
Bus Service Lines as a Driver of the Regional Bus Transport Availability

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Abstract:

Purpose: The paper presents the impact of changes in the length of bus transport lines in Poland on the regional availability of public transport services.

Design/methodology/approach: The temporal analysis takes into account the period dating back to 2000-2020. The studied period saw a significant reduction in the length of bus transport lines in Poland, which should be combined with the socio-economic changes that happened in Poland after 1989. This situation was influenced by a number of factors: the transformation into market-oriented economy, a change in the rules of bus transport organisation, growing role of transport user preferences, a change in the transport behaviour of population and growing access to passenger cars.

Findings: The paper is theoretical and empirical in nature. The theoretical layer presents a review of scientific achievements concerning the role played by the public transport in socio-economic development and an assessment of the transformation of bus transport segment in Poland. The empirical layer presents changes in the length of transport lines as well as a spatial and demographic assessment of the density of bus transport lines in Poland. On this basis, a weighted average index reflecting changes in the availability of bus services in Poland was determined. The calculations were presented for the 2000-2020 period, by country and region.

Practical implications: The reduction of the number of transport lines and their length affects the operation of localities in Poland. Above all, it results in reduced availability of transport services for local communities. This has a negative impact from the social perspective, limiting mobility opportunity for persons deprived of access to passenger cars. Negative consequences are also connected with the economic and environmental dimension (higher environmental costs).

Originality/Value: To date no mechanisms have been developed in Poland to limit the negative consequences of limiting the supply of bus transport services. This is particularly disadvantageous for younger population (in Poland for high school and university students), the elderly and those deprived of an option to use passenger cars.

Keywords: Bus service lines, regional bus, transport availability.

JEL codes: R410.

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1. Introduction

The model of state development adopted in Poland after 1989, was associated, inter alia, with the reduction of interference with socio-economic processes. This laid the foundations for the development of a market-oriented economy, but due to its nature, limited the state's involvement in the real sphere of the market, including support for economic entities from public funds. Importantly enough, the social perception of transport changed. It was no longer treated as a public service.

The process of systemic transformation was related, inter alia, to the public transport sector, including bus transport². Market-oriented changes led, inter alia, to the commencement of the process of adapting the transport service offer by transport players to the transport needs of the population and the appearance of new market entrants. However, market-oriented players discontinued delivering transport services on non-profitable routes, thus limiting the availability of transport services.

This paper's objective is to present the impact of changing length of bus transport lines on the level of availability of transport services at the national and regional levels. Key to the analysis was the calculation of demographic and spatial density indicators and sustainability index. The scope of analysis covered the 2000-2020 period.

2. Public Transport Role Played in the Socio-Economic Development

The role of bus transport is evidenced by such general terms as the "bloodstream" of the general population and the economy (Grzywacz and Burniewicz, 1989) or the "load-bearing foundation" of the economy (Pawłowska, 2013). Bus transport can be characterised by the functions it performs. The primary functions are related to social and economic development.

In the social sense, it ensures territorial cohesion and, by securing mobility it conditions the standard of living of population by fulfilling their natural demand for mobility, social satisfaction and also reduces social exclusion (Załoga, 2013). From the economic perspective, it is an essential condition for satisfying transport requirements, taking into account the spatial distribution of settlement centres and the need to cover distances for various purposes (Domańska, 2004).

The development of public transport in the context of individual transport has different objectives. In urban areas, it is related to reducing the negative impact of

²Bus transport is understood as passenger transport organised and operated by transport undertakings; this does not include passenger transport by urban transport. Unlike urban transport companies, bus transport companies do not receive any support to their transport services (subsidised transport services) or for the purchase of new car park. Instead, they receive funds related to the reimbursement of statutory allowances.

passenger cars on the quality of life of the population. In the rural areas and outermost regions, it is connected with securing mobility capabilities for people who do not have their own cars or are unable to use them.

It should be noted, however, that for part of the population even a well-developed public transport network is not a rationale for limiting the ownership and use of individual transport. As noted by W. Paprocki, for this category of population other facilities that influence the choice of individual motoring are important, e.g., transport of prams for children, sports equipment etc., (Paprocki, 2015).

Thanks to the development of public transport, including bus transport in towns and cities, and the simultaneous application of tools that make it less attractive to use individual transport (e.g., financial, legal tools), it has been possible to inhibit the growth of automotive sector (which has taken place since the 1950s) and in a few cases (large metropolia in the Western European countries) even to reduce it.

