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DEVELOPMENT OF PUBLIC TRANSPORT IN RURAL AREAS IN POLAND: THE EXAMPLE OF THE ŚLUPSK DISTRICT

Summary. The paper addresses the development of public transport (PT) in rural areas in the context of the implementation of the Mobility-as-a-Service (MaaS) concept. This paper aimed to indicate whether and how rural areas can use the MaaS concept to develop PT and improve transport accessibility. The financing model for the operation of collective PT in the example of Poland was analysed. The case study Pomeranian Voivodeship was selected due to the strong influence of the Tri-City agglomeration, which does not directly include western parts of the region such as Ślupsk County. Several research methods were used: desktop research, case study and GIS analysis. The results highlight that the MaaS concept has the potential to be implemented in rural areas; however, this will be a long-term process and will require advanced cooperation between local authorities, private operators and service providers. This process is dependent on measures being taken to support the use of MaaS at a national level. From the inhabitants' perspective, such changes are a positive direction for PT.

1. INTRODUCTION

Countries included in Central and Eastern Europe (CEE) are characterised by a lower level of development than Western European countries, which are defined as developed countries [1]. These countries include Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia and the three Baltic states of Estonia, Lithuania and Latvia. The inadequate development of road and rail infrastructure is compensated for by numerous projects implemented mainly with the support of the European Union, e.g. the development of the TEN-T road network. Socio-economic development is crucial for CEE countries due to the unification of the internal structures of the EU, especially the standard of living of its inhabitants.

Transport and, in particular, the construction of new and the modernisation of existing infrastructure play important roles in this process [2]. Investing in public transport (PT) can have positive direct and indirect effects. The first ones relate to getting around an area faster and more efficiently, while indirect effects include increased attractiveness and competitiveness. Developed countries are characterised by a well-developed road infrastructure (Fig. 1). CEE countries have significantly relatively few kilometres of roads per 100 km², which may contribute to the regression in the socio-economic development of this part of Europe.

Currently, the road network is more developed than other elements of the grey infrastructure due to the high popularity of passenger cars and the transport of cargo mainly by road [4]. A similar situation

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can be observed in the length of railway lines, as CEE countries have a significantly lower length of railway lines than developed countries (Fig. 2).

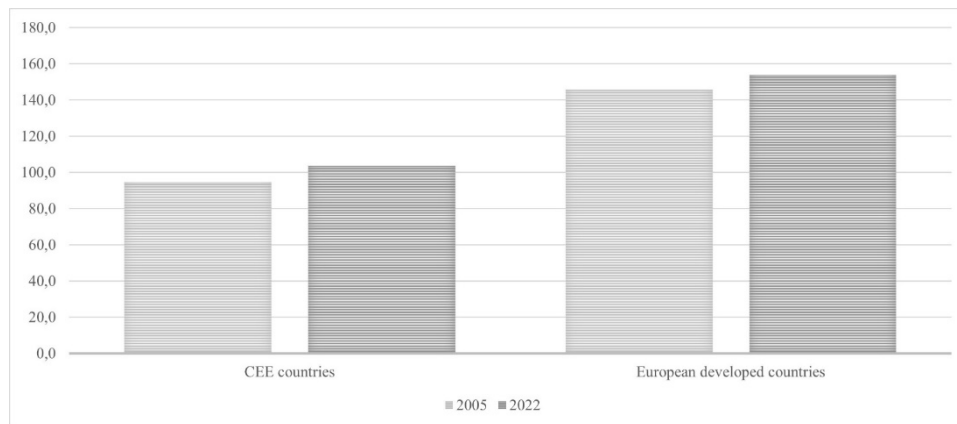


Fig. 1. Total length of roads in developed and CEE countries [million km per 100 km²]. Source: [3]

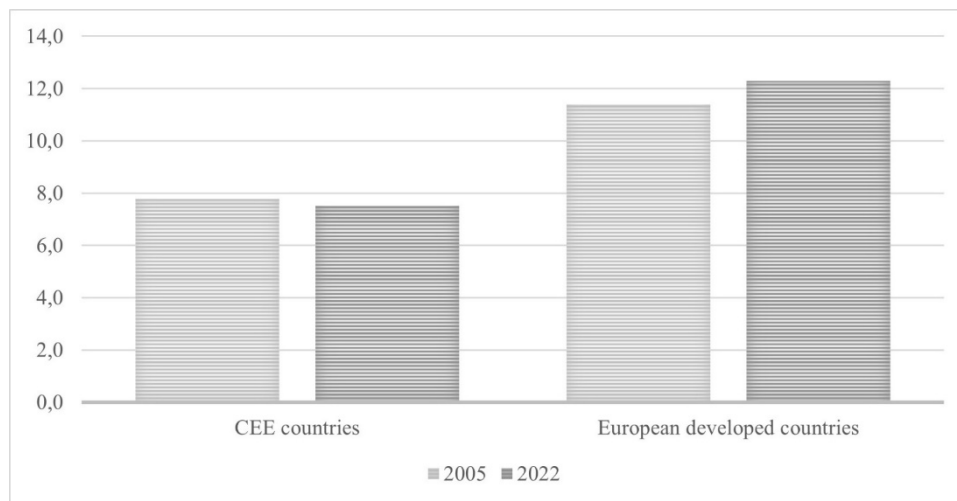


Fig. 2. Total length of railway lines in CEE countries and developed countries [thousand km per 100 km²]. Source: [3]

The road and rail infrastructure in CEE countries is at a lower level of development compared to Western countries, which significantly limits the accessibility of transport for inhabitants of rural areas and small towns [5]. In 2006, the World Bank highlighted the relationship between place of residence and accessibility to transport by introducing the Rural Accessibility Index (RAI) [6]. The index value shows the extent to which rural residents have access to transport infrastructure (roads). It also reduces factor mobility, which reduces economic growth. Therefore, there is a need to implement mechanisms to reduce the development gap between countries.

