Pomeranian Metropolitan Railway as the Element of Regional Logistics

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The development of a region depends on a number of factors. One of them is a well-functioning logistics, which in this context can be named as the logistics of the region. Due to the fact that the literature deals with the problem of logistics of regions to a small extent on the one hand, and on the other hand at the same time one of the major investments treated as an essential element of logistic system in Pomeranian Region, i.e. Pomeranian Metropolitan Railway, has been just recently completed, a great opportunity to study an impact of the element on the regional development has appeared. The results of the study show that the Pomeranian Metropolitan Railway has contributed to the liquidation of the unbalance between logistically highly developed Tricity (Gdansk, Sopot, Gdynia) and poorly developed area of Kashubian sub-region resulted mainly in better transportation access for inhabitants, as well as higher logistic service level for the Gdansk Airport.

Keywords: logistics.

1. INTRODUCTION

Based on the literature review it can be claimed that logistics of regions is not a new category. It can be traced from the first book [United 1997] through a number of articles [Wojewódzka - Król 2015, pp. 61 - 66] and other books [Kaźmierski 2009] up to the present state. It covers a lot of research areas, some of which seem to be the most exploited ones, as for instance the role and meaning of logistics for a regional development [Witczyńska 2014, pp. 261-275] or investments in logistic infrastructure [Domańska 2006]. However, there are still some issues which have to be discussed. Especially, the problem of multi-aspect influence of logistics investments on the regional development seems to be of most importance from the scientific point of view. The other problematic area covers the questions regarding the methodology of analyzing the influence and formulating thesis and other final observations, which verify the theory as well as can be used by regional decision makers for their managerial purposes. One of the suggested methods to face the above mentioned problems is a case study. Favourably, a real opportunity to verify the theory has just recently happened in Pomeranian Region i.e. the Pomeranian Metropolitan Railway case. This regional project with the value of €400m, whose history can be traced from 1914, has been taken as a research object in this paper to give an answer to the problem of the influence of this logistics investment on the regional development. Therefore, the aim of the research process is to perform a multi-dimensional study of the Pomeranian Metropolitan Railway case in the context of regional logistics, and the purpose of this article is to present results of the case analyses. The above formulated problems and aims are supplemented by a thesis stating that Pomeranian Metropolitan Railway is a "must" part of the regional logistic system, with an important influence on the development of the region. This thesis is verified through the following research stages. First, based on the theory of regional logistics, the main description views and levels are identified which are used to formulate a concept of multi-dimensional analysis of the selected logistic case. After it, at the second research stage, the above mentioned concept is applied to Pomeranian Metropolitan Railway to analyze it, and thus justify the thesis if the railway is an important element of

the region or not, in the views of the previously identified dimensions.

2. METHODOLOGY

The literature on regional logistics is dominated by qualitative methods at the form of studies, surveys and observations, which results stand for an input to heuristic methods of logical analysis as induction, deduction and reduction leading to output at the form of abstract or detailed conclusions, which results are presented as a text supported by tables and pictures. These methods are used mainly to describe the idea of regional logistics, identify its main research problems, analyze selected cases, or even to prove an influence of logistics on regional development [Kaźmierski 2009, Domańska 2006].

Despite the dominating role of qualitative methods of description, a group of quantitative methods can also be traced in the literature on regional logistics. Especially in the aspect of measuring the impact of logistic investments on the level of region development, some numerical methods are applied. First of them is a cost-benefit analysis, which can be treated as a common name for a set of particular methods of assessing investment projects, including: regional income or cost share, unemployment rate, net present value, market grow, etc. [Kauf, Tłuczak 2014]. An example of this method can be found in the book of T. Kamińska, where these quantitative methods were applied to estimate transport infrastructure effectiveness [Kamińska 1999]. There also exist some variants of the cost-benefit analysis, such as: value added method, UNIDO [Kamińska 1999, pp. 114 -119], or cost-effectiveness analysis [Kauf, Tłuczak 2014, p. 201]. On the basis of criticism of cost-benefit methods which are perceived as methods emphasizing financial information and neglecting other evaluation criteria, in the literature there can be found another numerical method known as a multi-criteria analysis (MCA), which combines several methods, including cost-benefit analysis. Examples are studies of assessing the effectiveness of Trans-European Transport Network commissioned by the European Commission [EUNET/SASI 2001, p. 23, 124; Tavasszy 2004, pp. 19 - 26], which in addition to the economic assessment, include a valuation of social and environmental impacts, as for instance impact on unemployment, liquidation of social barriers or the usage of nature resources. Apart from the above-mentioned and relatively well recognized cost-benefit and MCA methods, there is a number of less commonly used quantitative methods as multiplier or econometric ones [Domańska 2006, p. 115].

