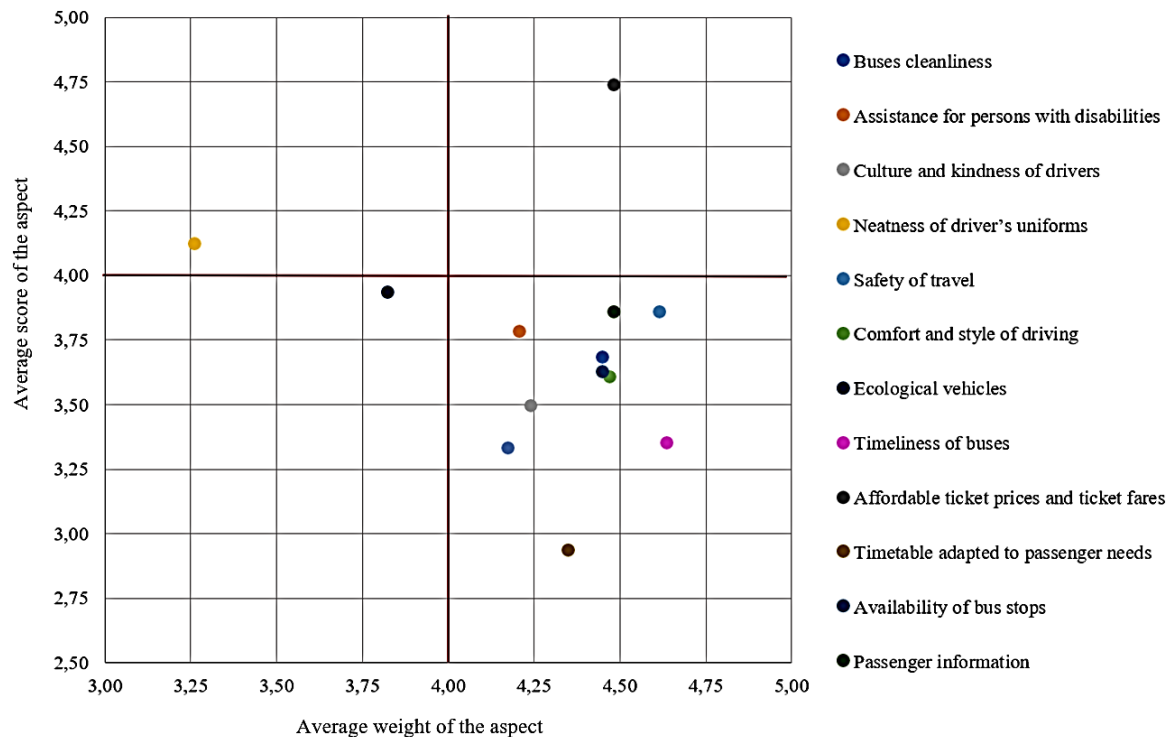


Figure 3. Quality map for the system of Lubińskie Przewozy Pasażerskie. Own work.

The environmentally friendly nature of vehicles is the area where improvements should be sought next. However, considering the fact that the carrier has just purchased vehicles fuelled by a CNG and that these have gradually begun to displace diesel buses, the result should not give cause for concern. The aspect of passenger satisfaction that receives the least attention and is therefore of little importance is the neatness of the drivers' uniforms.

Perspectives for improving the quality of the public transport system in Lubin district

Conducted research and analyses of obtained results allowed to identify areas which require improvements. Considering the importance of specific aspects determined when examining the level of logistical customer service, as well as possible effects of introduced changes, it is suggested to focus primarily on:

- deepening the integration of district transport with rail transport,
- adapting timetables to the needs of the passengers,
- diversification of the available vehicle fleet.

The progressive integration of bus and rail services should be considered as a key factor in proposing improvements. The reason behind this choice is the fact that the notion of integration of various transport systems appears in every conducted study, passengers while determining satisfaction evaluated this category with the second lowest score, whereas changes in this matter

can bring the results in the form of more efficient cooperation between carriers of various transport branches and improvement of provided services. Suggested solution should include both collective planning and connecting the passenger information.

