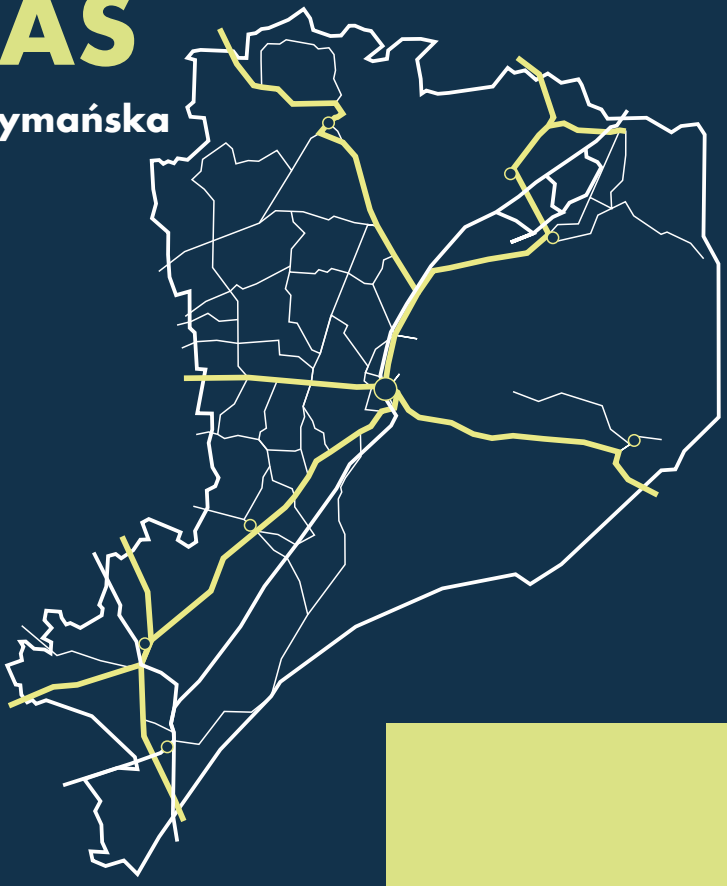
MOBILITY INNOVATIONS IN PERIPHERAL AREAS

Elżbieta Szymańska



Politechnika Białostocka

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I dedicate this book to the memory of Eugenia Skrodzka, de domo Supińska – a bright economist, a lover of numbers and science, a noble person and my dear mother.

Elżbieta Szymańska

Introduction

The problem of the modern economy, which is of particular concern to the European Union, is the persistent discrepancies in the economic potential of regions. The issue of peripherality has been a subject of interest for politicians and scientists for many years, both in theoretical and practical dimensions. Therefore, the goal of the researchers is to find/develop solutions to reduce the disparity between the "rich" and less wealthy regions (with a lower level of GDP per capita). A deficient level of development of transport infrastructure, low levels of education, and no access to qualified human resources are considered to be the main features and causes of peripherality.

The subject and research problem of this study are limitations in terms of mobility in peripheral areas. The main goal of the research is to come up with innovative solutions in the field of mobility of residents and tourists of peripheral areas based on the example of Hajnówka County and to develop a model of a system of co-ordination and cooperation in the area of implementation of innovations in mobility. The starting point of the research is to identify innovative solutions in that "filed in the peripheral" areas of the Baltic Sea States. At present, the Baltic Sea region faces a challenge in a growing gap between urban and peripheral areas. People migrate to urban centres, which leads to a decrease in population in a large number of peripheral areas. The drop in population and demographic changes lead to growing costs per capita associated with satisfying (socio-economic) needs, including public transport. This phenomenon causes lower quality of life among residents of a village. Simultaneously, this limited accessibility within peripheral areas, a lack of cost-effective solutions in terms of mobility and the exclusion of inhabitants of secluded areas from "basic social services" are reflected in the implementation of the EU's cohesion policy aimed to reduce "disproportions between specific regions". Transport in particular should be adjusted to the needs of residents so as to provide them with free access to basic social needs and other diversified demands (decreasing population and growing demand diversification). To minimise these problems, it is necessary to undertake measures that may allow the obtaining of complete information on the needs of residents in terms of mobility. This information will assist local authorities in undertaking measures within the growth in the efficiency of transport systems by implementing innovative solutions which, in turn, should contribute to improved accessibility of these areas. This publication as a part of the MARA Project (Mobility and Accessibility in Remote Areas – a new approach to developing mobile expressions in remote areas) aims to partially minimize these deficits.

The following specific research purposes were formulated in the study:

- P1 – Evaluation of residents' and tourists' mobility problems and needs in Hajnówka County
- P2 – Assessment of the degree of saturation of transport services in Hajnówka County (How does the current offer of transport services meet the expectations of residents and tourists?)
- P3 – Assessment of the need for introducing changes and innovations in transport infrastructure and mobile services
- P4 – Development of a model of a system of coordination and cooperation with regard to the implementation of innovative mobile solutions in Hajnówka County.

The empirical research on citizens and tourists mobility in peripheral areas (prezented in the chapters 3.4.; 4.1.; 4.2 & 4.3.) was conducted and finansed in 2019–2021 years, as the part of the MARA international project: Mobility and Accessibility in Ruralareas (MARA) – New approaches for developing mobility concepts in remote areas; Problems of mobility and accessibility of tourist regions – on the example of rural areas of the Baltic Sea Region, financed by the Interreg BSR Program, Priority 3 "Sustainable transport". Specific objective 3.2 "Accessibility of remote areas and areas affected by demographic changes", Contract number 100#, project budget of EUR 2.3 million.

The monograph is divided into main two parts: theoretical and practical. It consists of four chapters, an introduction and conclusions. The first chapter presents an introduction to the innovative theoretical aspects as the background of further consideration. The second chapter describes the specific problems of peripheral areas including mobility issues. The next chapter contains the characteristics, methods and procedure of citizens' and tourists' mobility problems and needs research. The fourth part is a presentation of synthetic research results in the field of mobility services for inhabitants and tourists of analyzed Hajnówka County regions. The author's individual contribution is primarily the development of a theoretical model – a system of coordination and cooperation of innovations in the field of mobility (passenger transport) in a peripheral region. The whole consideration was completed with detailed and general conclusions. General recommendations were also specified.

The research implementation procedure consisted of three stages (Figure 3.1.). The first stage involved the literature review on innovation, and then, a review of literature and reports on peripherality, which required the performance of an analysis of theoretical and practical concepts referring to that topic in terms of understanding the concepts of innovation, peripheral region, as well as the possibility of supporting the development processes of those regions. Based on the above, various ideas have been developed to describe and understand the processes of initiating and stimulating regional progress. This stage also included the development of tasks and research procedures, as well as the division of tasks between individual partners, taking into account the specificity of each region (remote region, low-population region) and each partner (research institution, local government unit).

The result of the cooperation initiated by a German coordinator in 2017, was the preparation and submission of the project. The second stage was field research and performance of other tasks under the project. The tasks were planned to be completed in the period from January 2019 to June 2021; however, due to the SARS-CoV-2 pandemic, the deadline for the performance of the activities was extended until September 2021. The third and final stage consisted of summarising the research and the entire project, preparing final reports, as well as formulating and presenting conclusions and recommendations. The scope of the tasks under the project also included a scientific publication, which the author of this monograph has undertaken.

While implementing the project, especially its research part, the project partners applied different methodologies, both quantitative and qualitative. Secondary sources of information were used, i.e., research publications and reports on mobility. It must be noted that some regions were subjected to that type of research for the first time. Those were partners from Finland and Russia. The use of diverse methods makes it difficult or impossible to compare the obtained results. Therefore, the author of this monograph used the extensive research conducted in Poland by the team from Bialystok University of Technology in cooperation with the authorities of Hajnówka County. The research was conducted in Hajnówka County, mainly in the Białowieża Forest, which is the county's most attractive area. The research on the mobility needs of residents and tourists in Hajnówka County was conducted using the survey method (diagnostic sonar). Two research methods were used: F2F (face-to-face) and CAWI (Computer Assisted Web Interviewing). In both cases, respondents or interviewers were able to download the survey questionnaire on their mobile devices (smartphone, tablet) by means of scanning the QR code. From the perspective of the F2F method, the respondent had access to a paper version of the questionnaire and were able to provide answers in the questionnaire or to the interviewer who recorded them in an electronic version. The use of various research techniques was a consequence of the unexpected pandemic on a global scale. The SARS-CoV-2 pandemic, which resulted in the introduction of significant restrictions on movement, forced researchers to transfer part (continuation) of the research to the virtual space. To calculate the correlation between individual variables, the Chi-square test of independence and Cramer's V test were performed.

The main results of the performed research contribute to the theory, that is, to the disciplines of management and quality studies as well as economics and finance in the form of a proposed methodology for the assessment of mobility and needs and results of the research inquiry in the form of an Author's theoretical model – a system of coordination and cooperation of innovation in the field of mobility (passenger transport) in the peripheral region. The practical application of the results of the research includes recommendations for cooperation of the interested parties in the field of mobility and recommendations of mobility strategy in Hajnówka County.

1. Innovation as a major factor in the economic development

The problem discussed in this part of the study is defining the concept of innovation. The classification and scope of innovations were presented and the role of innovations in economic development was described, both at the macro, meso and microeconomic level.

Knowledge and innovativeness are currently being promoted as factors of development and are the most important instruments for raising the competitiveness of businesses and regions. Economic development, in an era dominated by a globalising, knowledge-based economy, does not take place solely by increasing the accumulation of capital or labour but by engaging them in such a way as to increase innovativeness. P.F. Drucker[1] defines innovations as special tools of entrepreneurs, thanks to which changes are created that contribute to undertaking a new economic activity or providing a new quality of service. According to W. Kosiedowski: "...nowadays, investments are the driving force of the economy, and their growth produces multiplier effects. Nowadays, though, the emphasis is put on their innovativeness. Also, labour resources are still a fundamental factor for development but their interpretation is changing, where the emphasis is put not so much on their size as on the quality of human capital..."[2].