CEE countries face many challenges due to historical circumstances, which have led to the development of different cultural and social patterns. After the transformation phase, a process of convergence, or 'catching up' with developed countries, began [6]. This required transformations at the organisational and administrative levels. Currently, however, CEE countries face broadly similar challenges to other European countries. These challenges include climate change, ageing populations and urbanisation problems such as suburbanisation and de-urbanisation. In the long term, CEE countries will be affected by population ageing and a reduction in the number of inhabitants (Fig. 3).

Projections indicate that more of the ageing population will decline in CEE countries. In 2100, there will be almost 30 million fewer people in these countries, while the population in EU countries will decrease by 25 million inhabitants. The projection indicates that CEE countries are at a much higher

risk of depopulation. This will have an impact on the public transport sector, which will have to be adapted to the needs of older people, often with reduced mobility [7].

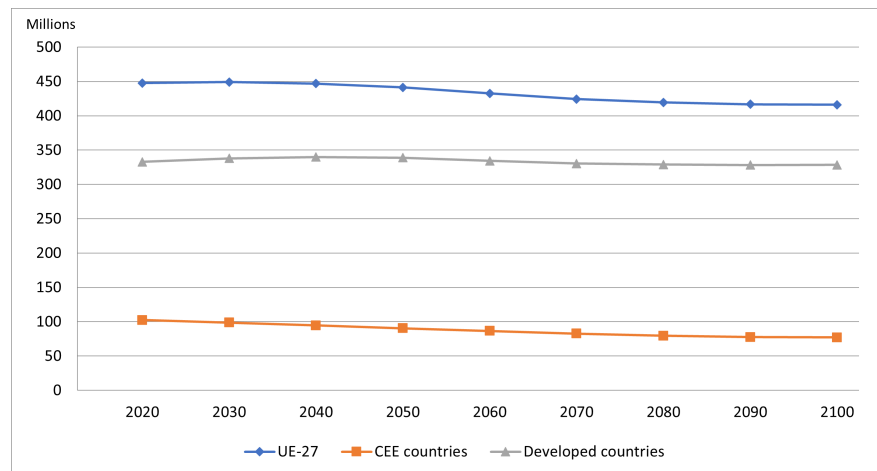


Fig. 3. Population projections to 2100 for developed countries, CEE countries and EU countries. Source: [3]

The social and economic situation of CEE countries is good in comparison to the rest of the continent but requires increased financial, administration system and organisational measures, including the formulation of appropriate transport policies. An opportunity for the region may lie in the implementation of innovative environmental solutions, thus becoming a leader in decarbonisation. Due to the underdevelopment of the transport sector, it is possible to 'skip' the stages that the developed countries of Western Europe have gone through. For this, appropriate tools in the form of a transport strategy or plans and regulations at the national level are required. Indeed, there is a close relationship between socio-economic development and the degree of infrastructure development [8].

Against the background of CEE countries, Poland plays a key role both economically, politically and culturally in the region. The most important means of PT in Poland is buses. Cities are investing in expanding their bus fleets, modernising routes or introducing new technologies. Bus lanes are increasingly being introduced to accelerate bus journeys and, thus, encourage people to switch from car to PT. Rail also plays an important role. Operators offer both intercity and regional connections. Investments have been made in the modernisation of railway stations, the upgrading of railway lines and the purchase of new trains. In recent years, Poland has also seen the emergence of innovative solutions in PT, such as urban bicycle systems, car-sharing and electric scooters.

The general picture of PT in Poland presented here concerns mainly urban areas. It should be noted, however, that despite the considerable development of PT, Poland still faces major challenges concerning infrastructure and organisation of transport systems, especially in its suburbs. These include smaller towns, towns with declining socio-economic functions, towns threatened with permanent marginalisation, former voivodship towns which lost their status during the political changes of the 1990s and rural areas. This case study was conducted to analyse the issue of transport development and identify possible directions of its development towards new mobility concepts.

2. RESEARCH METHODOLOGY

The main methods used in this study include the case study method, desktop research and geographical information systems (GIS) analysis. The study began by collecting qualitative and quantitative data on regional public transport in CEE countries, including Poland. Qualitative data included scientific publications, reports and strategic and planning documents, while quantitative data included statistics from Eurostat [3] and the Central Statistical Office as well as spatial data from the national database: Database of General Geographical Objects (BDOO) (Geoportal). Both qualitative and

quantitative data provided a thorough insight into the state of regional public transport operations, while spatial data allowed accessibility analyses to be carried out using GIS tools (ArcGIS Pro).

