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The Accessibility of Transport as an Economic Category

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Summary
This article attempts to organize concepts, classifications and methods of measurement, as well as to identify the factors affecting the accessibility of transport. The available reference literature does not offer a uniform, clear and unambiguous definition of transport accessibility. Due to the necessity for a change in the direction of transport policy in relation to the development of transport, the need for a more precise interpretation of transport accessibility, essential to research or practice, has been emphasized herein. The accessibility of transport as an economic category is placed in the areas of both the supply of services and transportation needs. The importance of the issue of transport accessibility stems from the role played by transport – an area of crucial importance in ensuring economic growth of the country. The passenger transport market in Poland is an example of the significance of the linear and nodal transport infrastructure as a factor determining the quality of transport accessibility. There is also emphasis on the necessity for a gradual modernization of the transport infrastructure with the aim of improving the level of services to guarantee that the quality-related needs of today's customers are met.

Keywords: transport accessibility, transport infrastructure, railway infrastructure

1. Introduction

Accessibility I n its general sense is quite a broad term, one of the most important notions in planning transport development, a measure used to assess transport systems in a spatial perspective. The expression of *transport accessibility* is frequently applied in the context of transport networks, all types of services, the economic development of regions (including competitiveness), and as a factor in economic activity, including manufacturing and services. Therefore, it is one of the key issues covered in the literature devoted to both transport and regional sciences. It is all the more important because of the fact that Poland's 2004 accession to the European Union, followed by other CEE countries joining the EU later on, revealed considerable disproportions in the level of development between particular member states. It is also not without significance that the period of pre-accession transformation in Poland was marked by a leaden pace of investment projects in the area of transport, especially in railway infrastructure. It seems that the early years of the political and economic transformation in Poland involved a particular misunderstanding of the investment needs of railway transport in the country, and a substantial underestimation of its role in the domestic economy [22]. At the same time, it is stressed that, in the Poland of 1989–2012, the process of learning good practices in the area of shaping a national transport system, including adapting legal regulations, searching for sources of funds for infrastructural investment projects, and implementing structural and organizational changes, was too slow. The purpose of this article is to present transport accessibility as an economic category, attempt to organize its most characteristic definitions, and discuss the issue of access to a linear transport infrastructure, with a particular emphasis on railway infrastructure.

2. The accessibility of transport as an economic category

If we regard an *economic category* as a mental expression of actual facts, phenomena and processes – and their economic interrelations, and, in consequence, as a generalization of their important features, it is possible to formulate a certain fundamental category. To this end, a reasonable starting point appears to be the essence of the economy, including clarification of the nature of *transport accessibility,* of its meaning, taking the complexity and the specificity of relationships manifested in a certain reality into consideration. In this context, it is also possible to accept

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the claim that economic categories emerge in particular historical conditions, when an objective economic phenomenon becomes mature in a given reality to the extent that makes it possible to formulate it in scientific terms. Literature research lets us distinguish a range of valuable opinions, analyses and concepts offered by authors arguing, among others, that:

- transport accessibility and infrastructure determine spatial mobility, which is one of the basic human needs [1, 37],
- transport accessibility, by affecting a number of areas, e.g. the standard and quality of life or investment attractiveness, is a significant element of spatial development reflected in the differences between the level of attractiveness of particular places [19],
- the increase in the level of accessibility affects a range of interactions, e.g. modernization of the existing transport infrastructure of a given area may generate greater traffic flows, and has a significant impact on the development of areas found near the modernized railway transport sections [24],
- each type of transport utilizes a dedicated network. All these networks are mutually complementary, creating a transportation system that determines the accessibility of particular areas and locations, and, as a result, the socio-economic roles these areas might play.

Adopting the most general definition of *accessibility* for further discussion, i.e. one that defines it as the ability of relations between more than one element of a set to take place (occur), we may acknowledge that such an assumption implies two fundamental qualities, typical from the point of view of accessibility or areas related thereto [19, 20]:

1. There are at least two elements in a socio-economic space, which may be unilaterally or mutually accessible, so, in theory, able to affect one another. In other words, it is an assumption of a source element and a target element of accessibility, in an exceptional case of, for example, the start and the destination of a journey.
2. The existence of a 'carrier' of this relationship, which is, in an exceptional case a means of transport or – speaking in broader terms – of communication. In the real world, these relationships encounter a number of barriers of physical, political and economic forms.

In the light of the fact that the above-mentioned common qualities recur systematically, the phenomenon seems to be lasting in nature, which defines its content and cause of occurrence. Specifying the set of terms defining the content of the investigated phenomenon, it is necessary to acknowledge, among others, that:

- accessibility does not exist as a quality of a place alone, it always has to be specified further by an indication of:
  - the places between which accessibility is measured,
  - the user of this accessibility,
  - the means used to travel,
- there is a clear bilateral relationship between the level of economic development and the quality of transport infrastructure and transport-related activity [2],
- in economic terms, accessibility illustrates a general monetary and non-monetary cost (time, money, effort, inconvenience and risk) required to reach a particular place or obtain a particular feature, depending most of all on the type and nature of mobility (distance, means of transport). The evaluation of transport policy is based on accessibility, which is about making people able to get the goods and services they need [25],
- the level of facility in reaching a given place depends on the existence of an infrastructure network and transport services.