1.1. Problems associated with defining innovation

Innovativeness is one of the main issues in the disciplines of economics and finance and management and quality sciences, while the consideration of innovation and its implementation is a part of the theory of innovation initiated by J.A. Schumpeter[3]

[1] P.F. Drucker, *Innovation and Entrepreneurship: Practice and Principles*, Harper and Row, New York 1985, p. 35–36.

[2] W. Kosiedowski, *Regiony Europy Środkowo-Wschodniej w procesie integracji*, Wydawnictwo Naukowe UMK, Toruń 2008, p. 48.

[3] J. Schumpeter, *The Theory of Economic Development*, Galaxy Book, New York 1932 (Polish edition: *Teoria rozwoju gospodarczego*, PWN, Warszawa 1960, p. 45).

already in the thirties of the previous century. Innovativeness is associated with the ability of organisations, sectors, regions or countries to seek, implement and disseminate innovation[4], i.e. to create something new or to make significant changes that can be measured and evaluated[5]. The term "innovation" comes from Latin and means the introduction of something new, reform, novelty – from *innovatio*, meaning "renewal", or from *innovare* – "to renew"[6].

Innovations are one of the factors determining competitiveness of the economy by identifying the position of an organisation on the market[7] and are related to its ability to introduce new products on the market, open new markets by combining strategic orientation with innovative actions and processes[8]. T. Kogabayev and A. Maziliauskas[9] consider the complex problem of defining and classifying innovations.

According to H. Brdulak[10], the creation, formation and use of innovations are becoming a basic measure of an organisation's efficiency in the competitive market and constitutes an important factor conditioning long-term economic success at the same time[11]. This opinion is continuing by C. Józefiak[12], who claims that the stronger the competition, the greater the compulsion to use product and technological innovations, also, the weaker the competition, the lesser the compulsion. E. Skawińska[13] believes that the competitiveness of economies is determined by the innovative activity of organisations, mainly enterprises. As a result of this activity, individual entities interact with each other to form various links, which fosters

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4 A. Pomykalski, *Zarządzanie organizacjami poprzez innowacje w regionie*, [in:] *Innowacyjność jako czynnik podnoszenia konkurencyjności przedsiębiorstw i regionów na Jednolitym Rynku Europejskim*, J. Otto, R. Stanisławski, A. Maciaszczyk (ed.), Wydawnictwo Politechniki Łódzkiej, Łódź 2007, p. 101.

5 M.F. Hilami, T. Ramayah, Y. Mustapha, S. Pawanchik, *Product and Process Innovativeness, Evidence from Malaysian SMEs*, „European Journal of Social Science" 2010, vol. 16, no. 4, p. 557–569.

6 W. Kopaliński, *Słownik wyrazów obcych i obcojęzycznych*, Wiedza Powszechna, Warszawa 1978, p. 433.

7 B. Glinka, J. Pasieczny, *Społeczny kontekst innowacyjności – wybrane aspekty*, [in:] *Działalność innowacyjna przedsiębiorstw w warunkach globalnych*, J. Bogdanienko, M. Kuzela, I. Sobczak (ed.), Wydawnictwo Adam Marszałek, Toruń 2007, p. 39.

8 E. Danneels, E.J. Kleinschmidt, *Product Innovativeness from the Firm's Perspective: Its Dimensions and their Impact on Project Selection and Performance* (Rev. 1/2000), Institute for the Study of Business Markets, The Pennsylvania State University, ISBM Report 4-2000; *Innowacyjność w zarządzaniu a konkurencyjność przedsiębiorstwa*, (ed.) R. Nowacki, Difin, Warszawa 2010, p. 30.

9 T. Kogabayev, A. Maziliauskas, *The definitions and classification of innovation*, „Holistica. Journal of Business and Public Administration" 2017, vol. 8(1), DOI: https://doi.org/10.1515/hjbpa-2017-0005.

10 *Wspólna Europa – Innowacyjność w działalności przedsiębiorstw*, H. Brdulak, T. Gołębiowski (ed.), Difin, Warszawa 2003, p. 133.

11 W.M. Grudzewski, I.K. Hejduk, *Zarządzanie technologiami. Zaawansowane technologie i wyzwanie ich komercjalizacji*, Difin, Warszawa 2008, p. 243.

12 C. Józefiak, *Efektywność zależy od stopnia konkurencyjności*, „Gazeta Prawna" 2006, entitled: *Ranking 500 najbardziej innowacyjnych polskich firm*, p. 32–33.

13 E. Skawińska, *Konkurencyjność i innowacyjność podmiotów*, Instytut Inżynierii Zarządzania Politechniki Poznańskiej, Poznań 2007, p. 5.

the creation of innovation. According to many economists, such as P.F. Drucker[14], R. Ciborowski[15], K. Meredyk[16], T. Kogabayev and A. Maziliauskas[17], the innovativeness of the economy is a direct determinant of economic development in developed countries. Much depends on the level of economic development. This could be, for example, a phase of development in which factors of production and access to them play a key role. This is the first phase of development, in the second phase, efficiency comes to the fore. This proves the transition from the extensive development phase to the more intensive one. K. Schwab[18] presents a very wide idea of the fourth digital revolution, pointing out that in the modern economy, changes occurring under the influence of innovative technologies are exceptionally dynamic in comparison to previous technological revolutions. The introduced innovations penetrate everyday life in every corner of the globe. Therefore, in his opinion, the most important task is to understand the new technological revolution in order to properly direct its course. This revolution offers great opportunities for humanity, while at the same time carrying numerous threats. There is an accumulation of technological breakthroughs and amazing achievements in such areas as[19]:

- Artificial intelligence (AI);
- Robotics;
- Internet of Things (IoT);
- Autonomous cars;
- 3D printing;
- Nanotechnology;
- Biotechnology;
- Materials science;
- Energy storage;
- or quantum computers.

There are numerous definitions of innovation in economic literature. These definitions were analysed, following J.A. Schumpeter[20], as early as the 1950s. J. Jewkes, D. Sawers and R. Stillerman recognised the need for the use of invention in business, calling it innovation[21]. Definitions of innovation can be found in publications

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14 P.F. Drucker, *Innowacja i przedsiębiorczość. Praktyka i zasady*, PWE, Warszawa 1994, p. 43.

15 R. Ciborowski, *Wpływ zmian w polityce ekonomicznej i globalizacji na postęp techniczny i konkurencyjność gospodarki Wielkiej Brytanii*, Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2004, p. 7.

16 K. Meredyk, *Instytucjonalne aspekty rozwoju gospodarczego Polski północno-wschodniej*, [in:] *Studia i rozprawy, koncepcja i koordynacja*, A. Kopczuk, K. Meredyk (ed.), Wyższa Szkoła Finansów i Zarządzania w Białymstoku, Białystok 2001, p. 6.

17 T. Kogabayev. A. Maziliauskas, op. cit.

18 K. Schwab, *Czwarta rewolucja przemysłowa*, Wydawnictwo Studio EMKA, Warszawa 2018, p. 17.

19 Ibidem, p. 18.

20 J.A. Schumpeter, op. cit., p. 45.

21 J. Jewkes, D. Sawers, R. Stillerman, *The Sources of Innovation*, McMillan, London 1958.

by M. Fischer[22] or C. McDermott and G. O'Connor[23]. This term is primarily combined with terms such as change, improvement or reform[24]. In contrast, H. R. Bartlett[25] used the term "idea" or "invention".

J.A. Schumpeter[26], who emphasised the need to implement the so-called new combinations, should be regarded as a precursor and creator of the theory of innovation. This combination, i.e. innovation, is expressed by the introduction of new goods into production or the improvement of existing ones, the introduction of new or improved production technologies, the application of new sales or purchase methods, the opening of new markets for the sale or distribution of production and supply, the use of new raw materials or semi-finished products, or the introduction of changes to the organisation of production. A broad approach is noticeable here, since the object of innovation, according to J.A. Schumpeter, may be a product, a production process, a new technique, a new management system, an organisation, as well as entry into a new market and new ways of marketing. Based on the studies conducted by Schumpeter, many definitions of innovation have been created, in which the common denominator remains the term *change*. Some examples of the definitions are presented below:

a) innovation is the first commercial introduction of a new product, process, system or device on the market[27];
b) innovations are understood as changes in production methods and products based on new or unused knowledge[28];
c) innovations as changes deliberately introduced by human beings or cybernetic systems designed by them, which consist in replacing previous states with others that are positively evaluated in the light of specific criteria and which, in total, constitute progress[29];
d) M.E. Porter believes that "innovation is the successful exploitation of new ideas"[30]. In his view, "innovation can manifest itself in a new product design, in a new production process, in a new marketing approach or in new ways of employee training"[31];

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22 M. Fischer, *Innovation, Knowledge Creation and Systems of Innovation*, „Annals of Regional Science" 2001, vol. 35, p. 199–216.

23 Ch.M. McDermott, G. O'Connor, *Managing Radical Innovation: An Overview of Emergent Strategy Issues*, „Journal of Product Innovation Management" 2002, vol. 19(6), p. 424–438.

24 *Innovation and technology transfer. Słownik pojęć*, E. Stawasz, K.B. Matusiak (ed.), PARP, Warszawa 2005, p. 65–66.

25 H.R. Bartlett, *The Development of Industrial Research in the United States*, National Research Council, Washington, D.C., 1941.