The county of Slupsk, which is located in the Pomeranian Voivodeship, was selected as the subject of the analysis. This district had the status of a voivodeship before the national administrative reform of 1990, and the city of Slupsk was its capital. This shows that the most important services of the region and the core of development were located in Slupsk. After the reform, Slupsk County was incorporated into the Pomeranian Voivodeship, thus becoming the westernmost county in the region. As a result of the political transformation, the functions of the Slupsk centre weakened in favour of, among others, the Tri-City. The Slupsk administrative district is also located in what is known as Central Pomerania. This area is among the most excluded areas in the country in terms of transport, including social transport [9, 10]. The literature review highlights that studies on this case are insufficient, especially in the area of transport accessibility.

An important element of the study was the analysis of strategic documents, planning documents and local legislation at the level of individual municipalities in the Slupsk district, in terms of financing public transport on a regional basis. This made it possible to identify the main development objectives relevant to improving passenger transport. In addition, a review of the development strategy was carried out in terms of factors and conditions for the functioning of public transport, including various forms of micromobility, cycling and walking. An analytical matrix was used for this purpose.

The final element of the study was the formulation of development directions for the sustainable development of regional public transport for the study region.

3. PUBLIC TRANSPORT IN SHAPING REGIONAL DEVELOPMENT

Regional PT is organised by local government units, which are also responsible for its planning and management [11]. This can be either a municipality, a district or a province. However, due to high costs, PT is often organised within inter-municipal unions, which allows for adequate funding as well as the provision of transport over an area larger than one municipality. It is the responsibility of local authorities to ensure the availability of passenger PT, as it is a public good – every person should have access to it per the principles of social justice [12]. It should be noted that some non-urban areas do not have PT connections. In addition, PT does not always respond to the real needs of the inhabitants, which means insufficient demand. The demand factor of regional transport depends on a number of different factors, including non-price factors, the most important of which remains income, which determines expectations concerning the services and goods purchased [13]. This is followed by ticket prices, the availability of transport services and the expectations and preferences of the individual passenger.

Regarding the development of transport demand, it should be noted that the passenger car remains the most preferred mode of transport, even when it is less economically efficient. The car is considered to be a comfortable, reliable and rapid means of transport, while PT is associated with poor quality. It is extremely difficult to compete with private cars due to the prevailing belief that owning one's own car is indicative of material and social status. For many passengers, having to use PT is a second-order choice [14]. This thesis is confirmed by statistical data (Fig. 4), showing the increase in registered passenger cars compared to the expenditure on transport by local government units. As a result, increasing expenditure on the operation of regional PT does not translate into increasing passenger numbers. There is also a decline in the length of bus transport lines regionally, as the length of active regional transport lines has decreased by more than 30,000 km since 2017 [15].

Year after year, the expenditure on transport is increasing, but this does not affect the number of registered passenger cars. Expenditure on the operation of public transport includes the purchase of transport services from operators, selected by tender, the operation of vehicles (buses, trams and trains), the cost of fuel and electricity and the modernisation or purchase of new rolling stock. For passengers, the dimension of benefits they can obtain when travelling by their chosen mode of transport is important [16]. Among those often mentioned are travel time, proximity to stops, reliability, accessibility to information, ease of transfer or the price and ease of purchasing tickets.

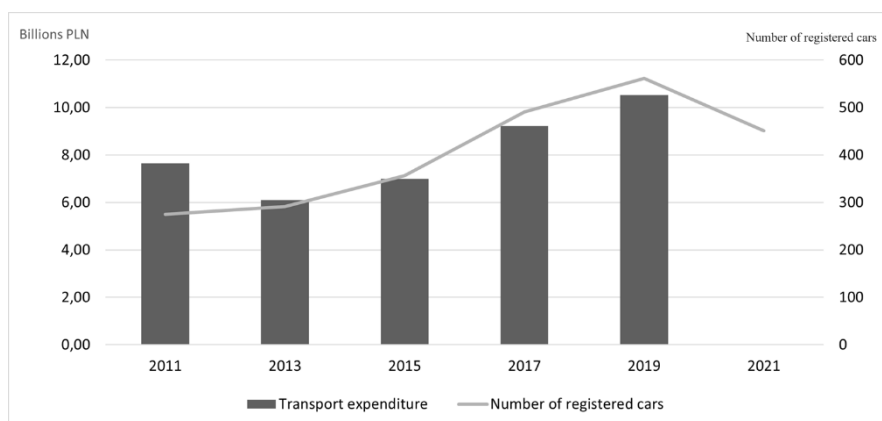


Fig. 4. Number of registered passenger cars vs. expenditures by municipalities on transport (2011-2021) [in items and PLN]. Source: [15]

4. OVERVIEW OF FUNDING FOR THE DEVELOPMENT OF PUBLIC TRANSPORT IN POLAND

The funding of PT development in Poland is based on the Act on Public Collective Transport [17]. It indicates which local government units are responsible for organising PT as well as who is responsible for funding its operation and to what extent. For several years, interest in regional PT has increased significantly in the public debate, resulting in the enactment of the Public Utility Bus Transport Development Fund Act [18]. Bus transport, per the assumptions of the fund, has the greatest potential to combat the problem of transport exclusion in non-urban areas, which is due to the small financial outlay. In addition, the functioning and financing of PT as a task of local government units is largely based on resolutions of local law.