A synthesis of the effect of the current discussion on the essence of economic processes and phenomena, on the typical common qualities of accessibility and the related notions, relations and permanent relationships occurring in a certain group has been adopted as the basis for verifying and proving the formula that transport accessibility is an economic category.

2.1. Review of definitions of transport accessibility

Accessibility is one of the most frequently used terms in many areas of our socio-economic life. The multifacetedness of this term stems from the fact that it may concern a transport system, spatial development, business operations, and the social and living needs of societies alike. It should be noted that in the light of the above, it seems reasonable to make a distinction between the notion of (potential) accessibility and availability. The opposite of availability to accessibility comes, for example, from the ability of persons or enterprises to incur certain costs of purchase of goods and services, hence it is not accessible to all users. According to an analysis of source literature, it appears that there is no universal and indisputable definition of transport accessibility. It seems that authors dealing with the matter do not attempt to define it, but restrict themselves mostly to changes in the notional scope, adapting the offered terms to the purpose of their work.

We can say that one of the first researchers dealing with the issue of transport accessibility was W.G. Hansen, the author of the concept of gravity spatial interaction – potential accessibility expressed for two places (origin and destination), directly proportional

to the attractiveness of a given place and inversely proportional to the impedance of the journey [15]. Based on the above-mentioned relationship, W.G. Hansen defined accessibility as the ability to interact. In the 1970s, there were studies on accessibility carried out by D.R. Ingram and M.J. Moseley. D.R. Ingram was the first to formulate the concept of relative and integral accessibility. He defined relative accessibility as the physical distance between two particular points — the greater it is, the poorer the accessibility. Integral authority, according to the author, is the measure of distance of a place with regard to other places (in the studied system), and unlike relative accessibility, this measure is not reciprocal [17].

M.J. Moseley's claim that accessibility can be viewed from three perspectives, i.e. a spatial one, a social one, and an economic one, depending on what determines the ability to take advantage of certain features, seems especially noteworthy [27]. It can be assumed that the most general definition of transport accessibility has been offered by R.W. Vickerman, who defined accessibility as a fundamental principle of human activity with regard to maximizing contacts at minimized costs of travel [38]. It's also important to mention that M.Q. Dalvi and K.M. Martin, as well as S. Liu and X. Zhu, have been promoters of the most popular definition of accessibility, which defines it as the ease with which any location can be reached from another location using a particular transport system [7, 26].

A similar definition has been offered by M. Wegener et al., arguing that „accessibility indicators describe the location of an area with respect to opportunities, activities or assets existing in other areas and in the area itself, where 'area' may be a region, a city or a corridor" [39]. Other authors, W.G. Hansen, K.T. Geurs, and B. van Wee, have paid special attention to the potential ability to interact [15, 11] or one's individual ability to choose a certain type of activity, as raised by L.D. Burns [4].

In addition, it seems worth mentioning the general definition of accessibility as proposed by A. Karlqvist, expressing the fundamental principle of human activity and behaviour, involving an aspiration to maximize contacts through minimum activity with regard to efforts that need to be made to maintain such contacts [18]. J. Black and M. Conroy, in turn, have emphasized unanimously that accessibility is the ease of reaching a certain form of activity from an investigated place in a given space using certain means of transport [3]. According to Handy and Niemeyer, accessibility is the time of travel between two main conurbations of a country, which describes transport systems, without taking the factor of space into account [14]. It should be noted that the formulation offered by the two said authors characterizes a transport system only to some extent, but fails to consider the significant context related to the use of space. This is pointed out by Z. Taylor, who defines accessibility as a „chance or opportunity that enables a person inhabiting permanently a given area to take advantage of different types of activities, features, some of which may be categorized as services" [34]. The author also adds that accessibility should not be equated with mobility since mobility is about actual moving, while accessibility means only „a possibility to take advantage of opportunities offered by various features". Besides this, accessibility is a „causative factor of a journey, not a result thereof" [35].

F.R. Bruinsma and P. Rietveld reach for other definitional possibilities, such as „ease of spatial interaction" or, more specifically, „attractiveness of a node in a network taking into account the mass of other nodes and the costs to reach those nodes via the network" [5]. P. Gould has found that „accessibility is an uncertain notion, one of those elementary terms used by everyone until they are faced with the need to define and measure it" [12]. The author stressed at the same time that the term of accessibility is one of those commonly used terms that everyone uses, yet nobody can define or measure it once and for all. It also seems reasonable to highlight that the main difficulty lies in the appropriate specification of the relationship between accessibility and the behaviour of the user of a transport network. P. Gould's views are shared by W. Ratajczak, who argues that the large number of interchangeably used definitions of accessibility makes it impossible to work out a single universal definition [29]. It seems, therefore, that the narrow understanding of the issue of transport accessibility originates from the lack of an appropriate term for accessibility and of sufficient knowledge on how to measure it. Słownik Języka Polskiego PWN, a dictionary of the Polish language, defines „accessibility" [*dostępność in Polish*] as: \

1) „możność dojścia, dotarcia, dostania się do jakiegoś miejsca" [*the quality of a place of being able to be reached or entered;* own translation],
2) „możność zdobycia, osiągnięcia czegoś; fakt, że coś jest dostępne, osiągalne" [*the quality of being obtainable; the fact of being accessible, easy to obtain;* own translation] [31].