26 J.A. Schumpeter, op. cit., p. 45.

27 Ch. Freeman, *The Economics of Industrial Innovation*, Francis Pinter, London 1982, p. 7.

28 W. Janasz, K. Kozioł-Nadolna, *Innowacje w organizacji*, Wydawnictwo PWE, Warszawa 2011, p. 56.

29 Z. Pietrasiński, *Ogólne i psychologiczne zagadnienia innowacji*, PWN, Warszawa 1971, p. 9.

30 M.E. Porter, *The Competitive Advantage of Nations*, The Macmillan Press Ltd., London 1990.

31 M.E. Porter, *Porter o konkurencji*, PWE, Warszawa 2001, p. 202.

e) P.R. Whitfield argues that "innovation is a sequence of complex problem-solving activities"[32]. The result is some concrete and completely developed novelty;
f) innovation is a deliberate human-designed change of a product (introduction of new or significantly improved products into production and onto the market), production method (use of new or significantly improved methods in production), work and production organisation (new organisational solutions in the structural and process sense or substantial improvement of those already existing) or management method, applied for the first time in a given community to obtain specific socio-economic benefits and which meets defined technical, economic and social criteria[33];
g) systematic innovation is the deliberate and structured search for change and the systematic analysis of opportunities for social or economic innovation that such change could allow[34];
h) innovations are products and methods previously unknown, i.e. original in an absolute sense. Other product and process changes, particularly those resulting from technology and organisational transfer, are, in his view, imitative by nature[35];
i) according to Ph. Kotler[36], the term innovation refers to any good, service or idea that is perceived by someone as new;
j) innovation involves the production and sale, and hence the putting into service, of a new product or the economic application of a new process to obtain previously known products[37]. Innovation is, in his view, the first economic use of an invention or idea;
k) innovation is the creation or modification of processes, products, techniques and methods of operation that are perceived by an organisation as new and progressive in a given field and lead to more efficient use of resources present at its disposal[38];

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32 P.R. Whitfield, *Innowacje w przemyśle*, PWE, Warszawa 1979, p. 26.

33 J. Baruk, *Dylematy rozwoju małych i średnich przedsiębiorstw*, „Gospodarka Narodowa" 2002, no. 3.

34 P.F. Drucker, *Innowacja i przedsiębiorczość...*, p. 29.

35 K. Meredyk, *Naturalna stopa wzrostu innowacyjności*, [in:] *Innowacje w rozwoju gospodarki i przedsiębiorstw: siły motoryczne i bariery*, E. Okoń-Horodyńska, A. Zachorowska-Mazurkiewicz (ed.), Instytut Wiedzy i Innowacji, Warszawa 2007, p. 24.

36 P.H. Kotler, *Marketing. Analiza, planowanie, wdrażanie i kontrola*, Gebethner & Ska, Warszawa 1994, p. 322.

37 J. Czupiał, *Zarys metodologii planowania i oceny przedsięwzięć badawczo-innowacyjnych*, PWN, Warszawa 1988, p. 50.

38 J. Penc, *Innowacje i zmiany w firmie – transformacja i sterowanie rozwojem przedsiębiorstwa*, Agencja Wydawnicza PLACET, Warszawa 1999, p. 143.

l) innovations are the production, creation, introduction and dissemination of novelties leading to developmental changes and are undoubtedly the driving force behind any economy[39];
m) innovation is the first practical use of an invention[40];
n) innovation is understood as any thought, behaviour or thing that is new, that is qualitatively different from existing forms[41];
o) Ch. Freeman claims that innovation is the first commercial introduction of a new product, process, system or device to the market[42];
p) S. Marciniak[43], on the other hand, puts emphasis on "creative changes", classifying creative changes in the social system, economic structure, technology and nature as innovation;
q) the definition of innovation depicted by E. Szymańska[44] presents this issue from the perspective of an enterprise, in the context of its financial results. The author emphasises that all the phenomena, both positive and negative, occurring in an enterprise are reflected in its financial result; she defines innovations as qualitatively different changes from the existing forms, at least from the point of view of the enterprise introducing them. The introduced changes result in an increase in revenue from sales or a reduction in operating costs of the enterprise;
r) J. Skalik[45] defines it as the ability and motivation of an organisation to continuously search for and apply in practice the results of scientific research and R&D work, new concepts, ideas, and inventions;
s) D. Castenowa believes that innovation is about finding good ideas and making them marketable[46];
t) J.A.F. Stoner, R.E. Freeman and D.R. Gilbert[47] by innovation understand the transformation of a new idea into a new form, a new product, a new service, a new process or a new production method;

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[39] I. Domanowska, *Znaczenie innowacyjności i instrumenty wspierające innowacyjność przedsiębiorstw w kontekście integracji z Unią Europejską*, [in:] *Zarządzanie innowacjami. Teoria i praktyka*, J. Szabłowski (ed.), Wydawnictwo Wyższej Szkoły Finansów i Zarządzania w Białymstoku, Białystok 2006, p. 198.

[40] W. Nasierowski, *Zarządzanie rozwojem techniki*, PLTEXT, Warszawa 1997, p. 45–46.

[41] W.M. Grudzewski, I.K. Hejduk, *Rozwój i implementacja organizacji inteligentnej*, [in:] *Przedsiębiorstwo przyszłości*, W.M. Grudzewski, I.K. Hejduk (ed.), Difin, Warszawa 2000, p. 139.

[42] Ch. Freeman, op. cit., p. 7.

[43] S. Marciniak, *Innowacje i rozwój gospodarczy*, Politechnika Warszawska, Warszawa 1998, p. 8.

[44] E. Szymańska, *Procesy innowacyjne przedsiębiorstw świadczących usługi w zakresie organizacji imprez turystycznych*, Oficyna Wydawnicza Politechniki Białostockiej, Białystok 2013, p. 65.

[45] *Zmiana warunkiem sukcesu. Zmiana a innowacyjność gospodarki*, J. Skalik (ed.), Wydawnictwo Akademii Ekonomicznej we Wrocławiu, Wrocław 2004, p. 536.

[46] D. Castenow, *Nowy marketing w praktyce*, PWE, Warszawa 1996, p. 35.

[47] J.A.F. Stoner, R.E. Freeman, D.R. Gilbert, *Kierowanie*, PWE, Warszawa 2001, p. 413–414.

u) The Center for Social and Economic Research[48], referring to the "Dictionary of Terms" developed by the Polish Agency for Enterprise Development (PARP), states that "...innovation is a variety of facts, processes and phenomena of a technical, organisational, social or psychological nature"[49]. PARP follows the notion of J.A. Schumpeter and assumes that innovation is "an innovative activity, which may take place in industry and services both in relation to products (by creating new or significantly modifying already existing products) and in relation to production processes (by their improvement)"[50].

In the Polish Act on Certain Forms of Support for Innovative Activity, this activity consists of "...developing a new technology and launching on its basis the production of new or significantly improved goods, processes or services"[51]. The said Act does not define the term "innovation". Meanwhile, innovation is a practical activity, referring both to production, in the sense of improving or creating processes and products, and to the service provided, as well as to the enterprise's management strategy. Statistics Poland (GUS) states that innovation is "a product or service that differs significantly in its characteristics or purpose from products previously produced by the enterprise"[52]. This definition, based on the guidelines of the Organization for Economic Co-operation and Development (OECD)[53] presented in the *Oslo Manual*[54], applies to the entire pragmatics of collecting, processing and using data collected and published by Statistics Poland. In the 2018 edition of the Manual, the OECD defines innovation as "a new or improved product or process (or their combination) that is significantly different from previous products or processes and that has been made available to potential users (product) or put into use by an entity (process)"[55]. The new definition formulates the phenomenon of innovation more precisely in terms of its use in economic nomenclature and in assessing the innovativeness of enterprises and economies.

When analysing the presented definitions, one can notice significant discrepancies in the understanding of the phenomenon of innovation and distinguish two main trends, that is, a detailed and general approach to innovation. In the detailed approach,

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48 Available at: http://www.case-research.eu/pl/publications, accessed: 20 March 2019.

49 *Innowacje i transfer technologii. Słownik pojęć*, K.B. Matusiak (ed.), PARP, Warszawa 2011, p. 111, available at: https://www.parp.gov.pl/files/74/81/469/12812.pdf, accessed: 24 March 2019.

50 Ibidem, p. 111.

51 Dz.U. [Journal of Laws] of 2018, item 142, Article 2 of the Act of 30 May 2018 on certain forms of support for innovative activities, available at: http://prawo.sejm.gov.pl/isap.nsf/download.xsp/WDU20081160730/U/D20080730Lj.pdf, accessed: 25 March 2019.

52 Concepts used in official statistics, Statistics Poland, available at: https://stat.gov.pl/metainformacje/slownik-pojec/pojecia-stosowane-w-statystyce-publicznej/626,pojecie.html, accessed: 25 March 2020.

53 www.oecd.org.

54 *Oslo Manual*, OECD 2018, http://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm, accessed: 25 March 2020.

55 The most recent definition by the OECD is available at: http://www.oecd.org/sti/inno/oslo-manual-2018-info.pdf accessed: 28 April 2020.

only innovations of the so-called "first application" can be considered as innovation. Those are the first result of an idea, invention, research or discovery and are applied for the first time. By contrast, in the general approach, innovation is defined at the level of the specific approach but may also include diffusion, copying, imitation or dissemination. That is, depending on the approach, innovation can be considered as both research, its effect in the form of an invention and its first application (in narrow terms) or its copy (in a broad sense)[56]. The definitions of, i.e., W. Nasierowski, M. Porter, Ch. Freeman or J. Czupiała fall within the detailed approach to innovation. In turn, the general approach to innovation is followed by S. Marciniak, D.M. Rogers, J. Baruk.

J. Baruk argues that the unambiguous definition of novelty allows for a correct distinction between innovation and any other change, as not every change is an innovation even though every innovation is a beneficial change to an existing state[57]. P.F. Drucker[58] claims that innovation, by definition, should be decentralised, spontaneous, independent and relate to the microeconomic scale. According to W. Janasz[59], the detailed approach to innovation dominates in the economic theory and the general approach is adopted in the economic practice.