This, however, required the development of public transport systems that guarantee the movement of people at the right quality level (fast, comfortable, with access to information). Public collective transport can be competitive with individual means of transport in many respects (especially in terms of time and safety).

The degree of development of public transport services, as an alternative to individual motoring, has an impact on mobility patterns. It is conditioned by the service offer, which is influenced by the number and quality of transport services. This approach requires attention to changes in the demand for passenger transport services (System transportowy, 2015) and the preferences of transport service users.

In the transport service market, service quality characteristics such as availability, punctuality, safety, journey time, connection ability, information, travel comfort are becoming important, with continued focus on price. Ensuring the preferred quality characteristics depends on transport development.

The reduction of the length and number of transport lines causing a lack of capacity to meet mobility needs, which in turn leads to a decline in the range of transport services offered by passenger transport operators and contributes to the development of social exclusion (Preston and Raje, 2007; Stanchev and Menaz, 2003). It causes negative consequences such as a deterioration in quality of life, financial status, reduced opportunities for self-development, constrained selection of goods, products and jobs (Kenyon, Lyons, and Rafferty, 2002).

Reduced mobility caused by limited access to public transport services has negative social impacts. It can contribute to a large extent to the emergence and deepening of social divisions, especially as a result of reduced availability of such areas as education, health or labour (Sustainable Urban...2000). In addition, limiting access to public transport forces a change in daily mobility pattern. This affects, inter alia,

rural area population, for whom the decommissioning of transport lines (bus and rail) has had a negative impact on spatial mobility (Społeczne skutki...). The social exclusion affects children and young people the most, as well as the elderly and the single persons, especially those without a driving licence and without a car.

To sum up the bus transport services are associated with the on-going and uninterrupted satisfaction of residents' transport needs. They perform a number of important social, economic and environmental tasks. The main ones, taking into account the concept of transport availability, include ensuring access to products and services, preventing social exclusion, reducing congestion in car transport, economic and functional activation of areas, ensuring a higher level of safety, better utilisation of energy resources, less environmental pollution, better utilisation of space.

3. Evaluation of the Bus Transport Operation in Poland

The current shape of the bus transport organisation in Poland was influenced by the liberalisation and deregulation processes taking place since the early 1990s. They were related to the introduction of market-oriented economy. Competition in the bus transport service market in Poland, in the initial phase of liberalisation, can be assessed as fierce. The newly emerging transport operators were most often competing on low prices and the practice of delivering transport services to the passenger outside the bus stops or journey time not in line with the timetable. Unfortunately, the cut-throat competition was not correlated with a rise of transport service quality (Kołodziejski and Wyszomirski, 2011).

The offer of new car transport operators was targeted at highly profitable market segments. At the same time, new entrants tried hard to minimise their operating costs. This included reducing the costs associated with point-to-point transport infrastructure. The burden of maintaining the point infrastructure, the development of the information system, customer service offices (bus terminal ticket offices) was reduced. This enabled these operators to offer price-competitive transport services vis-a-vis incumbents, who in turn could upkeep non-profitable lines to a smaller and smaller extent.

The changes in bus transport in Poland also involved the restructuring process. The restructuring process concerned state-owned bus transport enterprises - PKS. At the end of the 1980s, the PKS enterprise consisted of four independent units (based in Koszalin, Warsaw and Olsztyn, as well as National State-Owned Automobile Transport Company and 233 executive units. In the initial period, transformations involved primarily commercialisation (setting up of joint stock companies solely owned by the State Treasury) or direct privatisation.

Transformations looked different in individual enterprises and involved liquidation of enterprises, handing over to an employee-owned company for use against payment (employee lease), sale to third party domestic or foreign investors

(privatisation), handing over for use free of charge to district or provincial governments (municipalisation) (Taylor and Ciechański, 2010).

The liberal approach to bus passenger transport, results in only those lines being operated by carriers, which are profitable. The reduction of the transport service offer on non-profitable lines results in a lower degree of availability to public transport services for the general public. In practice, this applies to the areas with low or mixed demand for passenger transport services.

4. Analysis of Changes in the Structure of Bus Routes in Poland between 2000 and 2020

The length of bus transport lines in Poland follows a declining trend (Table 1). The reduction the bus line length and their number results in an enlargement of the area without access to bus transport. This situation has a negative impact on the availability of transport services, which has definitely deteriorated.