The sources of PT funding are diversified to a limited extent due to the focus on a few selected modes of transport, i.e. bus, tram, trolleybus and rail (Fig. 5). At the same time, regional rail transport is at the disposal of the voivodeship, so municipalities do not have the competence to organise it. The transport accessibility of municipalities, especially peripheral ones, is therefore dependent on bus transport, which is most often provided by commercial operators. The privatisation of regional transport significantly facilitates the organisation and funding of PT, but it often does not significantly affect transport accessibility.

Different local authorities have a variety of tasks concerning the organisation of public transport. At the national level, these include infrastructure investments of major economic importance, such as motorways. In addition, the state sets the legal framework, including the possibility of subsidising other infrastructure investments and the purchase of new rolling stock. At the local level, on the other hand, a number of tasks fall under public transport expenditure, including the purchase of new rolling stock or subsidies for operators, infrastructure investments (e.g. roads) and subsidies to operators for revenue losses due to fare concessions.

5. PUBLIC TRANSPORT'S ROLE IN SHAPING REGIONAL DEVELOPMENT

5.1. Accessibility characteristics of the Słupsk district

The Słupsk district belongs administratively to the Pomeranian Voivodeship. It is located to the west of the Tri-City agglomeration comprising Gdańsk, Gdynia and Sopot (Fig. 6). The Tri-City is the core of the Tri-City metropolitan area (OM G-G-S). The Słupsk district comprises the municipalities of Damnica, Dębica Kaszubska, Główny, Kępcice, Kobylnica, Potęgowo, Słupsk, Smółdzino, Ustka and the city of Ustka. In 2021, they formed a district-municipal association [19]. One of the tasks of the union is the joint organisation of PT. Almost all municipalities in the Słupsk district have a

development strategy; only the municipality of Kępcice does not. None of the municipalities, however, has a transport development plan. In 2021, the district was inhabited by 98,823 people, with the highest populations in the Słupsk municipality, the city of Ustka and the Kobylnica municipality.

This indicates a strong centralisation of the district around the largest centre with socio-economic functions. The remaining municipalities, i.e. Damnica, Dębica Kaszubska, Główny, Kępcice, Potęgowo and Smółdzino, are located in areas threatened by permanent marginalisation [20]. Despite its status as a regional city, Słupsk is also threatened by a permanent deepening of the development gap [21]. Marginalisation is associated with a degradation of the inhabitants' quality of life, including an intensification of the problem of transport exclusion. The Słupsk district is not well connected, as it is not covered by the agglomeration railway SKM (Rapid Urban Rail) or the Pomeranian Metropolitan Railway, which is the latest investment in rail transport in Pomerania [21]. The Słupsk district is located outside the influence of the Tri-City agglomeration.

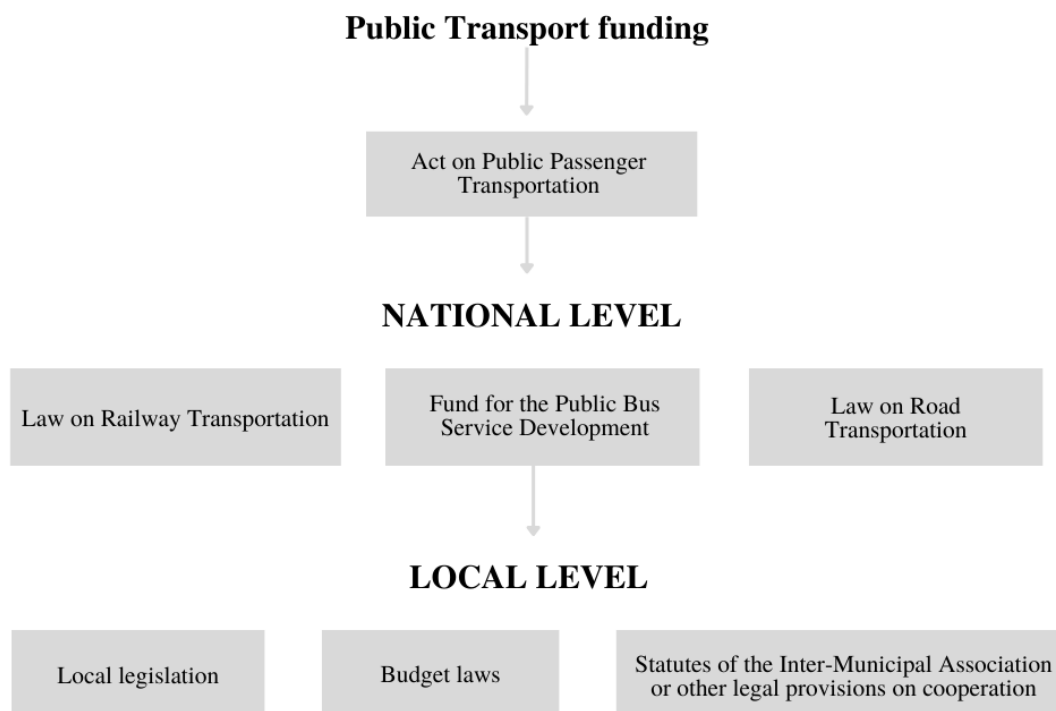


Fig. 5. The principal legal acts related to the financing of public transport in Poland

Marginalisation causes other phenomena, such as social exclusion and peripherality. The first concerns inhabitants of marginalised areas who, due to their place of residence, may be affected by exclusion due to long-term unemployment, low education or a lack of access [23]. The inability to travel to a place of work, recreation or other facilities necessary to meet one's daily needs is referred to as transport exclusion. This phenomenon can be defined as the inability to fulfil one's living, social and cultural needs due to the lack of PT [24]. Transport exclusion is closely linked to social exclusion and the risk of poverty. This is particularly noticeable in rural areas that have been deprived of PT during the system transformation [25]. Peripherality, on the other hand, concerns the formation of mainly economic and cultural relations with the central centre [26]. The periphery is characterised by poor accessibility to the central core in the region, which generates higher costs of doing business, as well as a low availability of recreation and services.