Moreover, another classification – of a dichotomous nature[60], highlighted in the *Oslo Manual*, is also used in the economic literature:

- innovation as a process involving the emergence of an idea as well as design, research and development works, production, marketing and dissemination;
- innovation as a result of that process, i.e. goods, services or ideas considered to be new in given markets.

A. Kukliński points out that innovation is more than just a single productive act and should be treated as a complex process resulting in the creation of new ideas, products and technologies[61]. P.F. Drucker[62] emphasised that the innovation process is organised in a purposeful, systematic and coordinated way, so that it is possible

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56 E. Szymańska, *Procesy innowacyjne...*, p. 65.

57 J. Burak, *Innowacje, kultura innowacyjna i poziom innowacyjności przedsiębiorstw przemysłowych*, „Gospodarka Narodowa" 2002, no. 11–12, p. 79.

58 P.F. Drucker, *Natchnienie i fart czyli innowacja i przedsiębiorczość*, Wydawnictwo Studio Emka, Warszawa 2004, p. 293.

59 *Innowacje w modelach działalności przedsiębiorstw*, W. Janasz (ed.), Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2003, p. 53.

60 Cf. B. Pysiak, *Innowacje w regionie*, [in:] *Innowacyjność w teorii i praktyce*, M. Stróżycki (ed.), Wydawnictwo SGH w Warszawie, Warszawa 2006, p. 187; J. Kot, *Foresight wiodących technologii województwa świętokrzyskiego w świetle jego struktury gospodarczej i poziomu innowacyjności*, [in:] *Gospodarka lokalna i regionalna w teorii i praktyce*, R. Brol (ed.), Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 46, Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław 2009, p.138.

61 K. Kuciński, *Organizacja przestrzenna gospodarki*, [in:] *Geografia ekonomiczna*, K. Kuciński (ed.), Wolters Kluwer, Kraków 2009, p. 1–7.

62 P.F. Drucker, *Innovation and Entrepreneurship and Principles*, Heinemann, London 1994, p. 25.

to move from an idea to the creation of an innovation. According to M. Pichlak[63], innovations may cover many areas of an enterprise's activity, thus there are many criteria for the division of innovations. However, one should acknowledge the opinion of W.M. Grudzewski and I.K. Hejduk[64] that innovation seen both as a "result" and as a "process" are intrinsically related to innovativeness.

To sum up, there are different definitions of innovation in the economic literature, as innovation is considered to be both scientific research, its results in the form of an invention and its first application (the detailed approach) and only a copy of it (the general approach). Most definitions, particularly those relating to business practice, fit into the general approach to innovation, consider innovation to be a copy or novelty from the perspective of an organisation. it is relatively easy to define and identify innovations and their effects in manufacturing companies, whereas a problem arises when service innovations are evaluated. Even more difficulties are encountered by the researcher exploring the issue of innovation in non-profit organisations, such as non-governmental organizations or entities providing public services. In the author's opinion, each introduced innovation should bring measurable benefits; therefore, it can be assumed that an innovation is a novelty (change) concerning a product or process that results in an increase in revenue from the sale of goods or services or a reduction in operating costs or a positive, measurable impact on the environment.

1.2. Innovation in research and its role in economic development

The impact of innovation on economic development is widely reported in the literature. A review of the literature shows a growing interest among researchers in knowledge and innovativeness as key factors in development, whether at the level of an organisation, a region or the entire European economy. The changing structure of industry and its declining role since the 1950s, has contributed to the emergence of new concepts. Initially, the issue of innovativeness was addressed from a macroeconomic perspective, mainly in terms of the impact of technological progress on economic development. Subsequently, a stream of research of a microeconomic nature was established, which concerned the analysis of the components of technical progress, including innovation[65]. The national economy was taken as the main point of reference in the innovation theory in the macroeconomic context, whereas the enterprise

[63] M. Pichlak, *Uwarunkowania innowacyjności organizacji. Studium teoretyczne i wyniki badań empirycznych*, Difin, Warszawa 2012, p. 29.

[64] W.M. Grudzewski, I.K. Hejduk, *Zarządzanie technologiami...*, p. 245.

[65] W. Janasz, K. Kozioł, *Determinanty działalności innowacyjnej przedsiębiorstw*, PWE, Warszawa 2007, p. 13.

was taken as the main reference in the microeconomic context. Several trends can be distinguished in the area of interest of economists dealing with innovation. The main ones include the research on the determinants of innovation in the economy (F. Gault[66] and H. Hollenstein[67]), also taking into account the knowledge-based economy (Baruk[68]; M. Dolińska[69]). One of the most important areas of research and recommendation is innovation policy (J.L. Furman, M.F. Porter, S. Stern[70]; A.H. Jasiński[71]; M. Szajt[72], E. Stawasz[73]). Innovation is an integral part of the economy in a global (R.W. Rycroft[74]; E. Bojar[75]) and microeconomic (Z. Perunovic and T.B. Christiansen[76]) context. Many researchers (M. S. Frel[77], W. Janasz and K. Kozioł-Nadolna[78], or A. Domanowska[79]; E. Okoń-Horodyńska[80]) relate their studies directly to enterprises. Extensive and detailed studies of innovation refer to technical progress and R&D expenditures and their role in the innovation process (B.Y. Aw, M.J. Roberts, D. Yi Xu[81];

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66 F. Gault, *Innovation Strategies for a Global Economy*, Edward Elgar, Cheltenham, UK, 2010.

67 H. Hollenstein, *Innovations modes in the Swiss service sector: a cluster analysis based on firm-level data*, „Research Policy" 2003, vol. 32(5), p. 845–863, DOI:10.1016/S0048-7333(02)00091-4.

68 J. Baruk, *Zarządzanie wiedzą i innowacjami*, Wydawnictwo Adam Marszałek, Toruń 2006.

69 M. Dolińska, *Innowacje w gospodarce opartej na wiedzy*, PWE, Warszawa 2010.

70 J.L. Furman, M.F. Porter, S. Stern, *Determinants of national innovative capacity*, „Research Policy" 2002, vol. 31, p. 899–993.

71 A.H. Jasiński, *Innowacyjność w gospodarce Polski: Modele, bariery, instrumenty wsparcia*, Wydawnictwo Naukowe Wydziału Zarządzania UW, Warszawa 2014; idem, *Polityka innowacyjna w procesie transformacji w Polsce. Czy skuteczna?*, „Optimum" 2018, vol. 3, p. 221–239, DOI: 10.15290/oes.2018.03.93.18.

72 M. Szajt, *Determinanty wzrostu poziomu innowacyjności w Polsce na tle innych państw europejskich*, [in:] *Działalność innowacyjna przedsiębiorstw w warunkach globalnych*, J. Bogdanienko, M. Kuzela, I. Sobczak (ed.), Wydawnictwo Adam Marszałek, Toruń 2007.

73 E. Stawasz, *Wybrane problemy realizacji polityki innowacyjnej w regionie łódzkim*, „Zeszyty Naukowe Ekonomiczne Problemy Usług" 2009, no. 28, p. 269–278.

74 R.W. Rycroft, *Technology-based globalization indicators, centrality of innovation network data*, „Technology in Society" 2003, vol. 25, no. 3, p. 299–317.

75 E. Bojar, E. Frejtag-Mika, *Objectives of competitive strategy of transnational corporations in conditions of globalization*, [in:] *The Economics of Education and Innovation for Sustainability and Growth*, Congress of Political Economics International (COPE), 19th Annual Meeting, New Delhi, India, July 12–19, 2008 (materiały konferencyjne na nośniku elektronicznym).

76 Z. Perunovic, T.B. Christiansen, *Exploring Danish innovative manufacturing performance*, „Technovation" 2006, vol. 26, p. 1051–1058.

77 M.S. Frel, *Sectoral patterns of small firms innovation, networking and proximity*, „Research Policy" 2003, vol. 32, p. 751–770.

78 W. Janasz, K. Kozioł, *Determinanty...*

79 I. Domanowska, op. cit.

80 *Tendencje innowacyjnego rozwoju polskich przedsiębiorstw*, E. Okoń-Horodyńska, A. Zachorowska-Mazurkiewicz (ed.), Instytut Wiedzy i Innowacji, Warszawa 2008.

81 B.Y. Aw, M.J. Roberts, D.Y. Xu, *R&D Investment, Exporting, and Productivity Dynamics*, „American Economic Review" 2011, vol. 101, p. 1312–1344.

K. Matusiak[82]; R. Ciborowski[83]). Emphasis is placed on the leading role of innovation in shaping competitive advantage (M.A. Weresa[84]; E. Skawińska and R.I. Zalewski[85]; W. Świtalski[86]). There are also studies of innovation in selected sectors, e.g., tourism (A.M. Hjalager[87]; E. Szymańska[88]; H. Sasinowski[89]), transport (P. Niedzielski[90]) or agriculture (J. Sikora[91]). There are also attempts to search for innovation in various areas of social activity and to combine completely different phenomena (R. Deshpande, J.U. Farley[92]; E. Szymańska, E. Panfiluk, H. Kiryluk[93]).

J.A. Schumpeter recognised the importance of innovation in economic development already in the first half of the 20th century[94], and his idea was followed until the Second World War. He was the first economist who argued, in his work "The Theory of Economic Development", that changes resulting from continuous adjustments in the economy do not lead to the formation of a new phenomenon nor to the development in the usual sense because development is characterised by new combinations formed discontinuously and these are innovations. The scholar stressed the correlation between innovation and creativity and the processes of the so-called creative destruction consisting in destroying existing solutions and structures and replacing them with new, more perfect ones. He gave a new dimension

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82 *Innowacje i transfer technologii*, K.B. Matusiak (ed.), Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2010.