Table 1. *Changes in the length and number of bus transport lines in Poland between 2000 and 2020*

Item	2000	2010	2020	2020:2000
Length of bus routes ('000 km)	1248.4	1000.5	480.0	- 63%
Number of bus routes (in thousands)	28.1	19.6	10.2	-61%

Source: *Own analysis: Transport – wyniki działalności 2000-2020, GUS, Warszawa 2001-2021.*

According to the data presented in Table 1, in Poland between 2000 and 2020 both the length and number of bus transport lines declined significantly, overall by more than 60%. At the same time, it should be emphasised that the decline rate was much higher between 2010 and 2020.

Based on their length, bus routes can be divided into: urban, suburban and regional. Urban and suburban bus routes (length up to 50 km) are decisive in satisfying the needs of daily commuting to work and places of education. In practice, the distance, in terms of journey time, does not exceed 1 hour. Changes in the length of the different types of transport lines in Poland, taking into account their length, are shown in Table 2.

According to the data presented in Table 2, the downward trend in the different bus route categories in Poland continues. Among the distinguished ones, the greatest decline was recorded in the category regional and city routes. The decline in the number and length of bus routes varied and the breakdown of individual categories of bus routes totalled to: regional routes approx. 75%, suburban routes approx. 60%, urban routes approx. 90% respectively. In the case of urban routes, the transport needs of the general public can be satisfied by the urban transport (if any). Regional

transport users are at a disadvantage, as they have to use their passenger cars, if the bus routes are decommissioned.

Table 2. Changes in the length and number of urban suburban and regional bus routes in 2000- 2020

Item		2000	2010	2020	2020:2000
Urban routes	Number ('000)	1	0.2	0.1	-85%
	Length ('000 km)	14.5	2.9	1.4	-90%
Suburban routes	Number ('000)	20.8	15.	8.4	-60%
	Length ('000 km)	662.7	474.1	274.2	-59%
Regional routes	Number ('000)	5.6	3.5	1.8	-75%
	Length ('000 km)	417.7	276.5	94.7	-77%

Source: Own analysis: *Transport – wyniki działalności 2000-2020*, GUS, Warszawa 2001-2021.

In Poland, higher motoring rates and households with a passenger car persist in non-urban areas (*Dochody i warunki życia...2019*). In urban areas, the percentage of households owning a passenger car is 62%, decreasing as the city grows. By contrast, in non-urban areas, nearly $\frac{3}{4}$ of households own a passenger car.

With the decrease in the number and length of communication lines, a decrease in the number of buses used by bus transport in Poland is correlated. In 2020, transport routes were served by more than 12,500 buses with a total number of passenger seats of more than 700,000. It should be noted that $\frac{2}{3}$ of buses complied with the Euro 3 standard, but only 38 buses used alternative fuels. The structure is dominated by buses with more than 23 seats (*Transport...2021*).

5. The Impact of Changes in the Length of Transport Lines on the Bus Transport Availability in Poland

The research methodology for determining changes in transport availability level in the regions influenced by the length of transport lines comprised two indices:

1. Spatial density index taking into account the length of transport routes and the area (of the country and of the provinces),
2. Demographic density index taking into account the length of transport routes to the number of inhabitants of the region (country and provinces)

Changes of the spatial and demographic density indices of bus service routes are shown in Table 3.

Deterioration of the spatial and demographic density indices of bus routes has an impact on the limited availability of bus services. However, it should be noted that regionally, the largest decrease, regardless of the type of density, was recorded in the Małopolskie and Śląskie Provinces. This indicates that with the overall decline of

availability of bus transport services in Poland, the limitations are the highest in these two provinces. Relatively smaller limitations in availability to bus transport services apply to the Mazowieckie and Opolskie Provinces.