Taking into account the above described methods, the methodology of this study is formulated as follows. For the purpose of this article, a multi - aspect study of Pomeranian Metropolitan Railway was formulated in the introductory chapter, as an element of regional logistics, and this case is taken as the research object. It should be also stated that from methodology point of view, all the above mentioned methods could be potentially applied to study the case. However, if the study is to be a multi-aspect one, the methods cannot be used separately, but need to be combined to identify and describe the research object at selected aspects. Therefore, to carry out the first research stage, i.e. identification of description views (dimensions, aspect, perspectives) for the analyzed case, qualitative methods are proposed to be applied in the form of literature and observations. Since costs, benefits or other criteria (social, environmental, technical, etc.), treated separately, reflect a particular aspect of the studied object, if used together, they can elaborate a whole (systemic) picture of Pomeranian Metropolitan Railway and its influence on regional development. Thus, qualitative as well as quantitative method is applied to describe the maximum number of aspects possible, especially in the form of numerical method known as a multi-criteria analysis.

3. IDENTIFICATION OF THE REGIONAL LOGISTICS DIMENSIONS

The fact that logistics supports the flow of cargo is a thesis not questioned in the literature, but whether logistics supports also the movement of passengers, or speaking more detailed if the concept of regional logistics is appropriate for passenger transport, is a question that requires a discussion. Two main attitudes to this problem should be presented at least. On the one hand the movement of passengers can be treated as the exclusive area of passenger transportation competence, but on the other hand, a passenger can be also a logistics flow object, even if used by analogy to the flow of goods. The first point of view seems to be more appropriate if the movement of passengers is considered partially or individually, but if perceived at more systemic,

interrelated perspective, the logistics conception should be rather used, including regional, urban or other specified geographic areas of logistics activities. This second point of view, proposed also in this paper, is reflected in the literature as well. For instance, in the book "Managing Passenger Logistics", there can be found that "The road freight transport industry has made great strides in the development and application techniques of logistics (…) Many of these techniques could be applied easily to the logistics of moving people (…) What, if it is not just-in-time delivery, is a dial-a-bus service? Is an airport departure lounge not a human warehouse?" [Fawcett 2000, p. 2] If airports or bus service companies can be perceived as a third party logistics service providers for the movement of people, than the core of regional logistics conceptions can be seen as cooperation (or collaboration, interaction) of interested logistics stakeholders. This thesis is followed for instance by Kiba-Janiak [2015, p. 561], who states that "Cooperation of city logistics stakeholders during planning, implementation and controlling of projects related to the passenger and freight transport" is perceived as a key success factor. Of course, it can be questioned if a city logistics can be taken by analogy as a regional logistics, but some great metropolises are often larger than a lot of provinces or regions. In the literature, there can be also found some cases on regional logistics support of the people movement. An example is the network of so called Regional Logistics Units (RLUs) and Humanitarian Procurement Centres (HPCs), which collaborate in the favour of people and refugees in the disaster regions in East Saharan Africa [Dufour 2017, pp. 1-2]. Another case has just been presented at the paper, because Pomeranian Metropolitan Railway is also perceived as an element of regional logistics system, especially the passenger one.