83 R. Ciborowski, *Wpływ zmian...*; idem, *Procesy innowacyjne w warunkach globalizacji*, [in:] *Ekonomia, polityka, etyka*, A.F. Bocian (ed.), Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2003, p. 163–184.

84 *Polska. Raport o konkurencyjności 2006. Rola innowacji w kształtowaniu przewag konkurencyjnych*, M.A. Weresa (ed.), SGH, Warszawa 2006 (oraz kolejne raporty).

85 E. Skawińska, R.I. Zalewski, *Klastry biznesowe w rozwoju konkurencyjności i innowacyjności regionów. Świat – Europa – Polska*, PWE, Warszawa 2009.

86 W. Świtalski, *Innowacje i konkurencyjność*, Wydawnictwo Uniwersytetu Warszawskiego, Warszawa 2005.

87 A.M. Hjalager, *A review of innovation research in tourism*, „Tourism Management" 2010, vol. 31, no. 1, p. 1–12, DOI:10.1016/j.tourman.2009.08.012.

88 E. Szymańska, *Innowacyjność przedsiębiorstw usługowych*, Polskie Wydawnictwo Ekonomiczne, Warszawa 2021.

89 H. Sasinowski, *Innowacyjność w promocji walorów turystycznych*, [in:] *Innowacje w rozwoju turystyki*, M. Jalinik (ed.), Wydawnictwo Politechniki Białostockiej, Białystok 2008.

90 P. Niedzielski, *Polityka innowacyjna w transporcie*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2003.

91 J. Sikora, *Innowacyjność w agroturystyce polskiej*, [in:] *Innowacje w rozwoju...*

92 R. Deshpande, J.U. Farley, *Organizational culture, market orientation, innovativeness, and firm performance: an international research odyssey*, „International Journal of Research in Marketing" 2004, vol. 21, p. 3–22.

93 E. Szymańska, E. Panfiluk, H. Kiryluk, *Innovative solutions for the development of sustainable transport and improvement of the tourist accessibility of peripheral areas. Case of the Białowieża Forest Region*, „Sustainability" 2021, vol. 13(4), p. 1–23, DOI: https://doi.org/10.3390/su13042381.

94 J. Schumpeter, *The Theory...* op. cit.

to the concept of creative destruction, thus describing the process of making breakthroughs[95], clearly emphasising the aspect of introducing novelty through the prism of change[96]. The successors of J.A. Schumpeter are such scholars as N. Rosenberg[97], P.F. Drucker[98], C. Poblete[99], N. Rosenbusch, J. Brinckmann and A. Bausch[100], S. Gomułka[101], A.H. Jasiński[102], R. Ciborowski[103], W.M. Grudzewski and I.K. Hejduk[104].

The last three decades of the 20th century saw the intense development of the service sector and, as a result, the scope for innovation widened considerably and went far beyond the technical sphere[105]. The OECD's[106] Innovation Research Programme, launched in 1988, was a response to these developments, stimulating a search for data interpretation, theoretical generalisations and guidance for national innovation policies. The publications issued by the OECD, starting from 1992 to the present day, are methodological studies on the economic and social impact of research and innovation.

Many classifications of innovations can be found in the economic literature and they relate to many areas of human activity. Just like innovation systems, the classification of innovations in the literature has also evolved. H. Hollenstein[107] makes a simple dichotomous division of innovations, dividing them into two basic groups: technological and non-technological. R.W. Griffin[108] and K. Meredyk[109] also indicate two basic groups of innovations, namely those concerning products and processes. The classification of innovations can be made by taking into account the area of their occurrence, their scope or their effects. According to the latter

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95 M.A Weresa, *Polityka innowacyjna*, PWN Warszawa 2014, p. 11.

96 R. Klóska, *Innowacyjność jako determinanta rozwoju regionalnego w Polsce*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2015, p. 63.

97 N. Rosenberg, *Joseph Schumpeter: Radical Economist*, [in:] *Exploring the Black Box. Technology, Economics, and History*, Cambridge University Press, Cambridge 1994, p. 47–61.

98 P.F. Drucker, *Natchnienie i fart*..., p. 30.

99 C. Poblete, *Growth expectations through innovative entrepreneurship. The role of subjective values and duration of entrepreneurial experience*, „International Journal of Entrepreneurial Behavior" 2018, No. 24, vol. 1, p. 191–213, DOI: 10.1108/IJEBR-03-2017-0083.

100 N. Rosenbusch, J. Brinckmann, A. Bausch, *Is innovation always beneficial? A meta-analysis of the relationship between innovation and performance in SMEs*, „Journal of Business Venturing" 2011, vol. 26, no 4, p. 441–457.

101 S. Gomułka, *Teoria innowacji i wzrostu gospodarczego*, Centrum Analiz Społeczno-Ekonomicznych „CASC", Warszawa 1998.

102 A.H. Jasiński, *Innowacje i polityka innowacyjna*, Wydawnictwo Uniwersytetu w Białymstoku, Białystok 1997.

103 R. Ciborowski, *Wpływ zmian*...

104 W.M. Grudzewski, I.K. Hejduk, *Zarządzanie technologiami*...

105 W. Janasz, K. Kozioł, *Determinanty*..., p. 13.

106 Technology/Economy Programme (TEP): available at: www.oecd.org.

107 Compare: H. Hollenstein, op. cit.

108 R.W. Griffin, *Podstawy zarządzania organizacjami*, PWN, Warszawa 1996, p. 661–663.

109 K. Meredyk, *Naturalna stopa wzrostu*..., p. 24.

proposal, the division can be based on the criteria of benefits brought to the society[110], J. Baruk distinguishes[111]:

- cost-saving innovations,
- innovations resulting in improved product quality,
- innovations resulting in increased product volume,
- innovations resulting in improved working and safety conditions,
- innovations resulting in the protection of the natural human environment.

Referring to the publication by P. Skarzynski and R. Gibson, innovation can be distinguished by considering the areas of innovative activity[112]:

- service innovations,
- cost innovations,
- management innovations,
- business model innovations,
- industrial innovations.

This division originates from the discipline of management and quality sciences (formerly: management sciences). Apart from the above classifications, other divisions of innovations are also presented in the economic literature, the ordering of which was undertaken by P. Niedzielski (Table 1.1).

TABLE 1.1. Types of innovations according to P. Niedzielski

Innovation category	Type of innovation
Technical	• new machinery and equipment, • new means of transport
Anthropocentric (e.g. pushing the limits in sport, raising the average intelligence quotient)	• physiological improvement, • functional-morphological improvement, • neuro-psychological improvement
Societal (e.g. revolutions and evolutionary changes in political, economic and social systems)	• changes that accompany revolutions and the evolution of society, • changes in economic systems, • changes in social policy, • changes in organisation and management
Biotic	• plant and animal hybridisation, • selection of tree ecotypes, • pest control

SOURCE: P. Niedzielski, *Polityka innowacyjna w transporcie*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2003, p. 19–20.

[110] One can also speak of the so-called *incremental innovations*, compare: H. Hollenstein, op. cit.

[111] J. Baruk, *Zarządzanie*... op. cit., p. 108.

[112] P. Skarzynski, R. Gibson, *Innovation to the Core. A Blueprint for Transforming the Way Your Company Innovates*, Harvard Business Press, Boston 2008, p. 98–100.

The presented classification goes far beyond economic sciences and fits into the interdisciplinary nature of sciences, making interesting connections between its different disciplines. The TRIZ[113] concept, based on the search for innovative applications for existing inventions, is part of the search for a new reference point.

The classification of innovations in the scientific literature covers diverse areas of innovative activity of the modern human being. Among them were[114] both anthropocentric, biotic, technical and communication infrastructure and societal innovations, and above all innovations related to the activities of enterprises. Apart from the rather obvious connotations, there may be other ties as well.

Based on the *Oslo Manual*[115] classification and referring to the theory of J.A. Schumpeter, innovations can be divided into: product (concerning both goods and services), process, organisational and marketing. An additional type of innovation, namely – social innovation, is also considered as important. Product innovation includes any modification, improvement, change related to a product (which can be a good or service). Process innovations refer to improvements in a core process of organisation. Organisational innovation includes[116]:

- implementation of advanced management techniques,
- introducing substantially modified organisational structures,
- implementation of new or substantially changed strategies for the operation of the organisation,
- introduction of new forms of marketing,
- introduction of new forms of sales.

Marketing innovations can relate to products, pricing, distribution and promotion[117]. According to the *Oslo Manual*, a marketing innovation is understood as the implementation of a new marketing method involving significant changes in product design/construction, distribution, promotion or pricing strategy[118]. E. Stawasz lists many types of innovation[119]:

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[113] Information available in, i.e., *The Encyclopaedia of Management*, available at: https://mfiles.pl/pl/index.php/TRIZ, accessed: 17 August 2019; at: http://triz-innowacje.pl/triz-technika.html, accessed: 17 August 2019.

[114] Compare: E. Szymańska, *Innowacyjność przedsiębiorstw turystycznych w Polsce*, Oficyna Wydawnicza Politechniki Białostockiej, Białystok 2009, p. 60; *Innovation in Small Firms and Dynamics of Local Development*, T. de Noronha Vaz, J. de Viaene, M. Wigier (ed.), Scholar, NY 1999, p. 15.

[115] *Oslo Manual*, OECD–Eurostat, Paris 2005. The latest edition of the Manual simplifies this division by distinguishing two types of innovation: product and business – compare: *Oslo Manual*, OECD, 2018, information available at: http://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm, accessed: 26 March 2019.

[116] Compare: www.oecd.org/dataoecd, accessed: 25 March 2019.

[117] M. Koszembar-Wilkik, *Innowacje marketingowe – advertainment i advergaming w komunikacji z rynkiem*, „Nauka i Gospodarka" 2001, no. 2, p. 32–33.