Table 3. *Changes in the spatial and demographic density indices of bus service routes in Poland in 2000-2020*

item	spatial density (length of bus lines in km (/100 km ²))			demographic density (length of bus lines in km/1000 inhabitants)		
	2000	2010	2020	2000	2010	2020
Polska	426,2	344,83	165,5	84,02	67,43	31,25
Dolnośląskie	570,62	446,33	169,49	121,39	94,27	32,61
Kujawsko-pomorskie	380,12	666,67	204,68	82,49	141,79	40,98
Lubelskie	601,66	348,55	128,63	121,34	71,31	27,60
Lubuskie	381,68	244,27	122,14	139,66	87,91	45,07
Łódzkie	341,18	294,12	135,29	62,77	54,47	25,03
Małopolskie	518,52	140,74	37,04	43,59	11,50	2,82
Mazowieckie	393,39	402,40	174,17	72,10	73,42	30,07
Opolskie	395,35	162,79	162,79	67,06	28,17	30,63
Podkarpackie	620,48	271,08	210,84	81,88	35,66	28,16
Podlaskie	281,25	244,79	140,63	106,51	94,95	58,82
Pomorskie	447,67	261,63	127,91	111,43	62,24	25,4
Śląskie	752,94	564,7	129,41	64,52	47,95	10,41
Świętokrzyskie	500,00	372,73	81,82	77,03	57,99	13,47
Warmińsko-mazurskie	208,51	238,30	55,32	84,92	96,72	22,41
Wielkopolskie	315,60	184,40	106,38	62,76	35,74	18,53
Zachodniopomorskie	383,18	317,76	154,21	157,69	129,03	61,68

Source: Own analysis based on: Results of transport operations.

The road infrastructure demographic and spatial density indices can be used for comparative evaluation of one characteristic - the length of roads per area or specific population. The above indices can be used for a more sophisticated analysis involving the calculation of the weighted average density index (Table 4)³.

The main effect of shrinking length and declining number of bus transport lines is declining density of the average weighted index of bus lines in Poland, which results in deteriorating availability of public transport services throughout the country. This is particularly burdensome for people without access to passenger cars, the elderly

³The weighted average density index takes account of spatial and demographic density. It is the quotient of the length of the network (e.g., road network) and the square root of the product of the surface and population of the studied area. This is discussed in more detail in W. Grzywacz, *Infrastruktura transportu, WKiŁ, Warszawa 1982.*

and those who for various reasons cannot use passenger cars, e.g. due to age or lack of driving license.

Table 4. Changes of the weighted average density index in 2000-2020.

item		Dolnośląskie	Kujawsko-pomorskie	Lubelskie	Lubuskie	Łódzkie	Małopolskie	Mazowieckie	Opolskie	Podkarpackie	Podlaskie	Pomorskie	Śląskie	Świętokrzyskie	Warmińsko-mazurskie	Wielkopolskie	Zachodniopomorskie
weighted average density	2000	0,83	0,56	0,85	0,73	0,46	0,48	0,53	0,51	0,71	0,55	0,71	0,70	0,62	0,42	0,46	0,78
	2010	0,65	0,97	0,50	0,46	0,40	0,13	0,54	0,21	0,31	0,48	0,40	0,52	0,46	0,48	0,26	0,64
	2020	0,24	0,29	0,19	0,23	0,18	0,03	0,23	0,22	0,24	0,29	0,18	0,12	0,10	0,11	0,14	0,31

Source: Own analysis based on: Results of transport operations.

6. Conclusion

Bus transport is an important factor in improving the quality of life of the population in economic, social and environmental terms. As a tool, it serves the concept of sustainable development. As a service of general interest, its operation depends primarily on being subsidised by the public authority.

The shrinking transport service offer in Poland, for a part of the population, which does not have individual means of transport, represents a significant problem in terms of their mobility. It results in the lower and lower satisfaction of transport needs (transport exclusion) of a part of population, social cohesion and, as a consequence, social exclusion. From the social perspective, transport services safeguard territorial cohesion and, by ensuring mobility, drive the standard of living of citizens by fulfilling the natural need for mobility, social satisfaction, they also help to curtail social exclusion phenomenon.

Bus transport is also a key economic development driver. Therefore, it is also important to look from the perspective of the benefits that bus transport development can bring at the regional level. Its efficiency boosts the development of the region thus enhancing regional competitive edge, innovation, the inflow of new investments (e.g., FDI), but also the retention of existing businesses.

The statistics shows that the reduction of bus transport service offer in Poland is large, although regionally differentiated. This is reflected in a decline in the number of passengers carried, but also stimulates the growth of individual motoring.

To sum up, bus transport services promote social, economic and environmental development. However, their maintenance, in the light of their deficit generating nature, requires subsidies, in the areas where their delivery is unprofitable for bus operators. This is based on the assumption of developing equal access to public transport for the general public.

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