To meet the paper goal, first the identification of the regional logistics dimensions is carried out through a study of regional logistics category to extract, by reduction and deduction methods, different views, levels, aspects or perspectives, which are used to define, describe or concretize this category. As a result of these research works a set of regional logistics dimensions (or its elements) are identified. However, because of coming from different definitions, these dimensions are not structured orderly or are incoherent, thus they require to be linked together by the usage of induction method in a logically consistent system which can be applied to describe Pomeranian Metropolitan Railway at the next research stage. S. Kauf and A. Tłuczak mention five dimensions of regional logistics before they come to the final definition. These authors [Kauf, Tłuczak 2008, p. 13] express opinion that logistics of regions and its elements can be described according to the following dimensions:

- operating/managerial,
- effectual,
- functional,
- processual,
- instrumental.

According to the first perspective, logistics of regions include a flow control of all material, human and information resources in the region and between its subsystems [Kauf, Tłuczak 2008, p. 13]. If focusing on effectual aspect the regional logistics is perceived as a factor in increasing the competitiveness of the region, and it is defined as "(…) an orientation on providing beneficiaries with optimal solutions for regional (metropolitan) logistic systems, while rationalizing the cost structure" [Kauf, Tłuczak 2008, p. 13]. On the other hand, from the functional point of view, the logistics of regions is defined as "(...) the concept connected with shaping the movement of persons and goods in the region, the aim of which is to guarantee a constant quality of transport services while reducing transport traffic. (...) It is also emphasized that the attention on the importance and consolidation of the flow of goods in the region contributes to the reduction of their number" [Kauf, Tłuczak 2008, p. 13]. Shifting to the instrumental approach, the logistics of regions is considered to be "(...) a primary instrument for the efficient management of living and doing business in the region. This includes all infrastructure measures used in managing the flow of people and goods in the region" [Kauf, Tłuczak 2008, p. 13]. In the perspective of processes, regional logistics "(...) focuses on operation and dispositional measures, which should ensure beneficiaries (meeting the environmental protection requirements) with the supply of the necessary resources and waste collection at the right time, amount and place" [Kauf, Tłuczak 2008, p. 14]. Later in the paper the authors conclude that "In the context of the above perspectives, the logistics of regions can be defined as any management activities related to the development of regional logistics network, its implementation and improvement, for supply of strategic groups in the region with the necessary

resources and environmentally friendly disposal of waste. (...) The aim of logistics in the region can be considered as a provision of beneficiaries with the right products at the right time, in the right place and at the lowest possible cost. (...) Thus, the object of regional logistics is the flow of goods, people and information, considered, examined and designed in terms of the system within the regional structures" [Kauf, Tłuczak 2008, p. 14].

In another publication, despite the lack of explicit definition of regional logistics, it can be read that "Logistics is an area that can significantly contribute to regional governance arrangement. This can be referred to enterprises located in regions that have shaped specific relations to each other and to the environment. These relations are creating an attention to the correct arrangement of logistic chains, particularly with regard to the enterprise - enterprise and enterprise - trade ties. This is particularly important at the transition and transformation period of regional economic processes taking place in the economies of the newly accessed European Union countries" [Kaźmierski 2009, p. 22].