5.2. Transport accessibility in the municipalities of the Słupsk district

The location of municipalities in relation to central-provincial centres is an important developmental factor for the socio-economic plane. Units located closer to regional or sub-regional cities benefit from

a good geographical location. This includes better employment prospects and higher wages, access to a better educational base, public administration or other services. The further away a location is from such centres, the more likely there are to be problems in meeting higher-order needs. Development processes despite a negative geographic location are influenced by the decision-makers of the local authorities, who, by means of an appropriately implemented spatial accessibility policy, are able to create a beneficial image for peripheral regions. Improving accessibility includes both investment and infrastructure activities related to increasing external transport access to the local system, which is crucial from the perspective of attracting investors [29].

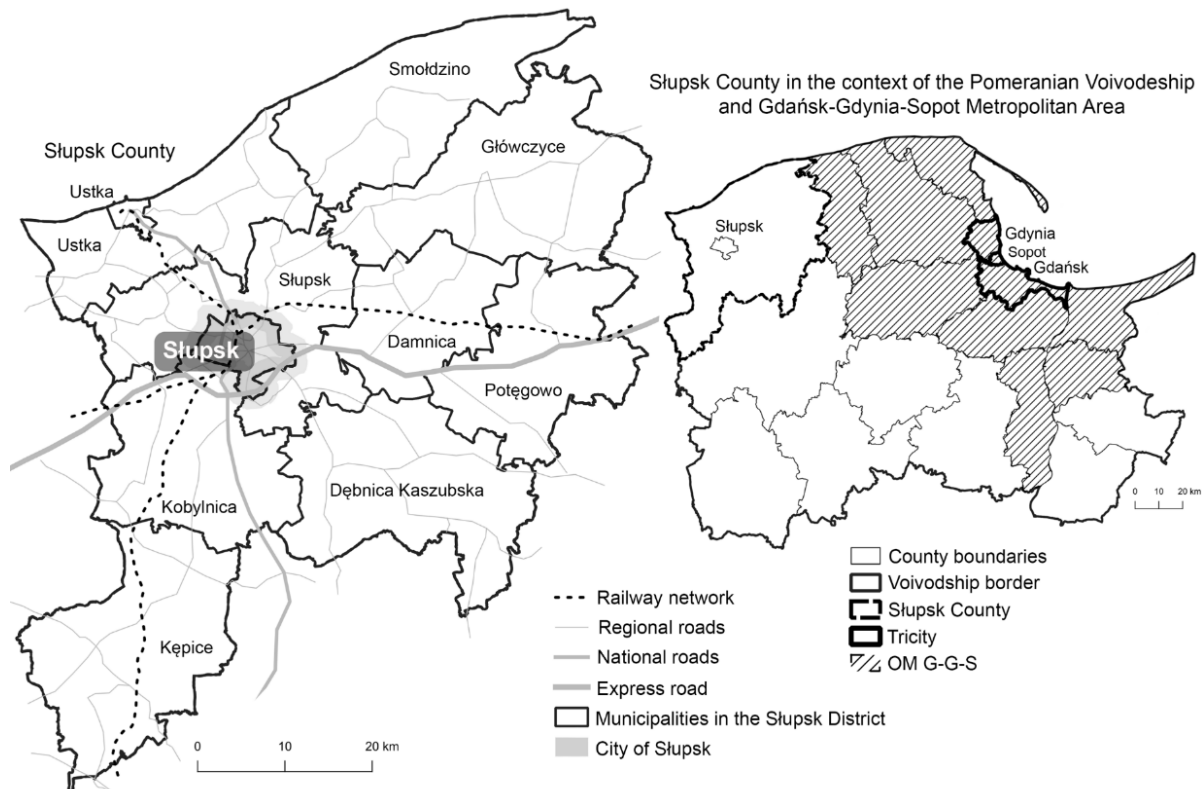


Fig. 6. Delimitation of the Pomorskie Voivodship area. Own elaboration based on: [16]

In addition to external accessibility, internal accessibility, i.e. how the localities within a given system (municipality) are linked to each other, is of key importance. The problem of spatial accessibility of smaller settlements in relation to larger centres has been gradually declining and is related to the political changes that have taken place in Poland since the end of the 1980s. The political transformation has reorganised the PT market in a commercial direction [30].

The PKS network ("Car Transport Company") was important from the point of view of transport access. This company was the leading transport operator in Poland, which gradually began to extinguish its connections over time. Between 1993 and 2016, nearly 75 per cent of PKS transport customers were deprived of this service due to the closure of the company [31]. In 2004, a private company, Nord Express, was established to provide bus passenger transport services. The company operates 10 lines in the Słupsk district. Nord Express stands out in the local market due to the quality of passenger service, availability of timetable information and locations of bus stops [32]. This signifies the increasing problem of forced motoring and the associated consequences, both socially and environmentally, in small towns.