[118] *Oslo Manual...*, 2005, p. 57.

[119] E. Stawasz, *Rodzaje innowacji*, [in:] *Innowacje i transfer technologii. Słownik pojęć...*, p. 143–145.

a) Taking the subject into account:
   – product (subject), consisting of the manufacture of a new product or the improvement of products already manufactured,
   – process (technological), involving changes in manufacturing methods,
   – organisational (procedural), concerning changes in the organisation of the production process.
b) Taking the scale of innovation into account:
   – radical, ground-breaking,
   – revolutionising the production process,
   – incremental, ensuring less progress than in the previous cases and only improving the production.

In earlier publications, the author proposed a division based on the reach (impact) of innovations, distinguishing[120]:
- global reach (equivalent to absolute, i.e. unique);
- national reach (a national novelty);
- regional reach.

Innovation theory has been vigorously developing in recent decades. At the beginning of the 21st century, Z. Perunovic and T.B. Christiansen[121] distinguished six concepts of innovation, and a dozen different concepts can be identified presently, such as[122]:
a) linear:
   – science-pushed (knowledge),
   – market-pulled;
b) complex:
   – coupled,
   – integrated,
   – IT and ITC,
   – self-learning and cross-learning,
   – open,
   – user-driven innovation,
   – integrated and networked,
   – dispersed,
   – of the three horizons.

[120] Compare: E. Szymańska, *Procesy innowacyjne...*

[121] P.K. Ahmed, *Sixth Generation Innovation: Innovation Management Systems Into Future*, „European Journal of Innovation Management" 2000, vol. 3, p. 112–114; Z. Perunovic, T.B. Christiansen, op. cit., p. 595–602.

[122] E. Szymańska, *Innowacyjne przedsiębiorstwo usługowe*, Polskie Wydawnictwo Ekonomiczne, Warszawa 2021.

The presented dynamics of the development of innovation theory is impressive as the number of concepts has more than doubled since 2006 – moving from linear to increasingly open-ended propositions. In relation to subsequent innovation concepts (models, processes, systems), one encounters diverse nomenclature in the literature referring to these concepts: innovation systems, innovation process models, and innovation generations[123]. It is important to recognise that they all fit into the general theory of innovation. It originated in the first half of the 20th century and resulted in two concepts – linear models of innovation processes, which include: "science-pushed" and "market-pulled" (market-driven). Other models (systems) are complex in nature and one should speak of two basic groups of them: linear and complex (non-linear).

In the "science-pushed" model, the initial impulse is basic research, mainly new scientific theories, which results in the development of applied science followed by the development of technology in the form of discoveries and inventions. Research conducted to discover new scientific regularities, mechanisms or principles is called basic research and is the basis for formulating the laws of science. They become an impulse to undertake applied research, which concerns the possibility of using the possessed knowledge in practice to implement a specific idea. Basic and applied research is commonly referred to as "research and development", abbreviated R+D[124]. The "science-pushed" model is also called the supply-side model[125]. Such a model, according to A. Pomykalski[126], includes the following elements: concept, concept analysis, operation model, prototype (tests, improvements), production prototype (tests, improvements, design, assembly), short series (improvements), and launching full production. E. Stawasz[127] argues that such a model was widely used until the mid-1960s, and its result is commercialisation, which means basing some activity on commercial principles[128]. Commercialisation is a way of transforming innovative ideas into market-ready innovative technologies, processes or products[129].

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123 This issue is described by the author in: eadem, *Procesy innowacyjne...*

124 *Zarządzanie innowacjami. Wybrane problemy*, Z.J. Bogdanienko (ed.), SGH, Warszawa 1998, p. 14.

125 M. Urbaniak, *Funkcjonowanie przedsiębiorstw w ujęciu modeli procesu innowacyjnego*, [in:] *Rozwój przedsiębiorstw – strategia – integracja*, J. Tarajkowski (ed.), Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań, 2004, p. 33.

126 A. Pomykalski, *Zarządzanie innowacjami*, Wydawnictwo Naukowe PWN, Warszawa–Łódź 2001, p. 79.

127 E. Stawasz, *Innowacje a mała firma*, Uniwersytet Łódzki, Łódź 1999, p. 26.

128 Commercialization, from the Latin "commercialis" – commercial, on the basis of: *Słownik wyrazów obcych*, PWN, Warszawa 1991, p. 440.

129 Source: *Innowacja*, electronic document available on the website of the Polish Agency for Enterprise Development: http://pi.gov.pl/PARP/data/Prezentacja_17_12_08/modul_1.pdf, accessed: 5 September 2019; compare also: K. Gruba. A Łubnicka, *Innowacje i komercjalizacja wyników badań naukowych na Uniwersytecie Jagiellońskim*, CITTRU, 2007, available at: http://www.cittru.uj.edu.pl accessed: 5 September 2019.

The group of linear models includes the "demand-stimulated (pulled)" model, also known as the demand model[130]. Already in the 1970s, R.L. Daft[131] recognised the importance of customer needs as the initial impulse in the innovation process and proposed five stages, where the initial impulse is the need of consumers, and the final element of the process is the implementation of innovation. This model requires the organisation to constantly monitor the market, as it is in the market that the signals and inspirations for action by the scientific and research sphere originate. The need expressed by consumers may mean a lack satisfaction with the current state or a problem that needs to be eliminated. An extended linear model of the demand process was presented by P. McGowan[132]. The scientist emphasises a large number of ideas processed by an organisation and believes that in every enterprise there is a need to generate innovative ideas in many areas of its functioning.

Non-linear (complex) concepts form the second group of models. The originators can be considered to be S.J. Kline and N. Rosenberg[133], who recognised that the innovation process is not linear and does not mean a cause-and-effect process, such as discovery-invention-innovation[134]. Their proposal is supported by the likelihood of interdependence of the process phases and the existence of multiple feedbacks between them[135]. This approach has led to the construction of a coupled model where individual elements arise from the coupling between science, the market and the enterprise. This process is characterised by the occurrence of *feedback*, which is a mechanism of direct or indirect influence of changes in the outputs of a given system on the state of its inputs, and is based on cooperation between consumers and various teams: marketing, sales, design, suppliers, production. The result of the cooperation should be a product that meets consumer expectations[136]. This idea led to the development of another concept – an integrated management system, which consists of at least two subsystems the role of which is to optimise internal and external processes by offering ready-made tools that should be more effective in achieving objectives than the traditional approach[137].

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130 M. Urbaniak, op. cit., p. 33.

131 R.L. Daft, *A dual-core model of organizational innovation*, „Academy of Management Journal" 1978, vol. 21, p. 193–210.

132 Compare: P. McGowan, *Innowacja i przedsiębiorczość wewnętrzna*, [in:] *Praktyka kierowania. Jak kierować sobą, innymi i firmą*, D. Steward (ed.), PWE, Warszawa 1996, p. 581–582.

133 S.J. Kline, N. Rosenberg, *An Overview of Innovation*, [in:] *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, R. Landau, N. Rosenberg (ed.), National Academy Press, Washington 1986, p. 289.

134 S.J. Kline, *Innovation is not a Linear Process*, „Research Management" 1985, vol. 28, p. 36–45.

135 W. Butryn, *Od sekwencyjnego do symultanicznego modelu procesu innowacyjnego*, „Innowacje" 2004, no. 22.

136 W.M. Grudzewski, I.K. Hejduk, *Zarządzanie technologiami...*, p. 371.

137 BSI Management System Integration, *A Guide*, BS HB, 2000, www.iso.sos.pl, accessed: 15 September 2019.

The next generation of models (systems) of innovativeness is called "self-learning" systems. The idea was born in parallel with the concept of a knowledge-based economy, which assumes that knowledge is the basis of development and is an essential factor in creating innovation. These models relate mainly to an enterprise and are characterised by the following features[138]:

- high structural efficiency of an enterprise,
- creating changes in company culture and employee behaviour,
- a balanced concern for technology and the need for intellectual resources,
- the success of innovation depends on prudent management,
- product development evolves into a continuous learning process focused on delivering value to the customers,
- a full focus on knowledge management and learning supported by an electronic toolkit to facilitate ongoing information transfer and decision-making,
- planning and arranging organisational systems in such a way that they allow for the accumulation of new knowledge, the externalisation of the creativity of employees and managers, the storage of knowledge, the discovery of knowledge, the dissemination of knowledge, the application and re-use of knowledge,
- the need to overcome social, organisational, technical, structural, strategic and managerial problems.

The above-mentioned characteristics can be generalised to all organisations, including those that are not enterprises, i.e. public goods institutions or NGOs. The concept of knowledge-based innovation has coincided with the widespread use of information (IT) systems, which are associated with the introduction of new technologies and especially the computerisation of organisations. The IT system is defined as a set of interconnected components, the function of which is to process data using computer technology. IT systems are now essential for the proper functioning of business entities[139] and other organisations, as the Internet is the source of most information and a prerequisite for rapid communication.

The new millennium brought further groundbreaking concepts[140]. One of the most important ones is the proposal of *open innovation* by Henry Chesbrough[141], which proved to be a breakthrough in the perception of the innovation processes. It has resulted in numerous studies and publications and an attempt has been made to put it into practice. It is based on the belief that organisations do not have to focus only on their own resources but can, and should, look for ideas and ways to conquer

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[138] J. Baruk, *Zarządzanie...*, p. 122.

[139] T. Rutkowski, *Systemy informatyczne w przedsiębiorstwie*, „Monitor Rachunkowości i Finansów" 2007, no. 3.

[140] C.K. Prahalad, M.S. Krishnan, *The New Age of Innovation*, The McGraw-Hill Companies, USA 2008.