According to the Ministry of Infrastructure's SRT transport lexicon dictionary, transport accessibility is „the level of ease at which it is possible to reach a given place thanks to the existence of a network of transport services and infrastructure. A given site in an area becomes more accessible transport-wise if there are other sites that can be reached quickly, affordably, and problem-free" [own translation] [32]. One of the most interesting definitions seems to be the one presented by Spiekermann and Neubauer, according to whom accessibility is a product of a transport system,

and determines the local advantage of a certain location over other locations [33]. Defining accessibility in this context as the key effect of a transport system, with an impact on the advantageousness of the location of a given area (region, city or neighbourhood) compared to other areas, one should acknowledge that transport accessibility is determined in this case not only by the geographical distance but also by the transport infrastructure. Such infrastructure is composed of a range of linear and nodal elements. Linear elements include roads, railway lines, air corridors, rivers, canals and other navigable waters. Nodal elements, in turn, comprise those points of a transport network where it is possible to carry out fragmentary operations related to passenger service and managing freight and means of transport [30]. These include spatially isolated facilities, such as: stations, stops and trans-shipment points.

The source literature lists a range of terms related to accessibility, i.e. transport, communication, spatial, social, economic, physical and temporal accessibility. It's important to see that the correlation existing between them generates the greatest problems definition-wise. Because of this, the publications of the classics of economics quoted above feature a lot of freedom in this respect, manifested sometimes in using these definitions interchangeably. It seems, however, that the existing notional relation between the terms of „*transport accessibility*" and „*communication accessibility*" may legitimize a certain compromise. On account of the fact that communication involves both transportation and the act of communicating, communication accessibility may be defined as transport accessibility and telecommunication accessibility.

It's impossible to cover all the views concerning the nature of the notion of transport accessibility, that's why only those most distinctive have been selected for the purpose of this article. The presented literature review proves the fact that the notion of transport accessibility is not defined unambiguously. Depending on the assumed purpose, authors tend to enrich the term with different elements. Upon synthesizing the effects of the performed review of definitions, it is necessary to agree with the opinion of the majority of authors, according to which transport accessibility is one of those terms that are in common use but haven't yet been given a universal, best definition. Thus, the available research makes it possible to assume that the limited understanding of the issues related to transport accessibility arises from the lack of a good definition for accessibility and of knowledge of the ways to measure it.

2.2. Classification of methods of research into transport accessibility

The source literature has been seen to attempt to formulate different methods of classification of transport accessibility a number of times. It is important to see that the analysis is based on multiple criteria and depends additionally on the chosen transport sector, taking the type of transport (passenger or freight) into consideration. But there is an argument that a greater number of research methods does not translate into a more extensive presentation of the matter, i.e. what some authors consider a separate method, others classify as a variant of a method described earlier. It should be emphasized that detailed analyses and studies of transport accessibility have been conducted by, among others, the Gdańsk Institute for Market Economics at the commission of the Ministry of Regional Development. Literature research has made it possible to propose six selected methods of analysis and measurement of transport accessibility [19]:

1) **infrastructure-based accessibility measure**, identified by means of indicators of infrastructural features in a given area, e.g. the amount and the quality of infrastructure as well as the congestion level (e.g. the likelihood of congestion on a certain percentage of network sections). Congestion affects the average travel speed and the scope of renovation needs, which may be considered determinants of infrastructure quality;
2) **distance-based accessibility measure**, measured by physical, real physical, temporal or economic distance from the destination or a set of destinations of a journey, e.g. the average or total cost of travel between the point of origin and the destinations of interest to the network user (e.g. cities with a population of over 100,000);
3) **isochrone-based accessibility measure**, which is, in other words, accessibility measured by the range of an equal (comparable) communication impact, and in many cases it may act as a variant of the distance-based accessibility measure since, from a cartographic point of view, the isochrone method involves outlining zones of the same temporal distance; it is measured by estimating the set of destinations accessible at a given time, at a particular cost, or with a certain effort; an example is the use of isochrones to study the accessibility of travel destinations (e.g. of people) at a temporal distance of 15, 30, 45 and 60 minutes away from the travel origin;
4) **potential-based accessibility measure**, measured by the possibility of interaction between the travel origin and the travel destination, a set of travel destinations, e.g. different variants of accessibility measured by means of potential indicators or gravity models. In the context of the mobility of people, transport accessibility can be determined according to the following formula [33]:

$$D_i = \sum_j f(A_j) \cdot g(c_{ij}),$$

where:
D_i – transport accessibility of region i,
$f(A_j)$ – function determining the attractiveness of region j,
A_j – activities available in region j,
$g(c_{ij})$ – space resistance function,
c_{ij} – the total time (cost) of travel from region i to region j;