The above presented research results in the idea of regional logistics and its dimensions can be continued further, but the provided results seem to be sufficient substantively to put them under critique to formulate a conception of multi-dimensional analysis of Pomeranian Metropolitan Railway. In relation to the above cited propositions of understanding logistics of regions, it can be concluded first that the definition of this category proposed above [Kauf, Tłuczak 2008, p. 14] is incorrect because it includes a so called "idem per idem" (the same by the same) tautology error, which is contained at the expression "(…) *logistics of regions* can be defined as any management activities related to the development of *regional logistics network* (…)" [Kauf, Tłuczak 2008, p. 14]. As a result, after reading this definition the meaning of logistics of regions is still unclear because it has been explained by relation to the same defined term in the form of regional logistics network. Secondly, a lot of more dimensions than five can be drawn out from the above cited literature. Of course, it depends on the level of abstraction or concretization, but some other aspects of regional logistics can be added relatively easily to these five dimensions. They can be perspectives of flows, relations/contribution to other region elements, beneficiaries, aims, costs, time, place, quality, infrastructure, network and environment. However, the problem is that they cannot be added directly to the five dimensions identified before, because if not ordered logically, they will not be consisted and against classification rules, which impose the classes to be excluded each other and cover all possible aspects of the research object. To identify according to the above rules the right classes or dimensions of analysis, the fundamental question is, if Pomeranian Metropolitan Railway as an element of regional logistic system is needed at all, because perhaps there is no justification for its existence? Thus, the reasons or other speaking rationales stand for the main analysis dimension of the research object on the highest level of abstraction. Because it is too general, it requires to be disaggregated into some detailed dimensions. Because logistic infrastructure is perceived in long time perspective, the first group of reasons are the historical ones, which include all the prerequisites coming from the past time, but still playing an important role. The second bundle of rationales consists of socio and economic reasons. They are studied together, because their ties are very close. However, if the historic, and mainly the socio-economic rationales are to decide about the importance of Pomeranian Metropolitan Railway and its grow in time, the investment is also required to be sustainable or friendly to the natural environment. So, the third group of factors the railway should be related to comes from the idea of sustainability. In conclusion, the analysis focused on the justification of Pomeranian Metropolitan Railway as an important element of regional logistics is proposed to be performed according to the following three dimensions:

- historical,
- socio - economical,
- sustainability.

4. MULTI-DIMENSIONAL ANALYSIS OF POMERANIAN METROPOLITAN RAILWAY

Starting the multi-aspect analysis of Pomeranian Metropolitan Railway at the historical dimension it was discovered that over 100 years ago on 1st May 1914, a precursor of PKM, so-called Kokoszkowska Railway, started its operations on the route linking Wrzeszcz - Kokoszki and Stara Piła. At that time it was the shortest connection between Gdansk (the region's main city) and the western side of the Kashubian area. This railway had functioned for almost 31 years, when in 1945 it was destroyed by German