Another identified area in which the improvement should be made is the adaptation of timetables to the needs expressed by the transport passengers. Both the analyses of complaints and the results of survey study indicate that the buses repeatedly leave the stops earlier than the passenger train arrives at Lubin station. The result is having to wait for the next transit and, in extreme cases, not being able to use bus services to suburban areas. For this purpose, it is proposed to create a passenger platform for Lubińskie Przewozy Pasażerskie. The platform would take the form of a website, a link to which would be placed on the website of the carrier *pks.lubin.pl* and on the website of the organizer *powiat-lubin.pl*. The platform could be used to submit, using pre-designed forms, not only objections to the introduced timetable, but also the proposals of opening new bus stops or bus lines, as well as complaints about provided services. Creation of a single website would make the process of collecting passengers' remarks more efficient and would allow to continuously improve various areas in the functioning of Lubińskie Przewozy Pasażerskie. In addition, such platform would enable direct impact of the citizens on the functioning of public transport which could ultimately contribute to increasing the popularity of public transport in the district.

The last proposal for improving the mass transport system in the Lubin district area is using diversified types of buses by PKS Lubin S.A. operator. Diversification means buying or leasing more mini (up to 10 metres in length) and mega (up to 18 metres in length) vehicles. Currently the lines are operated mostly by un-articulated 12-metre buses and, in a survey conducted, passengers complain about insufficient space in the vehicles. It has also been noticed that in case of suburban lines, the buses on less busy lines run virtually empty.

Before investing a big amount of money into new means of transport, it is worth to at least conduct test drives with the use of few previously hired vehicles. During the aforementioned test drives, the bus occupation should be measured. This examination would be aimed at indicating on which lines and especially at what time of the day bigger (or smaller) buses should be used.

Summary

Public transport is an extremely complex research problem in modern cities. At the same time, it is a critical issue due to the part it plays in the functioning of the cities. Considering the fact that the public transport offer should be adjusted to the needs of local communities, there is a need for case studies describing what is being done in individual municipalities and districts so that other cities can benefit from good practice in this area.

The research described in this paper addresses these needs. It identifies positive aspects of the offer of Lubińskie Przewozy Pasażerskie, including free public transport, its sustainability and neatness of the drivers which makes for the good image of the company. The most frequent complaints received by the District Office in Lubin concern delays and failure of transit, failure to adjust the timetable to the needs of passengers (32% of the total number of complaints). Passengers complain to a lesser extent about an inappropriate behaviour of the driver, as well as the failure to correlate the bus timetable with passenger trains. Calculated logistical customer service index CSI totalled 74% which indicates overall passenger satisfaction, however there is a need to improve certain aspects of the service of Lubińskie Przewozy Pasażerskie. Results of the research presented in this paper recommend to the public transport organizer in Lubin such improvements as: deepening the integration of district transport with rail transport, adjusting the timetable to passengers' needs and diversifying the available vehicle fleet. Suggested actions should contribute to the project services being provided at the level expected by passengers.

References

1. Brdulak, H., Kauf, S., Szoltysek, J. (2016). *Miasta dla pieszych. Idea czy rzeczywistość*. Warszawa: Texter.
2. Chodyński, A. (2019). Wykorzystanie dorobku nauk o zarządzaniu na rzecz podnoszenia bezpieczeństwa miast. Koncepcja smart. *Bezpieczeństwo. Teoria i Praktyka*, No. 4, pp. 39-62.
3. Desroches, R., Taylor, J.E. (2018). The promise of smart and resilient cities. *Bridge*, Vol. 48, No. 2, pp. 13-20.
4. Detyna, B. (2011). *Zarządzanie jakością w logistyce. Metody i narzędzia wspomagające. Przykłady, zadania*. Wałbrzych: Wydawnictwo Uczelniane PWSZ im. Angelusa Silesiusa w Wałbrzychu.
5. Ej dys, S. (2014). *Optymalizacja miejskiego transportu zbiorowego na przykładzie miasta Olsztyna* (Rozprawa doktorska). Białystok: Uniwersytet w Białymstoku, Wydział Ekonomii i Zarządzania.
6. Elmqvist, T., Andersson, E., Frantzeskaki, N., McPhearson, T., Olsson, P., Gaffney, O., Takeuchi, K., Folke, C. (2019). Sustainability and resilience for transformation in the urban century. *Nature Sustainability*, Vol. 2, No. 4, pp. 267-273.
7. Grondys, K., Kott, I., Sukiennik, K. (2017) Funkcjonowanie polskich miast w dobie zrównoważonego rozwoju z punktu widzenia transportu. *Zeszyty Naukowe Politechniki Częstochowskiej, seria: Zarządzanie*, Vol. 25, No. 1, pp. 237-245.