- **space-time-geography-based accessibility measure**, based on Hägerstrand's concepts from the 1970s, which are about the individual nature of human mobility in the form of, for example, daily paths; it can be measured by estimating the individual, specific trips between the point of origin and the destination,
- **utility-based accessibility measure** refers to individual accessibility measured by the behaviour of the user of a transport system. Such accessibility is understood as the result of a choice made between a set of possible transport solutions making it possible to satisfy a particular need of a network user. Hence, a traveller's aim will be to maximize utility according to the following formula [12]:

$$A_i^n = \max_{i,j} U_{j/i}^n$$

where:
A_i^n – utility of traveller n from region i,
$U_{j/i}^n$ – expected utility of traveller n,
n – traveller (network user),
j – region j (travel destination),
i – region i (travel origin)
and:

$$U_{j/i}^n = v_j^n - c_{ij}^n + \varepsilon_{ij}$$

where:
v_j^n – measure of attractiveness of an alternative for traveller n to j, observable to the creator of the model,
c_{ij}^n – the total time (cost) of travel from region i to region j for traveller n,
ε – stochastic, random, and non-observable part of accessibility ($\varepsilon = 0$ for the traveller, but unknown for the creator of the model).

It should be stressed that the development of utility-based accessibility measure models has resulted in a combination of the approach discussed herein with time geography models – in the US in particular.

Among the mentioned methods of analysis and measurement of transport accessibility, one of the most often applied methods of evaluating transport policy [4] is measuring accessibility on the basis of indicators of infrastructure features offered in a given area (usually a statistical unit). Such accessibility is defined in other words as accessibility measured with simple indicators, which include [19]:

- the quantity of infrastructure components (e.g. the length of railway lines, the length of motor roads, presence of an airport, an inland port or a seaport),
- the quality of infrastructure components (e.g. higher grade roads, i.e. highways and expressways or high-speed lines, the average speed of transport resulting from the traffic model adopted for a given area, the rate of demand for renovation and airport capacity,
- the level of congestion (e.g. the likelihood of congestion on a certain percentage of network sections) results from the traffic volume and the quality of infrastructure (number of tracks, traffic lanes); there is also feedback between the level of congestion and the quality of infrastructure because congestion affects the average traffic speed and the demand for renovation, which may, in turn, be considered determinants of infrastructure quality.

The advantages of simple indicators include: the possibility to obtain statistical data and the relatively easy interpretation of findings. It's also important to add that indicators of infrastructure features provide vital information about the condition of intra-regional infrastructure, but fail to take destinations found outside the borders of the analysed area into consideration, and so do not fulfil the basic theoretical criterion of taking the component of space utilization into account in the study.

This component, apart from accessibility measured on the basis of infrastructure, is found present in five other methods, all based on composite indicators including two components: transport and space utilization. It is necessary to stress that assessing a transport system in a spatial context often involves a number of indicators of transport accessibility and research methods, depending on the entity carrying out the research and on the intended objective. A quantitative and qualitative assessment of transport infrastructure in terms of capacity, number of connections, etc. is a starting point for further studies of transport accessibility. It is important to mention that an accessibility analysis is a multi-criteria analysis, which depends additionally on the selected transport sector and the type of transport (passenger or freight).

3. Transport accessibility and economic growth

The practical utility of transport accessibility cannot be overestimated. It is a notion of crucial importance to our further discussion, just like the notion of spatial accessibility, which can be defined as the

ease with which a place or a feature of another place/ other places can be reached, expressed by the distance to be covered, with regard to the cost of transport or the time of travel, regardless of the assets at the user's disposal. Moreover, it should be acknowledged that transport accessibility is a much broader notion than spatial accessibility since its scope covers the entirety of communication relations in a given area. Transport accessibility depends on the location of places of residence, destinations of accessibility (workplaces, municipal offices, schools, etc.) that connect these sites. In such a perspective, the key aspect is the proper functioning of the area of transport.

Transport is an activity that is to serve the purpose of enabling people and goods to move. Its role of a particularly significant branch of the economy involves making it possible for virtually every sector of the economy to perform efficiently and effectively, which depends to a great extent on the existing infrastructure. Neglecting the development and maintenance of the transport infrastructure, which is a very important factor determining the economic growth and the development of different regions, translates into a poorer effectiveness of other components, and, in effect, of the whole economy. The significance of the issue of transport accessibility is related to the function served by transport. It seems that the relationships occurring here may be presented in the following way:

1. The linear and nodal transport infrastructure, the services in the scope of quality, frequency and price, are the most significant factors determining the level of transport accessibility.
2. The proper economic performance of a country, including that of regions, and the quality of life of its inhabitants are associated strictly with transport accessibility.
3. Transport accessibility is one of the most important issues in the light of solving problems related to the attractiveness or competitiveness of regions.
4. Transport accessibility has a major impact on the amount of turnover, the competitiveness of regions, and on their position in both national and regional economies. It also plays an intermediary role in the country's foreign trading.