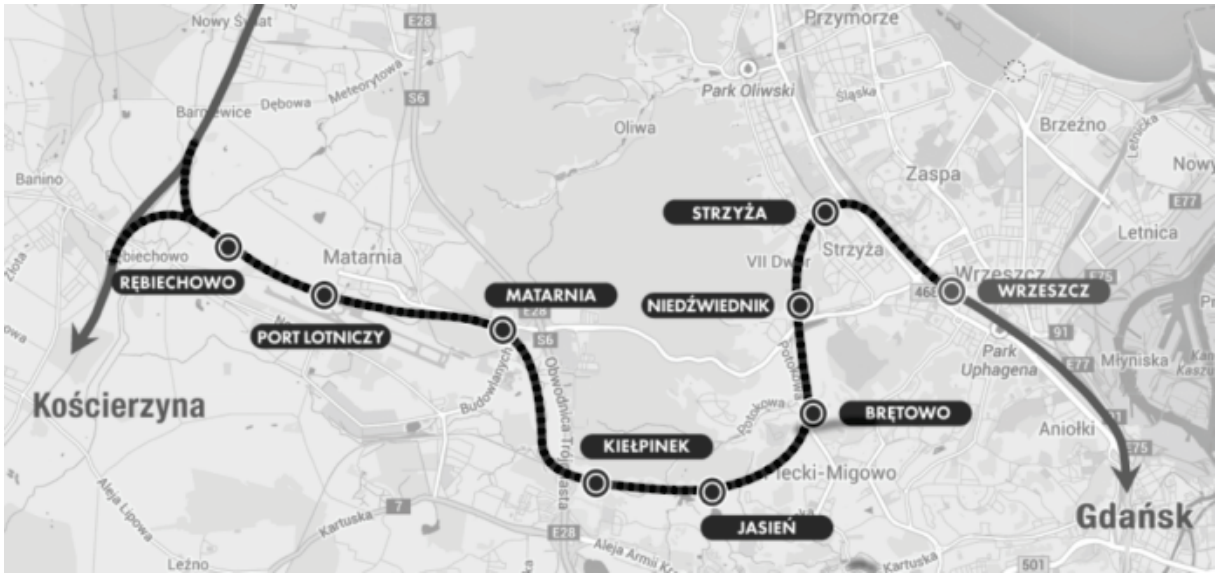

Fig. 1. Map of Pomeranian Metropolitan Railway.
Source: http://www.pkm-sa.pl/glowna/wp-content/gallery/o-projekcie-dt/pkm-mapa-2014_ok.png [accessed 23.07.2016]

troops leaving Gdansk. A lot of ideas for the reconstruction of the remains of the Kokoszkowska Railway were created, unfortunately no significant steps to recover the line were taken until 2005, when the idea of so-called Tri-City Railway Bypass came to reality. This conception initiated works on a feasibility study commenced in October 2008 and finished by the end of 2011, because of variety of decision variants and difficulties during public consultations. Finally, the variant of two-railway line between Gdansk-Wrzeszcz and Gdynia through Gdansk-Airport, with links to Kashubian main cities - Kościerzyna and Kartuzy, had been decided to be put into implementation stage. It turned into reality under the name of Pomeranian Metropolitan Railway, which started to operate in full on 1st September 2015 (fig. 1), as a new element of regional logistics system with close relations to Gdansk Airport, the other railway and city transportation companies, and logistics services users. Of course, there is also an indirect impact on social and business environment. It should be also added that during the 5-year construction period, a completely new rail line of 18 km long distance and 18 stops supported by the most modern railway traffic control system in Poland had been managed to be built. Noteworthy is the fact particularly that a new railway line had been built from scratch for the first time in Poland since 40 years, and the investor was not a railway operating company as usual, but a regional government, i.e. Pomeranian Voivodeship Authorities.

Simultaneously to the above described historical reasons to build Pomeranian Metropolitan Railway, socio-economical factors had also played a great role. A set of them is presented at the form of SWOT analysis results in Table 1. These results show that except of great social and economic potential expressed in strengths and opportunities, the region suffers also some problems included in weaknesses and threats.

The most painful problem which can be related to regional logistics, is an unfavourable spatial differentiation between dynamically and comprehensively well developed Tri-City Metropolis and the remaining, not so well developed, part of Pomeranian Region. These unbalances are reflected by a lot of social (including cultural, educational, personal, etc.) and economic (including business, vocational, etc.) differences. Among others, this is due to historical, infrastructural or institutional factors (including different availability and quality of public services). In relation to logistic system, this region is also not balanced, because of not sufficient transport accessibility and its great diversity. A spectacular example of these problems was a lack of railway service of Gdansk Airport, which decreased the logistic attractiveness of the airport. In addition to these significant disparities, logistics of the region suffers of different transportation modes characterized by insufficient degree of carriers' coordination, and troubles with integration their tariffs resulted in discomfort of passengers. Especially, the western and south-

Table 1. SWOT analysis of Pomeranian Region.