By analysing spatial accessibility in relation to a regional centre, it can be observed that irregular rings are formed around a larger settlement, which is the place where services are concentrated in a given settlement tissue. These rings contain settlements that, due to investment activities in infrastructure, have direct access to them or settlements that started to develop together with the suburbanisation

process, i.e. the urban sprawl into suburban (mainly rural) areas [32]. The cartogram illustrates the discussed ring of accessibility to the county town, the capital of Słupsk district (Fig. 7, cartogram no. 1). The situation is different in terms of access to the voivodeship centre - the Tri-City agglomeration.

The Słupsk district is characterised by a chain of other municipalities and towns apart from the city of Słupsk and its surroundings (ring), which are characterised by poorer, peripheral spatial accessibility. The Słupsk district is also located in the border belt of the West Pomeranian and Pomeranian Voivodeships, which have difficult accessibility to regional cities. It is located on the territory of the former Słupsk Voivodeship. Between 1975 and 1998, Poland had an administrative division into 49 voivodeships. During those years, Słupsk was the capital of the Słupsk Voivodeship and, thus, performed the function of a regional capital. In line with the nature of the influence of this type of centre, the distribution obtained from the study is consistent with the formation of the Słupsk settlement system, by which Słupsk was the centre of the network and areas of its direct influence were formed around it. This also explains the relationship that indicates that the further the distance from Słupsk, the more difficult the access to it is [33].

Considering spatial accessibility, the question of how settlements in municipalities are connected to PT is also crucial. The results of the study clearly indicate that areas of better spatial accessibility are concentrated around larger cities. However, this analysis does not take into account another type of PT service provided in smaller towns, namely school transport. The distribution of access to educational facilities in a municipality is primarily based on their placement in localities that concentrate different types of services. In Poland, there has been a process of closing schools in rural areas and concentrating more school pupils transported from a larger area to one facility in a nearby town [34]. In this situation, there was a need to enable pupils to travel to such establishments from small towns where PT does not function and where the distance is too far for an alternative mode of transport. School transport organised by local authorities has a seasonal character. The network of courses depends on the timetable of the respective educational establishment.

In Fig. 7, cartogram 2, one can notice a contradiction resulting from the location of the closest communes in the development ring of Słupsk. Considering the direct zone of its influence, the areas closest to it should have the best communication with PT, which, in this case, is organised by the Municipal Transport Company in Słupsk. The suburban area is not always characterised by easy PT accessibility. Affluent inhabitants of the suburbs usually do not use urban PT services. As the distance from the county town (Słupsk) increases, the number of localities with access to stops increases. Sometimes, these stops are remnants of former PKS bus services. The commune with the city of Ustka stands out in terms of PT connections in the Słupsk district. The city of Ustka is an important tourist destination due to its coastal location and the presence of a seaport [35]. These elements contribute to a better transport accessibility policy.

The Słupsk district is also characterised by relatively weak dynamics in terms of spatial accessibility. The municipalities in the district are mainly characterised by poor rates of change. This can be understood as the fact that activities in the area of spatial accessibility were undertaken in a fragmentary way rather than as systemic activities aimed at pursuing a policy to increase spatial accessibility (Fig. 7, cartogram no. 3). The Słupsk district is characterised by diverse (internal) migration attractiveness, i.e. the ratio of migration balance to migration turnover in the district [36, 37]. Again, a regularity emerges that Słupsk and the area in its immediate range are characterised by a higher population than the rest of the county. This may result in depopulation of the eastern parts of the district. As also illustrated in Fig. 7, cartogram no. 4, the most attractive places to live are areas around cities.

5.3. Challenges in the development of local public transport in the Słupsk district

Locally, the creation of regional development takes place through the design of long-term development goals, which are taken into account in strategic documents. The most important of these remains the development strategy. It contains postulates for long-term development, including PT. Half of the municipalities of the Słupsk district indicated PT development as the main objective to be achieved (cells filled in grey) (Table 1). The matrix uses ✓ and X symbols, with ✓ indicating that a

form of transport has been included in the development strategy document and X indicating that it has not.

All municipalities in the Słupsk district include the development of bus and road transport in their strategic documents. Only one commune – the city of Ustka – indicated the development of rail transport. This may be due to difficulties in establishing long-term cooperation with the management of the PKP S.A. company, which manages rail transport in Poland. This shows that at the municipal level, there is an awareness of the problem of marginalisation, but the measures taken are disproportionate to the severity of the threat and its impact on inhabitants' quality of life. The majority of communes of the Słupsk district (Damnica, Dębica Kaszubska, Głównyzyce, Potęgowo, Słupsk and Smołdzino) have noticed an opportunity concerning the development of cycling. Municipalities such as Głównyzyce, Smołdzino and Ustka have indicated the development of walking as an objective. Micromobility has not been included in any of the documents covered in the analysis, which may indicate that local authorities do not perceive PT in a holistic way. Thus, they do not use the opportunities that are generated by the use of diversified forms of mobility in PT design (bicycle systems, rental cars and scooters or walking).