According to most authors, transport accessibility as an economic category is one of the basic measures useful in assessing a transport system in a spatial perspective. This stems usually from the location and the transport infrastructure features available in a given region, which affects, among others, location-related decisions made by investors, taking the time and the cost of transferring people and goods into consideration. The source literature offers many valuable insights by authors who stress the important fact that accessibility and transport infrastructure determine spatial mobility, which is, in turn, one of the basic human needs [1, 37].

Supporters of the concept of focusing investment projects on supraregional transport infrastructure point to objective mechanisms and economic effects of the development of economic activity in such areas. Based on the available analyses, we may name the main determinants of economic processes, which include: good communication accessibility, low costs of transport, economies of scale and agglomeration [10]. Carrying out infrastructural investment projects and, in effect, the development of transport systems contributes to the process of reorganization of space, which means increasing and constantly new needs for mobility and further development of the area of transport [16]. A. Domańska, in turn, notes that the issue of the impact of transport infrastructure on regional development is not clearly proven and encompassed within a uniform theory because of its multifacetedness [8].

Based on the discussion so far, it seems reasonable to acknowledge that the relation between transport infrastructure and accessibility is crucial for such development to proceed. It is also important to highlight the fact that poor infrastructural equipment and infrastructure depreciation processes cement the existing functional-spatial structures, meaning the level of transport accessibility hinders socio-economic development especially in peripheral areas. Investments in infrastructure are a must in order for this situation to improve substantially [13, 21]. Literature research focused on the notion of accessibility makes it possible to define the role of transport as a significant factor behind facilitating the satisfaction of various types of social and economic needs. One thing that is quite puzzling, though, is that most studies, analyses and other scientific coverage concentrate mainly on the geographical aspect, i.e. a discussion concerning the relations between transport and spatial accessibility, but there seems to be a lack of reports, expert studies and analyses devoted to the relationships occurring between transport infrastructure and transport accessibility in an economic perspective.

4. Utilization of infrastructure in passenger transport

In the light of the discussion so far, it seems legitimate to claim that infrastructure, considered key to the new quality of a transport system, plays a significant part in the optimization of transport accessibility. It can therefore be acknowledged that transport infrastructure is essential to granting mobility to people and freight as well as to making a country competitive and territorially coherent. It's important to add that solv-

ing ongoing problems in this area is associated with the right knowledge resources and the ability to create innovative solutions. This becomes especially significant when mobility in the social and economic space has reached a level at which the infrastructural capacity becomes exhausted, and it is no longer possible to extend this infrastructure by means of conventional investment. It should also be emphasized that railway transport in Poland is less and less able to compete with car travel, which – unlike the railway sector – benefits from the state's support in the form of favourable legal solutions and much higher spending.

To study the utilization of infrastructure in passenger transport, an analysis of transport activity in this type of transport in Poland in the period 1990–2015 has been performed (Tab. 1).

According to the presented statistical data, in the years 2004–2014 especially, the railway passenger transport volume dropped compared to motor transport by approx. 4 million people, i.e. by 1.5%, and by approx. 3.7 billion passenger-kilometres.

The analysis has shown diversified volumes of utilizing the two types of transport (trains versus cars), indicating a progressing marginalization of the railway transport sector. When it comes to passenger transport, one of the main factors behind the drop in its volume, occurring until the middle of the past decade, is the development of road transport accompanied by a simultaneous underinvestment in the railway sector. Moreover, the analysis of the relative share of railway and motor (bus) transport in the passenger transport market leads to the following conclusions:

- the share of railway transport in the market, measured by the number of travelling passengers, grew from 25% in 2004 to 37.8% in 2014, and the share of car-based transport fell from 74.4% in 2004 to 60.8% in 2014,
- in the years 2004–2014, the relative share of railway transport in the market, measured by the performed transport activity, dropped from 33.0% in 2004 to 31.3% in 2014, but the rate was still lower than that for motor transport, whose market share, measured also by the performed transport activity, was 53.7% in 2004 and 41.7% in 2014.

Looking at the presented conclusions, one may say that, in the period of 2004–2015, railway transport lost a significant number of passengers, which was accompanied by a quite substantial drop in the level of transport activity. However, it managed to maintain a high share in the passenger transport market while there was a progressive slump in the rates for transport volumes and transport activity in the area of motor transport. It also appears that the proposition of the growing significance of railways as the means of transport selected frequently for short routes (everyday commuting to cities, to work, to schools and universities, etc.), but much less often for longer distance travelling (intranational and international traffic), is well grounded. The phenomenon may be reflected in further years, hence the expected growing competition for the passenger market between railway and motor transport operators.

Therefore, orienting activities at reversing the negative trends in passenger transport, i.e. developing a high-speed line system, should be considered reasonable. Importantly enough, according to social environments – including academic ones, there has been an increasingly emphasized opinion, especially as of late, according to which Poland cannot afford to postpone the decision on constructing a high-speed line network, i.e. a system that is a significant factor in improving the competitiveness of railways in the transport market. The key argument behind it is the experience of other EU countries, which proves that such solutions are treated as a factor supporting rail infrastructure development and improving the competitiveness of railways in the European market of passenger transport, which, in effect, changes the structure of the sector of passenger transport.