[141] H. Chesbrough, *Open innovation. The New imperative for creating and profiting from technology*, Harvard Business School Press, Boston, 2003; idem, *The era of open innovation*, „MIT Sloan Management Review" 2003, vol. 44, p. 77–82.

the market outside their structures. Part of the innovation process may move (take place) outside of the organisation. H. Chesbrough[142] recognises that there are many barriers limiting the applicability of this model, therefore he provides guidance and suggestions to simplify the implementation of this model. The proposal of *consumer innovativeness*[143] seems to be a follow-up to the above-mentioned model. This is evidenced by a report[144] in which the authors assess the openness of the innovation policies of Finland and the UK. The results show that even in these developed countries, more emphasis should be placed on supporting innovation. According to S. Łobejko[145], open innovation is becoming a new network source of competitive advantage. The computerisation of society and the economy have created the possibility of including resources located outside the enterprise, i.e. other companies, organisations and customers, in the innovation creation process.

P. Hobcraft is credited with two interesting concepts in the area of innovation theory, namely the "dispersed model" and the "three horizons" model. The first of P. Hobcraft's[146] proposals focuses on open innovativeness inside and outside the organisation and requires knowledge flows and the involvement of a large group of employees. Research on the effectiveness of this model was conducted on a representative group of enterprises providing medical tourism services in Poland. The results showed that the application of this model results in the highest, among the proposed 9 models, level of innovativeness of the studied entities[147]. The latter model appears to be the most recent proposal available and focuses on open innovation inside and outside the organisation occurring at three different levels[148]:

- Horizon One, which is the focus on the current business;
- Horizon Two, which is more closely linked to emerging business opportunities;
- Horizon Three, the development towards an entirely new company with the potential to disrupt the status quo.

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142 Idem, *Business Model Innovation: Opportunities and Barriers*, „Long Range Planning" 2010, vol. 43, p. 354–363.

143 G. Roehrich, *Consumer innovativeness. Concepts and measurements*, „Journal of Business Research" 2004, vol. 57, p. 671–677.

144 J. Bos, R. te Velde, H. Gillebaard, *United we stand: Open service innovation policy schemes; An international policy scan and two case studies – London and Helsinki metropolitan areas*, Dialogic innovative interactive, Utrecht 8 October 2010.

145 S. Łobejko, *Przedsiębiorstwo sieciowe. Zmiany uwarunkowań i strategii w XXI wieku*, Szkoła Główna Handlowa, Warszawa 2010, p. 14.

146 R.G. Cooper, *Winning a New Products – Creating Value through Innovation*, 4th edition, Basic Books, New York 2011.

147 E. Szymańska, E. Dziedzic, A.M. Panasiuk, E. Panfiluk, A. Rutkowski, *Innowacje w turystyce zdrowotnej*, Difin, Warszawa 2017, p. 215–238; E. Szymańska, *Innowacyjność usług turystycznych – koncepcja modelu procesu rozproszonego*, „Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu" 2017, no. 473, p. 562–570.

148 P. Hobcraft, *Seeing innovations across the three horizons. Agility Innovation Specialists*, 2013, available at: https://paul4innovating.files.wordpress.com/2015/06/seeing-innovation-across-three-horizons--series-2.pdf, accessed: 26 March 2020.

The concept of *User – Driven Innovation* (UDI), which is based on the premise that consumers have an increasing influence on commercial offerings by participating in the process of creating the products and services they purchase, should be considered as an interesting one. UDI can be defined as the process of the implementation of users' knowledge to develop new products, services and concepts, based on a true understanding of users' needs and systematically involving users in the business development process[149]. It focuses on the needs of consumers, whose expectations are rising but, at the same time, thanks to their participation in the creation process, they can submit and implement individual solutions created specifically in response to their interests. Within this concept there are two approaches that define the position of the consumer in the innovation process[150]:

- voice of the consumer – where the organisation focuses on discovering consumer needs and using the feedback to improve existing products/services in the market;
- the consumer leadership – characterised by the search for and development of new ideas coming from consumers.

According to H. Gebauer[151], the innovative approach to the implementation of innovations is based on the latest concepts, and the current transition is from technology-driven innovations to consumer-co-created innovations. The most recent concepts even go beyond the national framework and, as M. Gorynia[152] postulates, require team cooperation also on the international forum.

Numerous scientific journals specialise in the presentation of research results on innovation and the following ones deserve special attention: "Research Policy", "Technovation", "Journal of Product Innovation Management", "International Journal of Innovation Management", "Creativity and Innovation Management", "European Journal of Innovation Management", "Technological Forecasting and Social Change", "Technology in Society".

According to I.O. Pareo and M.N. Wijnberg[153], the differences in the interpretation of innovations and their classification may result in the use of different methods to measure innovativeness, therefore, while considering different types of organisations

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149 L. Selden, I.C. MacMillan, *Tworzenie innowacji z myślą o kliencie*, „Harvard Business Review. Polska" 2006, no. 42; *How to profit from open innovation? Organizing and managing open innovation*, [in:] *Creativity, Innovation and Management*, Management International Conference, University EMUNI, University of Primorska, Management Faculty, 25–28 November 2009, Sousse Tunisia, p. 12.

150 Compare: J. Rosted, *User-Driven innovation. Results and recommendations*, FORA, Copenhagen 2005.

151 H. Gebauer, *Exploring the contribution of management innovation to the evolution of dynamic capabilities*, „Industrial Marketing Management" 2011, vol. 40, p. 1238–1250.

152 M. Gorynia, *Innowacyjność, produktywność i konkurencyjność gospodarki a międzynarodowa współpraca gospodarcza*, „Ruch Prawniczy, Ekonomiczny i Socjologiczny" 2018, vol. 4, p. 209–228.

153 I. Orosa Paleo, N.M. Wijnberg, *Organizational Output Innovativeness: A Theoretical Exploration, Illustrated by a Case of Popular Music Festival*, „Creativity & Innovation Management" 2008, vol. 17(1), p. 3–13.

(private, state, non-governmental), the structure of innovations in question should be somewhat broader than in the case of profit-making entities (enterprises), hence social innovations have been included in European studies.

1.3. Contemporary research on innovativeness in the economy

Numerous studies and innovation rankings are carried out, both at the international, national and regional level. The most important institutions involved in that type of research are: the World Bank, the World Economic Forum, the Organisation for Economic Cooperation and Development (OECD), Eurostat, and national statistical offices. The starting point for most research on the introduction and evaluation of innovations is the *Frascati* family of manuals, which presents guidelines and statistical results of research on innovation activities. The subsequent editions of the *Oslo Manual* are of great importance, the third edition of that manual, published in 2005, introduced interesting changes relating to various types of innovations, including marketing ones. In 2018, the fourth edition was published, which introduced significant changes in terms of the proposed innovation research methodology, in comparison to the previous edition[154]. The proposed "Oslo methodology" is not only the standard for assessing R&D in the OECD member countries but thanks to the organisation's cooperation with UNESCO, Eurostat and with other organisations, it is now the international standard for measuring innovativeness. Already in the third version of the manual, the typology of innovations was extended and organisational and marketing innovations were introduced in addition to product and process innovations[155]. The issue of innovativeness of the economy is contested in many scientific and research and non-governmental centres such as: the International Scientific Network Science, Economy and Local Government in the Process of Technology Transformation and Innovative Activity OPI[156], European Economic Association[157], Institute for Research on Innovation and Services for Development[158].

Research on innovation is also carried out in Poland by such entities as, inter alia: ministries responsible for the economic development of the country (until 2015 – Ministry of Economy, in 2015–2018 Ministry of Development), the Institute of Economics of the Polish Academy of Sciences[159], the Polish Agency for Enterprise

[154] Publications from the Frascati Family are available on the website of the OECD: http://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm, accessed: 26 March 2019.

[155] *Oslo Manual*..., 2005.

[156] Compare: www.msn.opi.org.pl, accessed:15 March 2020.

[157] https://www.eeassoc.org/, accessed: 12 January 2020.

[158] https://www.iriss.cnr.it/en/, accessed: 12 January 2020.

[159] https://inepan.pl/, accessed: 5 September 2019.

Development[160] (PARP) and universities that operate in the area of the disciplines of management and quality sciences as well as economics and finance, previously called economic sciences[161]. The Ministry of Development was replaced by other central institutions that took over its tasks: the Ministry of Entrepreneurship and Technology[162], the Ministry of Investment and Economic Development[163], the Ministry of Infrastructure[164], the Ministry of Digitalisation[165]. However, regardless of the new entities created at the government level, the main budgetary institution carrying out the constant monitoring of the innovativeness of enterprises is PARP[166].

International rankings of innovativeness and competitiveness place Poland further down among the EU Member States. Studies such as the[167] *Global Competitiveness Reports* prepared by the World Economic Forum or reports prepared by World Bank economists are based on three main sources of growth: capital, labour and changes in production indicators[168]. The World Intellectual Property Organisation (WIPO) produces a ranking of the "World's Most Innovative Economies"[169], based on a survey of the number of filed patents. At the European level, systematic surveys are carried out by Eurostat in cooperation with the OECD, and the results are presented in the annual *Community Innovation Survey* (CIS) reports[170]. In the assessment for 2018 (a 2019 release), the share of innovative enterprises in the total number of enterprises in Poland was 22%, which puts the country in the penultimate position among the Member States, ahead of Romania, for which this share was 10% and far behind the leader – Belgium with a result of 68%. The EU average was 51%. Due to the collapse of the global economy resulting from the SARS-CoV-2 pandemic, it is difficult

[160] Polska Agencja Rozwoju Przedsiębiorczości. Centrum Rozwoju Małych i Średnich Przedsiębiorstw, https://www.parp.gov.pl/, accessed: 3 February 2020.

[161] E. Szymańska *Polityka proinnowacyjna w Polsce*, [in:] *Przesłanki konsolidacji sektora B+R*, K. Meredyk, A. Wildowicz-Giegiel (ed.), Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2012, p. 87–108.