Strengths	**Weaknesses**
1. The settlement attractiveness and development opportunities related to the seaside location, as well as diverse and rich nature and landscape resources or values. 2. Tri-City Metropolitan Area is one of the development centres in Poland and in Pomeranian Region, which gains importance as an international logistic hub. 3. High economic activity of residents and pro-export orientation of Pomeranian companies. 4. The relatively high level of social capital and a strong sense of local community's identity. 5. Good market position of regionally specialized industry subject to its seaside location. 6. A stable and relatively high birth growth and positive net migration. 7. Unique heritage and cultural region diversity. 8. Advantageous natural conditions for energy development, including green-energy	1. The peripheral location and low transport availability of the region; the lack of a coherent management of regional public transportation system; underdeveloped system of multimodal transportation. 2. Low spatial mobility of residents. 3. Low effectiveness of offers for external investors. 4. Insufficient cooperation and coordination of regional initiatives and innovations. 5. Large disparities in quality and access to public services, including insufficient developed IT infrastructure. 6. Unsatisfied participation of organized forms of children care, as well as the relatively low quality of education at primary and secondary level. 7. Relatively high morbidity and mortality caused by diseases of civilization. 8. Unsatisfactory parameters of the natural environment; increasing exploration pressure on the nature and the fragmentation and degradation of natural habitats.
Opportunities	**Threats**
1. The increase of the foreign investors' activity, particularly in sectors with the greatest development potential in the region. 2. Intensification of economic relations in the Baltic Sea Region and increase its importance in the global economy. 3. Increase of social activity, including residents' participation in management processes at the public services' sphere. 4. Changing social attitudes, including the behaviour of education (including lifelong learning, digital competences). 5. Reorientation of spatial and branch development directions by the energy and petroleum industry sector, into the better use of the natural resources' potential and regional infrastructure. 6. The decentralization of the management of the country development, including public finance	1. The permanent weakening position of the EU in global economic relations, including the disintegration of the EU structures and the single European market 2. Fiscal, legal and systemic barriers to economic development, including inhibition of nationally important network or point infrastructure investments and actions arising from the EU access obligations. 3. Low effectiveness of systemic reforms in the country in terms of health, social and education security, including permanent inadequacy of the education system to create professional and social competences. 4. The severity of the negative demographic processes, including the aging population. 5. The growing risk of adverse effects of human activity pressure on the environment. 6. High risk of natural disasters and other emergencies of wide range.

Source: Regional Development Strategy of the Pomeranian Voivodeship until 2020, p. 16-17. Document available at http://strategia2020. pomorskie.eu/documents/240306/400793/Pomorskie_SRWP2020.pdf/ d1fb1e1b-4c73-4221-8f2b-8cff5b3a9f45

western areas of Pomeranian Region are vulnerable to the adverse effects of poor performance of the regional logistic system. At the context of the above mentioned problems, Pomeranian Metropolitan Railway can be perceived as a very required and long time expected element of great importance to the logistic system of Pomeranian Region, which increases transportation accessibility, and thus contribute to the liquidation of logistic system unbalance in the region. Speaking more detailed, according to the timetable [Rozkład 2016], Pomeranian Metropolitan Railway offers passengers to use about 60 modern trains on working day, shuttling between Gdansk - Wrzeszcz and Gdansk Airport, including 17 trains to and from Kashubian city - Kościerzyna, with an average frequency of 15 - 20 minutes operating between 4 o'clock in the morning and 1 o'clock at night. Of course, it should be added that time tables and the tariffs are coordinated under a so called unified metropolitan ticket, accepted by five transportation companies. Except of strictly transportation aspects, it should be clearly stated that this investment initiated and still creates business activities. An example is only the value of the investment calculated at PLN 1 billion, financed in 85% by the EU, which represented an enormous income to regional or even country businesses. Other examples are constructions of new housing estates alongside the line [Koprowski 2014] with social and service facilities, and for instance roads, shops, parks, schools, kindergartens, etc. One can imagine how important element of Pomeranian logistic system is the railway, what is reflected and underlined by Gdansk Voivodeship Marshal, who said that

"PKM line set in Gdansk and Pomerania new transport corridor, around which a modern infrastructure, both rail and residential and business-services is created. We can say that with the construction of the metropolitan railway entire city is being built. (…) Also, more and more investors are interested in the location of their businesses near the new railway line, which will provide a quick access to them by employees as well as customers" [Struk 2015, p. 3]. However, in addition to the above optimistic words, it should be noticed that in comparison to the projected flow of about 5 million passengers per year, including 1 million passengers generated by Gdansk Airport [Kolej 2010, p. 40, 44, tab. 30, 37], a great decrease is expected up to 600 thousand passengers per year pointing out some problems as for instance the lack of a direct connection to Gdansk main railway station or plans to cut off near 25% of trains in the new time table starting in December 2016 [Naskręt 2016].