5. Utilization of infrastructure in freight transport

In the light of the discussion so far, it needs to be emphasized that the poor condition of railway infrastructure and the present system of rates for access thereto, combined with the low reliability of transport services, are the main factors behind the limited demand for railway services, which is especially noticeable in the area of freight transport. There are also other factors behind the negative opinion on their competitiveness, such as the need to make up for the outstanding renovation works and problems left over from the previous era.

Using the available statistical data, an analysis of the utilization of infrastructure in freight transport in the area of goods transportation in Poland in the period 1990–2015 has been performed (Tab. 2). According to the presented data, in the years 2004–2014 especially, the railway freight transport volume dropped compared to motor freight transport by approx. 1,533,032 m. tonne-kilometres, making up only 26.64% of the transport activity carried out using car-based transport. Despite the slight increase in the volume of railway-transported freight in the period of 2013–2014 compared to 2012, there was still a noticeable growth in the demand for car-based transport services, which makes the former trend too weak to hinder a further drop in the share of freight transport in the market.

Table 1

Transport activity in passenger transport in Poland [in millions of passenger-kilometres]

Type of transport	Year												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Overall:	101,623	85,640	75,386	72,532	69,277	65,483	65,128	64,037.0	65,290.2	65,225.7	62,016.7	60,124.9	56,599.6
rail	50,373	40,115	32,571	30,865	27,610	26,635	26,569	25,806.1	25,664.0	26,197.7	24,092.5	22,468.9	20,445.2
motor	46,599	41,720	39,009	37,812	37,812	34,024	33,984	33,128.5	34,034.7	33,250.8	31,735.1	30,996.6	29,295.6
air	4,430	3,589	3,577	3,653	3,653	4,633	4,407	4,929.5	5,401.1	5,628.5	6,034.0	6,411.7	6,671.9
inland sailing	28	21	15	13	13	25	12	30.3	17.9	18.1	25.9	41.9	37.1
maritime	193	195	214	189	189	166	156	142.6	172.5	130.6	129.2	205.8	149.8
Overall dynamics [%]:	100.00	84.27	74.18	71.37	68.17	64.44	64.09	63.01	64.25	64.18	61.03	59.16	55.70
rail	100.00	79.64	64.66	61.27	54.81	52.88	52.74	51.23	50.95	52.01	47.83	44.61	40.59
motor	100.00	89.53	83.71	81.14	81.14	73.01	72.93	71.09	73.04	71.36	68.10	66.52	62.87
air	100.00	81.02	80.74	82.46	82.46	104.58	99.48	111.28	121.92	127.05	136.21	144.73	150.61
inland sailing	100.00	75.00	53.57	46.43	46.43	89.29	42.86	108.21	63.93	64.64	92.50	149.64	132.50
sea	100.00	101.04	110.88	97.93	97.93	86.01	80.83	73.89	89.38	67.67	66.94	106.63	77.62
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Overall:	56,674.5	56,071.6	56,182.6	58,555.1	58,734.4	56,640.3	50,646.2	47,985.6	50,073.0	49,884.0	50,088.0	51,441.1	52,584.2
rail	19,638.0	18,689.7	18,156.5	18,552.1	19,858.6	20,194.7	18,637.4	17,921.1	18,176.8	17,826.0	16,797.0	16,014.9	17,366.9
motor	29,995.6	30,118.0	29,314.1	28,148.3	27,359.3	26,790.5	24,386.4	21,600.3	20,651.0	20,012.0	20,039.0	21,449.2	21,570.0
air	6,869.9	7,071.4	8,503.7	11,640.6	11,290.6	9,438.5	7,427.9	8,273.0	11,064.6	11,864.0	13,084.0	13,810.5	13,486.8
inland sailing	33.7	23.0	20.7	26.7	32.6	35.5	29.6	23.3	24.3	24.0	20.0	18.6	21.7
maritime	137.3	169.5	187.6	187.4	193.3	181.1	164.9	167.9	156.3	158.0	148.0	147.9	138.8
Overall dynamics [%]:	55.77	55.18	55.29	57.62	57.80	55.74	49.98	47.22	49.27	49.09	49.29	50.62	51.74
rail	38.99	37.10	36.04	36.83	39.42	40.09	37.00	35.58	36.08	35.39	33.35	31.79	34.47
motor	64.37	64.63	62.91	60.41	58.71	57.49	52.33	46.35	44.32	42.95	43.00	46.03	46.28
air	155.08	159.63	191.96	262.77	254.87	213.06	167.67	186.75	249.77	267.81	295.35	311.75	304.44
inland sailing	120.36	82.14	73.93	95.36	116.43	126.79	105.71	83.21	86.79	85.71	71.43	66.43	77.50
maritime	71.14	87.82	97.20	97.10	100.16	93.83	85.44	86.99	80.98	81.87	76.68	76.63	71.91

Source: Author's own work on the basis of [36, 40].