8. Jonek-Kowalska, I. (2018). Kondycja finansowa jednostek samorządu terytorialnego jako determinanta rozwoju inteligentnych miast w Polsce. *Zeszyty Naukowe Politechniki Śląskiej, seria: Organizacja i Zarządzanie, No. 120*, pp. 131-140.
9. Kauf, S., Thuczak, A. (2018). *Logistyczna obsługa klienta. Metody ilościowe*. Warszawa: PWN, p. 188.
10. Liu, T., Ceder, A., Bologna, R., Cabantous, B. (2016) Commuting by customized bus: A comparative analysis with private car and conventional public transport in two cities. *Journal of Public Transportation, 19(2)*, pp. 55-74.
11. Rasca, S., Saeed, N. (2022) Exploring the factors influencing the use of public transport by commuters living in networks of small cities and towns. *Travel Behaviour and Society, 28*, pp. 249-263.
12. Sienkiewicz-Małyjurek, K (2010) Management of city public safety. *Ekonomika i Organizacja Przedsiębiorstwa, Nr 8*, pp. 3-11.
13. Sienkiewicz-Małyjurek, K., Szymczak, M. (2011). Wyniki badań źródeł informacji o transporcie zbiorowym w mieście. *Transport Miejski i Regionalny, No. 6*.
14. Skotnicka-Zasadzień, B., Wolniak, R. (2008). *Wybrane metody badania satysfakcji klienta i oceny dostawców w organizacjach*, Gliwice: Wydawnictwo Politechniki Śląskiej.
15. Skowron, K., Cheba, D. (2019) Diagnostic assessment of MZK Tychy's customer service level. *Kwartalnik Naukowy Organizacja i Zarządzanie, nr 2*, pp. 131-141.
16. Sosik, K. (2020) Współczesne miejskie systemy transportowe w kontekście zrównoważonego rozwoju w Polsce. *Zeszyty Naukowe Politechniki Częstochowskiej, Zarządzanie, No. 39*, pp. 49-63.
17. Szoltysek, J. (2007). *Podstawy logistyki miejskiej*. Katowice: Wydawnictwo Akademii Ekonomicznej w Katowicach.
18. Szoltysek, J. (2016). *Logistyka miasta*. Warszawa: PWE.
19. Szulc, T., Krawczyk, G., Tchórzewski, S. (2021) Models of delivery of sustainable public transportation services in metropolitan areas-comparison of conventional, battery powered and hydrogen fuel-cell drives. *Energies, vol. 14, no. 22*, 7725.
20. Szymczak, M. (2008). *Logistyka miejska*. Poznań: Wydawnictwo Akademii Ekonomicznej w Poznaniu.
21. Szymczak, M., Sienkiewicz-Małyjurek, K. (2011). Information in the city traffic management system. The analysis of the use of information sources and the assessment in terms of their usefulness for city routes users. *LogForum, Vol. 7, No. 2*, pp. 27-50.
22. Tundys, B. (2008) *Logistyka miejska*. Warszawa: Difin.
23. Ustawa z dnia 16 grudnia 2010 r. o publicznym transporcie zbiorowym, Dz.U. 2011 nr 5, poz. 13 (2011).
24. Ustawa z dnia 8 marca 1990 r. o samorządzie gminnym, Dz.U. 1990, nr 16, poz. 95 (1990).
25. *World Urbanization Prospects: The 2014 Revision*. Available online <https://population.un.org/wup/publications/files/wup2014-report.pdf>, 21.01.2022.

26. Woźniak, J., Zimon, D. (2016). Zastosowanie metody CSI do badania satysfakcji konsumentów na przykładzie wybranej sieci handlowej. *Modern Management Review*, Vol. 23, No. 3, pp. 219-228.
27. Zimon, D., Kruk, U. (2015). Wykorzystanie metody CSI do badania logistycznej obsługi klienta na przykładzie wybranej organizacji. *Logistyka*, No. 3, pp. 5094-5101.
28. Żebrucki, Z., Kruczek, M., Nieszporek, E. (2020) Customer satisfaction survey of urban public transport. *Zeszyty Naukowe Politechniki Śląskiej. Organizacja i Zarządzanie*, nr 145, pp. 685-699.