If the positive influence of Pomeranian Metropolitan Railway on the socio-economic aspect of living and making business in the Pomeranian Region is to be sustainable, it has also to be environmentally friendly. Usually it includes an assessment of influence of an investment on such elements of natural environment as earth's surface, water, noise, pollutants, energy, wastes, landscape, fauna and flora. According to the report on the environmental impact [Raport, 2012], the influence of Pomeranian Metropolitan Railway on the earth's surface and especially on the soil has been evaluated positively, mainly because the selected investment variant has occurred in geographical areas characterized by the favourable geological and engineering conditions. However, construction works always cause transformation of the earth's surface. To reduce the possible negatives, the construction works were limited to the minimum interference of technical and mechanical meaning, and restricted to the minimal required period of the works and re-cultivation of the soil after finished works. Considering the influence of Pomeranian Metropolitan Railway on the water, especially through water pollution and changes in the water stream system, it should be stated that some prevention means have been taken. Namely, to prevent the system of natural water against degradation, a dehydration technology has been applied at the form of storm and surface water drainage, as well as reconstruction or restoration of existing system of dehydration. Regarding the trackbed surface drainage, the correct shape of the trackbed, which is constructed as a falling transverse amounting to 4-5%, enables rainwater to fall down into the water drainage. Noise is the next very burdensome environment factor caused by the railway operations. The values of noise have been rated since the project was ended during so called test routs in the day as well as in night time. If the noise parameters out of range were registered, some protection measures as acoustic screens or vibration isolating securities have been applied. Shifting to the problem of pollutants, to reduce emissions of them and minimize the scope of their negative impact on the nature, a modern rail fleet was selected for regular transport operations, which were equipped at internal rail combustion buses powered by innovative engines that meet the strict standards on concentrations of particles in the exhaust gas, what is required by the European Directive 2004/26/EC. It is also related very closely to the next environmental factor, namely the usage of energy. It should be clearly stated that these modern railway buses are also very restrictive according to the electricity power consumption. Some technical methods used in the trains enable to change for instance the number of railway buses to form a train. It results in the possibility to send longer or shorter train on a respective route depending on whether it is the peak or off-pick time, what has also got an impact on the power consumption. Pomeranian Metropolitan Railway has also implemented a lot of measures related to waste management. In accordance with the applicable regulations, a selective waste collection based mainly on a waste bin system has been applied and controlled. Coming to the problem of landscape protection, since the project planning stage started new plantings adapted to the prevailing habitat conditions has been assured. It can be noticed that about 75000 trees and bushes have been planted since the project commenced. Similar measures to protect the amphibians' migration routes, including reptiles and small mammals, have been taken. It was planned to construct and carry out small concrete-made passages of rectangular shape equipped with dry shelves in projected areas, which should ensure a smooth movement of animals. However, the railway investment may also cause extraordinary hazards for the environment as for instance bad accidents, breakdowns or fire hazards, which could stay for a threat to life and health of living organisms or pollution of various elements of the environment

(chemical, biological, radiological, thermal pollution). Because these occurrences cannot be foreseen, some risk mitigation actions have been taken, for example in the form of common exercises of rescue, fire or anti-terrorism brigades.

5. CONCLUSIONS

The analysis conducted above lead to the conclusion that Pomeranian Metropolitan Railway is a very important element of regional logistics because it has got a great and positive impact on the development of the Pomeranian Region in the historical, socio-economical and sustainability dimensions. Regarding the social and economic development of the region, it gets support from the railway in different ways. The investment has created better transportation connections with the centre of the region: Gdansk - Sopot - Gdynia, which enabled them to become a real logistic hub managing goods and passenger flows. Especially from the perspective of sustainability it has appeared very valuable to examine the impact of Pomeranian Railway on the natural environment of the region. The aspect of activities taken during construction works and after finishing them as for instance meeting all the soil, air, noise, water and other requirements to prevent the usage of natural resources make a great impression. It is also a guarantee that Pomeranian Metropolitan Railway can be perceived as the environment-friendly user.

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