Table 2

Transport activity in freight transport in Poland in the period 1990–2015 [in m. of tonne-kilometres]

Type of transport	Year												
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Overall:	332,344	307,850	293,688	260,911	256,088	287,314	293,946	314,765.6	298,603.8	291,281.1	262,204.6	232,175.6	227,830.9
rail	83,530	65,146	57,763	64,359	65,788	69,116	68,332	68,651.0	61,760.0	55,471.0	54,447.8	47,913.0	47,756.3
motor	40,293	39,641	42,037	40,744	45,365	51,200	56,513	63,687.8	69,542.7	70,451.7	72,842.5	74,403.2	74,679.0
air	57	45	52	55	62	74	89	116.0	106.6	94.2	87.5	79.2	79.6
inland sailing	1,034	737	750	661	793	876	851	930.3	1,099.6	1,028.1	1,172.8	1,263.6	1,125.8
maritime	207,430	202,281	193,086	155,092	144,080	166,048	168,161	181,380.5	166,094.9	164,236.1	133,654.0	108,516.6	104,190.2
Overall dynamics [%]:	100.00	92.63	88.37	78.51	77.06	86.45	88.45	94.71	89.85	87.64	78.90	69.86	68.55
rail	100.00	77.99	69.15	77.05	78.76	82.74	81.81	82.19	73.94	66.41	65.18	57.36	57.17
motor	100.00	98.38	104.33	101.12	112.59	127.07	140.26	158.06	172.59	174.85	180.78	184.66	185.34
air	100.00	78.95	91.23	96.49	108.77	129.82	156.14	203.51	187.02	165.26	153.51	138.95	139.65
inland sailing	100.00	71.28	72.53	63.93	76.69	84.72	82.30	89.97	106.34	99.43	113.42	122.21	108.88
maritime	100.00	97.52	93.08	74.77	69.46	80.05	81.07	87.44	80.07	79.18	64.43	52.31	50.23
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Overall:	229,167.7	266,092.6	202,828.2	223,319.2	243,795.7	257,924.8	259,892.5	292,794.3	295,012.2	303,450.0	327,775.0	327,488.3	338,791.8
rail	49,594.7	52,331.6	49,972.1	53,622.5	54,253.3	52,043.4	43,445.5	48,706.9	53,745.7	48,903.0	50,881.0	50,073.0	50,602.9
motor	78,160.2	110,481.0	119,740.0	136,490.0	159,527.1	174,222.6	191,483.8	223,170.4	218,888.4	233,310.0	259,708.0	262,869.0	273,107.0
air	86.5	93.5	106.5	109.7	97.8	106.0	84.8	114.3	128.6	123.0	119.0	146.4	155.9
inland sailing	871.7	1,066.4	1,276.8	1,236.7	1,337.9	1,273.8	1,020.0	1,030.1	908.9	815.0	768.0	778.5	2,186.8
maritime	100,454.6	102,120.1	31,732.8	31,860.3	28,579.6	30,279.0	23,858.4	19,772.6	21,340.6	20,299.0	16,299.0	13,621.4	12,739.2
Overall dynamics [%]:	68.95	80.07	61.03	67.20	73.36	77.61	78.20	88.10	88.77	91.31	98.63	98.54	101.94
rail	59.37	62.65	59.83	64.20	64.95	62.31	52.01	58.31	64.34	58.55	60.91	59.95	60.58
motor	193.98	274.19	297.17	338.74	395.92	432.39	475.23	553.87	543.24	579.03	644.55	652.39	677.80
air	151.75	164.04	186.84	192.46	171.58	185.96	148.77	200.53	225.61	215.79	208.77	256.84	273.51
inland sailing	84.30	103.13	123.48	119.60	129.39	123.19	98.65	99.62	87.90	78.82	74.27	75.29	211.49
maritime	48.43	49.23	15.30	15.36	13.78	14.60	11.50	9.53	10.29	9.79	7.86	6.57	6.14

Source: Author's own work on the basis of [36, 40].

The shrinking volume of transport services rendered by means of public transport may also result in a progressive shortening of the length of railway lines, and in a limitation of the available regular bus communication in Poland. The adverse market situation of freight transport services shows a decline in the demand for such services, and in the significance of most transport sectors, with a simultaneous increase in the society's mobility and in the significance of individual car-based transport. In the light of the discussion above, one may claim that transport accessibility is a highly significant factor in shaping the trend of travelling using public transport, contributing to socio-economic growth and development. In this situation, it seems sensible to change the planning, with the change to involve departing from the aspiration to satisfy transport-related needs and increase mobility, and focusing on applying methods of active management thereof instead. Managing demand and controlling mobility may appear to be a crucial instrument in the state transport policy when it comes to achieving one of the fundamental objectives, i.e. increasing the community's access to all places where individuals are able to satisfy their needs.

These activities should be considered vital from the point of view of increasing the significance of public transport, improving its competitiveness, and following the principle of sustainable development [23].

The source literature frequently offers a view that the main determinant of transport accessibility is the linear and nodal transport infrastructure, including its density and spatial distribution. From the point of view of transport accessibility, this infrastructure is an important factor ensuring social and economic cohesion, as well as improving competitiveness by reducing the travel time and the distances to cover. According to the functional perspective of the issue of transport infrastructure, linear and nodal objects are tied permanently to space, they make transporting people and freight, changing the means of transport, storage and other activities occurring in the transportation process possible [9].