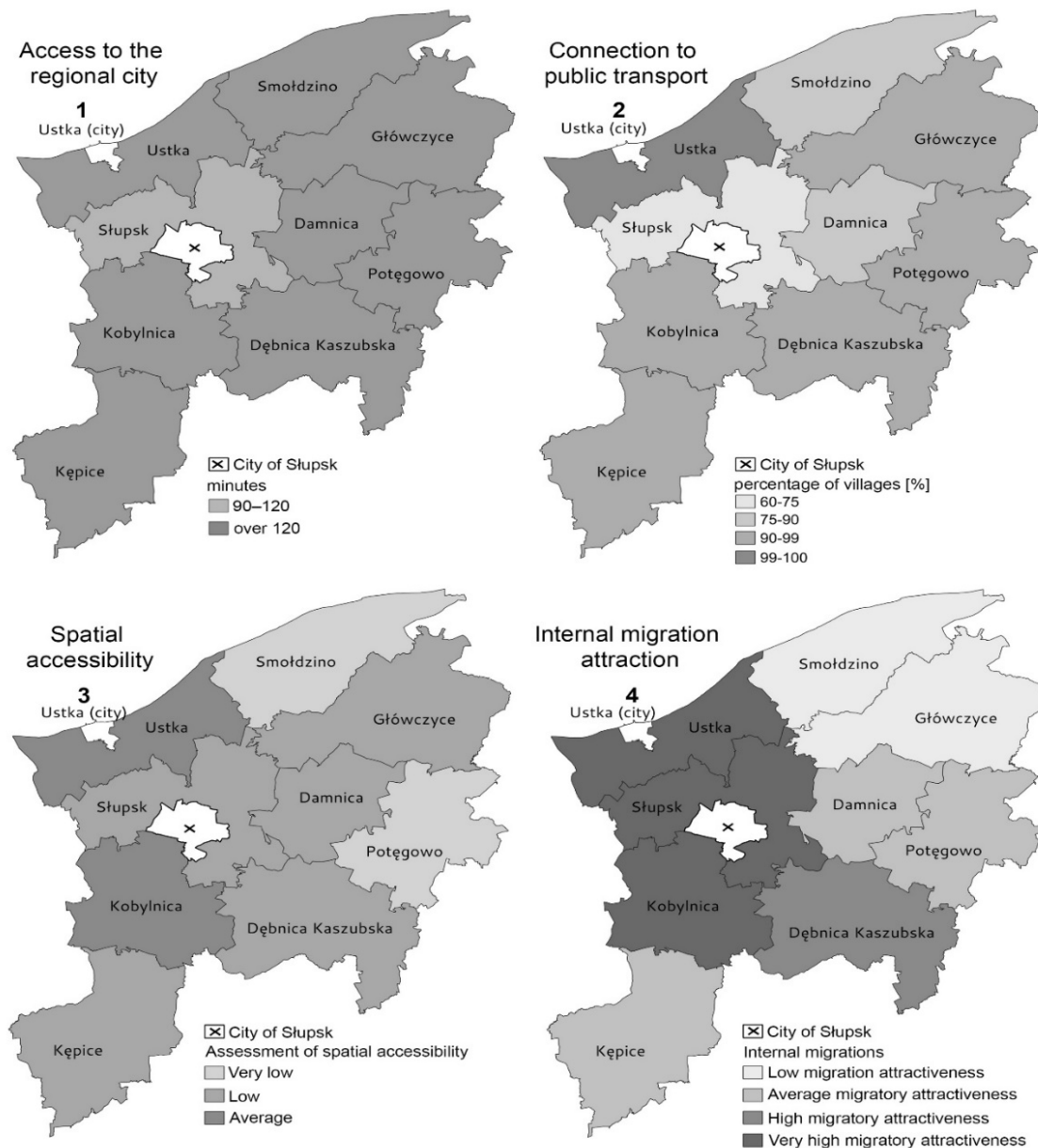


Fig. 7. Distribution of accessibility of the Słupsk district. Source: Own elaboration based on [16, 27]

Table 1

Analysis of the development strategy of the Słupsk district municipalities in the area of public transport inclusion

Municipality	Development of PT as an objective in the Development Strategy	Road transport	Railway transport	Cycling	Walking	Other forms of micromobility
Damnica	NO	✓	X	✓	X	X
Dębica Kszaubska	YES	✓	X	✓	X	X
Główczyce	YES	✓	X	✓	✓	X
Ustka city	NO	✓	✓	X	X	X
Kobylnica	NO	✓	X	X	X	X
Potęgowo	NO	✓	X	✓	X	X
Słupsk (municipality)	YES	✓	X	✓	X	X
Smóldzino	YES	✓	X	✓	✓	X
Ustka	YES	✓	X	X	✓	X

6. POTENTIAL TRENDS IN REGIONAL TRANSPORT TOWARDS NEW MOBILITY CONCEPTS

PT in non-urban areas is a subject of public debate in Poland. It should be emphasised that combining various transport systems can contribute to a real improvement in the living conditions of inhabitants of peripheral and transport-excluded areas [38]. The new mobility culture focuses on the development of multimodal passenger transport systems based on the idea of sustainable development and the use of public and individual transport modes [39]. Information and communication technologies support the development of the new mobility culture. Many benefits of using ICTs in non-urban areas have been pointed out, including reducing socio-economic inequalities [40].