There is also emphasis placed on the significance of information infrastructure and suprastructure. This stems from the role transport plays. The main factor shaping transport accessibility, determining the possibility to use transport services, is the transport point. It is necessary to stress that the type and the number of transport points in particular transport sectors have different purposes, with the biggest number of such points found in the motor transport sector, with much less thereof present in other sectors. From the point of view of transport accessibility, a linear and nodal transport infrastructure is an important factor ensuring social and economic cohesion as well as improving competitiveness by reducing the travel time and the distances to cover. According to the functional perspective of the issue of transport infrastructure, linear and nodal objects are tied permanently to space, they make transporting people and freight, changing the means of transport, storage, and other activities occurring in the transportation process possible [9]. The quantitative increase expressed by the growth in the length of railway lines translates into an increase in the transport accessibility index and, by analogy, the number of transport points (terminals, buildings, built features and platforms, etc.) determines the increase in the level of transport service accessibility index. A. Domańska, in turn, notes that the issue of the impact of transport infrastructure on regional development is not clearly proven and encompassed within a uniform theory because of its multifacetedness [8]. Based on the discussion so far, it seems reasonable to acknowledge that the relation between transport infrastructure and accessibility is crucial for such development to proceed. It is also important to highlight the fact that poor infrastructural equipment and infrastructure depreciation processes cement the existing functional-spatial structures, meaning the level of transport accessibility hinders socio-economic development, especially in peripheral areas. Investments in infrastructure are a must in order for this situation to improve substantially [13, 21]. It is necessary to see that in Poland we can distinguish a number of issues related to transport infrastructure, which do not benefit transport accessibility and have a large impact on the level of the socio-economic growth of the country, including its regions. This mainly concerns the trend of closing railway line sections and infrastructural features.

Quoting the above-mentioned issue of the wrong approach to modernizing and maintaining transport infrastructure, it is hard to question the very interesting view of K. Brzozowska, who claims that: „all studies and reports regarding the expected scale of investment needs in the area of transport infrastructure, or the investment projects already completed, contain information and data concerning new projects, but the issues related to maintaining and renovating the existing facilities tend to be omitted. Taking into account the capital-intensive nature of infrastructure, the expenditure on ongoing repairs and maintenance will involve considerable amounts – with a tendency to grow significantly, which will be in many cases hard to finance for public sector institutions" [own translation] [6]. It seems that the drop in the quality of transport, determining adverse trends in the passenger transport market, was caused to a large extent by the poor condition of the linear railway infrastructure, which is a consequence of the failure to adapt bridges and other major structures to the changing operating parameters in the areas of the travel speed and the

maximum allowable loads. In 2001–2015, outstanding works involving the repair and modernization of railway flyovers and bridges caused led to [28]:

- these features being excluded from use and operation because of their condition, which was insufficient to maintain the required level of safety for railway traffic, even when the most strict operating conditions were applied,
- risks of exclusion from use and operation for the nearest 12 months,
- use in limited operating conditions with regard to: speed, load bearing capacity and loading gauge, necessitating renovation or restoration works aimed at restoring the original technical parameters,
- risks of the necessity to impose operating constraints by the end of a given year, resulting from the anticipated deterioration of the technical condition, which could affect the level of safety of railway traffic when the then-current operating parameters were to be maintained.

The situation of the trans-shipment nodal infrastructure, i.e. of railway stations or industrial spurs, being points of direct contact with clients, is unfavourable as well. Each year sees a drop in the number of places for sending and loading parcels, and if there are no alternative organizational-technical ways to take advantage of railway transport, the trend of client outflow will continue, especially in the area of the so-called dispersed transport solutions. The special significance of transport accessibility can also be seen in the field of freight transport that is most dependent on the quality of the linear and nodal infrastructure, i.e. containers. The dynamic development of the area of containerization seen in recent years is related to the trade exchange of highly processed goods, which involves a need to comply with strict requirements for transportation in terms of quality (speed of transport, door-to-door transport, on-time delivery, etc.). It is important to note that, since the railway transport of today focuses mainly on mass transportation, the transport of dispersed loads (small and medium batches), a sector with a tendency to grow, is being taken over by car transport operators.

6. Conclusions

Transport accessibility as an economic category has not been defined yet in a definite, clear and unambiguous way. It is an expression used frequently in the context of transport networks, all types of services, the economic development of regions (including competitiveness), and as a factor in economic activity, including manufacturing and services. Therefore, it is one of the key issues covered in the literature devoted to both transport and regional sciences. The linear and nodal transport infrastructure, including its amount and quality-related parameters, plays an important part in ensuring transport accessibility.

Transport accessibility is a significant factor in shaping the trend of travelling using public transport, contributing to socio-economic growth and development. In order to enhance the status of public transport, it is necessary to make changes in the motor and railway passenger transport market as well as improve the accessibility of all places where individuals can satisfy their needs.

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