Solutions for a new mobility culture in non-urban areas include increasing the use of forms of sharing (carsharing, carpooling and bike-sharing), and individual means of transport such as bicycles and scooters are prominent [41]. There are also arguments in the literature for the implementation of free PT travel, which, despite higher operating costs, allows for an increase in passenger numbers and a reduction in environmental impact [42, 43]. A further step in creating desirable mobility attitudes among inhabitants using a variety of transport modes is the Mobility-as-a-Service (MaaS) concept. MaaS allows the full integration of transport in terms of multimodality, trip planning and ticketing [44]. However, it requires the development of mobile applications and the enhancement of digital competencies, especially for older people and those at risk of digital exclusion. MaaS can be considered a desirable direction for the development of PT in rural areas, but each area's specific conditions need to be taken into account [45].

In terms of the development of the MaaS concept, it is necessary to overcome the challenges arising from the specific characteristics of non-urban areas (Fig. 8), which include underdeveloped infrastructure, long distances between localities and underinvestment in PT in general. Integration with the use of modern technologies, including mobile applications and the availability of real-time passenger information, requires in-depth cooperation between the individual municipalities and the district and provincial authorities.

In the Słupsk district, shared mobility services are not developed. As of 2021, there is a city bicycle system in Słupsk with 20 stations located at the main traffic arteries [46]. According to the Sustainable Urban Mobility Plan, in addition to prioritising PT, solutions aimed at reducing car traffic will be implemented, while increasing the number of users of active mobility [47]. At the district level, sustainable mobility is not prioritised. The system called “Fala” is planned to be launched, which will cover the entire province. The system will allow the purchase of tickets for all modes of PT, with the main functionality being automatic fare calculation. “Fala” will therefore facilitate mobility in the voivodeship but will not be a direct tariff-ticketing integration. In terms of the whole Pomerania Voivodeship, most journeys are made using individual transport. This is mainly due to the insufficient offer of PT.

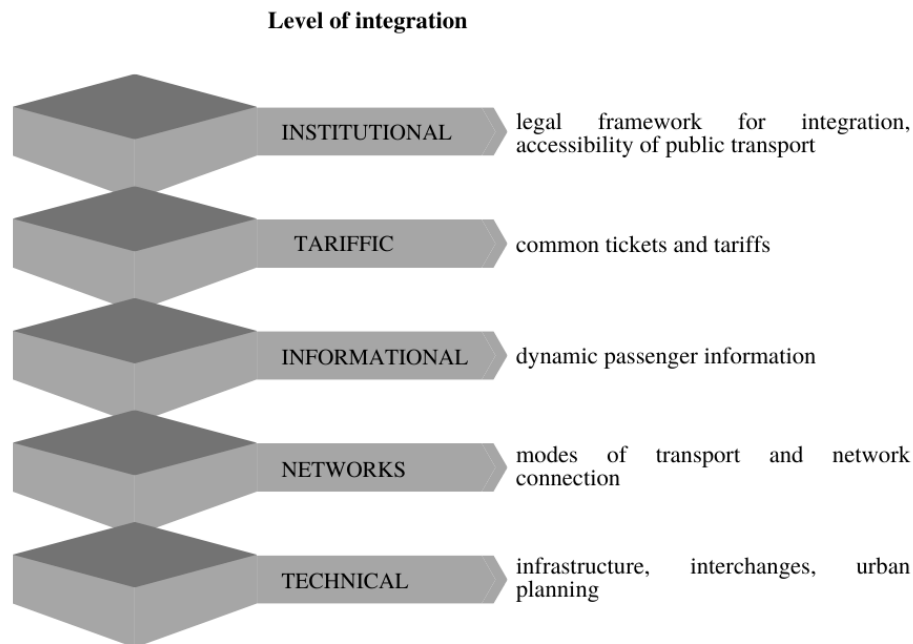


Fig. 8. Challenges of implementing the MaaS concept in rural areas

7. CONCLUSIONS

Mobility in non-urban areas is developing much more slowly than in urban areas, due to the specific characteristics of these areas. Most notably, these include greater distances between settlement structures, underinvestment in infrastructure and, above all, lower demand due to the number of potential passengers. Funding for PT is mainly focused on bus and rail transport. However, there is a lack of targeted funding to support the development of other forms of mobility: rural bicycles, scooters, carsharing or walking, together with information and communication technology infrastructure. The integration of PT and micromobility would make it possible to significantly reduce the problem of transport exclusion, especially in the smallest towns. The design of solutions to support the implementation of MaaS, including funding and organisation, should start at the central level. The tools developed could then support the transformation of mobility culture in non-urban areas.

The analysis of strategic documents at the level of municipalities in the Słupsk district shows that local authorities include PT in their development strategies, but most municipalities only take into account the development of road transport, while neglecting the benefits of implementing cycling, walking or other forms of micromobility and sharing. The privatisation of bus transport and the reluctance of local authorities to organise transport are additional problems. Municipal or district passenger transport could be integrated to a greater extent with rail transport, managed from the provincial level, as well as with other forms of mobility.

The analysis provides a background for possible developments of new forms of mobility. Extra-urban transport can be based on many different modes of transport, but there is a perceived need for more responsibility on the part of local authorities to organise it. The question of funding seems secondary to the need for long-term cooperation between municipalities and at the district and provincial levels. In light of the adopted considerations, this constitutes the greatest barrier to the implementation of MaaS in regional Poland.

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