[162] https://www.gov.pl/web/przedsiebiorczosc-technologia/, accessed: 26 March 2019.

[163] https://www.miir.gov.pl/, accessed: 26 March 2019.

[164] The website of the ministry shows the legislative acts: https://dziennikurzedowy.mi.gov.pl/, accessed: 26 March 2019.

[165] https://www.gov.pl/web/cyfryzacja, accessed: 26 March 2019.

[166] www.parp.gov.pl, accessed: 26 March 2019.

[167] *Global Competitiveness Report* is available at: https://www.weforum.org/reports/global-competitiveness-report-2019, accessed: 16 August 2020.

[168] *Europe 2020: Fueling Growth and Competitiveness in Poland Through Employment, Skills, and Innovation*, www.worldbank.org.pl., accessed: 10 March 2021.

[169] *Global Innovation Index* (GII) 2019, World Intellectual Property Organisation, available at: https://www.wipo.int/global_innovation_index/en/2019/, Report available as a PDF document at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf, accessed: 16 August 2020.

[170] Available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20190312-1, accessed: 16 August 2019.

to provide the data for 2022[171]. One of the most important rankings, the *Innovation Union Scoreboard* (IUS), includes 25 different indicators for measuring innovation[172]. Published every two years by the European Commission, the report on competitiveness in the "Innovation Union", covering all Member States and selected associated countries, provides a statistical and economic analysis, including indications and examples of research and innovation solutions[173]. The European Innovation Space (EIS)[174] was also created, which, when combined with the earlier ERA initiative, forms the European Research and Innovation Area. Activities within the European Union are supported by the European Research Council (ERC)[175] and by the Knowledge and Innovation Cooperation (KIC), an international alliance of universities, institutes and companies coordinated by the European Institute of Innovation and Technology (EIT)[176]. To measure the innovativeness of EU economies by sector, the *Innovation Sector Index* (ISI)[177] was developed, which is based on 12 indicators that are used in the evaluation and comparison.

Research on innovativeness in Poland is based on European findings and studies, particularly the Eurostat guidelines. A relatively new trend is the study of the innovativeness of the Polish service sector, conducted by Statistics Poland since 2000[178]. The system of these studies is based on international methodological recommendations presented in successive editions of the *Oslo Manual*. Statistics Poland measures innovation activity mainly in relation to enterprises and assesses the following elements[179]:

- research and development (R&D) work related to the development of new or significantly improved products (product innovations) and processes (process innovations), performed by one's own development facilities or acquired from other entities,

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[171] Please note that comprehensive data for the previous year was not yet available at the time of finishing this monograph in May 2022 and in the midst of war in Ukraine (Russia's aggression on Ukraine began 24th February 2022).

[172] http://ec.europa.eu/innovation-union, accessed: 25 February 2020.

[173] Information on the „Innovation Union" is available at: http://ec.europa.eu/iuc2011, accessed: 5 May 2020; *Innovation Union*, http://ec.europa.eu/innovation-union, accessed: 5 May 2020; *Europe 2020*, http://ec.europa.eu/europe2020/index_pl.htm, accessed: 5 May 2020.

[174] *Putting Knowledge into Practice: A Broad-Based Innovation Strategy for the EU*, COM (2006), Brussels 2006.

[175] www.erc.europa.eu, accessed: 15 May 2020.

[176] www.eit.europa.eu/kiccs1, accessed: 15 May 2020.

[177] Report available at: https://ec.europa.eu/growth/industry/innovation/facts-figures/regional_pl, *European Innovation Scoreboard 2019*, available as a PDF document: https://ec.europa.eu/commission/presscorner/detail/en/IP_19_2991, accessed: 16 August 2019.

[178] *Działalność innowacyjna przedsiębiorstw w sektorze usług 1997–1999*, Statistics Poland, Warszawa 2000.

[179] *Działalność innowacyjna przedsiębiorstw w latach 2006–2009*, Statistics Poland, Warszawa 2010, p. 17.

- purchase of knowledge from external sources in the form of patents, unpatented inventions (solutions), designs, utility and industrial designs, licences, *know-how*, trademarks, and technical services related to the implementation of product and process innovation,
- purchase of software related to the implementation of product and process innovation,
- purchase and assembly of machinery and technical equipment, purchase of means of transport, tools, devices, movable property, equipment, and outlays on the construction, extension and modernisation of buildings used for the implementation of product and process innovation,
- staff training related to innovation activities from the design to the marketing phase, covering both expenditures on the acquisition of external training services and expenditures on internal training,
- marketing of new or substantially improved products, these expenditures include expenditures on preliminary market research, market testing and advertising of marketed new or substantially improved products,
- other preparations for the introduction of product or process innovations include activities not classified as R&D activity, such as: feasibility studies, testing and evaluation of new or significantly improved products and processes, standard software development and improvement, instrumentation, engineering and preparation work.

Research on the level of innovativeness of the Polish economy, apart from domestic institutions, is carried out by international entities, including the OECD. "Strengthening Innovation in Poland"[180] should be mentioned here. The report indicates that the most important directions of activities to increase the innovativeness of the Polish economy are: strengthening the cooperation between representatives of science and business, strengthening the technological and scientific base.

Reports on research conducted by PARP can be considered a source of information on the level of innovativeness of Polish enterprises[181]. The authors of the last, the third, edition of the report showed that conducting innovative activities (understood as incurring various types of expenditure on innovative activities), regardless of their type, is correlated with the size of the company: the larger the company, the more often various types of innovative activities are carried out and the more expenditure is incurred on these activities. The purpose of innovative activities carried out by enterprises in Poland is to expand or renew the machine park, transfer

[180] OECD, the report is available at: https://www.oecd-ilibrary.org/economics/strengthening-innovation-in-poland_abf2c877-en, accessed: 19 August 2022.

[181] *Monitoring innowacyjności polskich przedsiębiorstw* (monitoring of innovativeness of Polish enterprises) – the results of the third edition of the research in 2020 are available at: https://www.parp.gov.pl/component/publications/publication/monitoring-innowacyjnosci-polskich-przedsiebiorstw-wyniki-iii-edycji-badania-2020, accessed: 20 August 2022.

technology or knowledge (purchases of machines and devices, training and software development are the most popular type of innovative activities undertaken by companies).

In conclusion, it is important to emphasise the ever-increasing body of knowledge in the field of innovation. Particularly after 2000, economists became more and more interested in the factors that influence the improvement of the innovativeness of enterprises and the possibilities of supporting the innovativeness by the state, also in the sectoral dimension. In the opinion of E. Dziedzic[182], the most important innovations for the economy are those that enable a permanent increase in productivity in particular branches of the economy, i.e. breakthrough innovations. Those belong to the group of technological innovations but organisational innovations of that type can also be identified, for example, the spread of the franchise system. According to N. Rosenberg[183], the impact on the environment and the potential to increase the productivity factor due to the introduction of an innovation is more important for economic development than the innovation itself.

The development of concepts for the effective growth and implementation of innovations is ongoing, with perceptions changing due to the rapid transformations in the global economy due to the SARS-CoV-2 pandemic. The military attack of Russia on Ukraine has also contributed to the change in the perception of innovation and the desired direction of development. Both "black swans", as N.N. Taleb[184] would call them, have had a significant impact not only on everyday life (and its threat) but also on the global economy, forcing the acceleration of research in some areas (medicine – vaccines, defence – improving weapons) or entering new tracks in the search for innovative solutions (for example, organisational – in connection with a pandemic). To sum up, it is important to recognise that both the theory and practice of innovation have been developing dynamically, starting from the initial phase, falling in the middle of the century, when innovative processes were described as linear, through more complex systems, up to the contemporary ones characterised by a strong emphasis on sharing knowledge and cooperation with external entities.

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[182] E. Dziedzic, *Perspektywy turystyki w warunkach rozwoju opartego o innowacje*, [in:] *Turystyka wobec nowych zjawisk w gospodarce światowej*, E. Dziedzic (ed.), Oficyna Wydawnicza Szkoła Główna Handlowa w Warszawie, Warszawa 2011, p. 348.

[183] N. Rosenberg, *Innovation and Economic Growth*, [in:] *Innovation and Growth in Tourism*, OECD, Paris 2006, p. 49–50.

[184] N.N. Taleb, *Czarny łabędź. Jak nieprzewidywalne zdarzenia rządzą naszym życiem*, Wydawnictwo Zysk i S-ka, Poznań 2020.

2. Peripheral regions and their problems

The subject of consideration in this part of the study are the problems occurring in peripheral areas. At the beginning, various concepts relating to the definition of peripheral areas were presented, and then the main problems faced by the inhabitants of these areas were indicated, with particular emphasis on mobility limitations. The factors influencing the development of peripheral areas were also reviewed, both from the theoretical side and in terms of solutions developed as part of projects implemented in the European Union, focusing in this case on mobility solutions.

2.1. Peripheral regions in the economic literature

Peripherality is a problem for many regions, therefore it is the subject of many considerations by politicians and researchers. The issue of peripherality requires an examination of the theoretical concepts referring to that topic in terms of understanding the term of the peripheral region, as well as the possibilities of supporting the development processes of such regions. As commonly understood, peripherality means a state of underdevelopment in relation to central regions, thus peripheries are considered as something "sticking out", less important, with negative associations[185]. Underdeveloped regions cannot withstand market competition with developed areas and become peripheral. The terms "core" and "periphery" refer to areas of different levels of socio-economic development[186]. Peripherality is characterised by a certain relativity and a different reference point can be a chosen as a criterion of peripherality, which means that a given region can be considered peripheral, e.g. in terms of industrial development, while it can also be a core region, e.g. in terms of the level of education[187]. However, there is no doubt that one of the main problems of the modern

[185] A. Bajerski, *Problemy wydzielenia peryferii społeczno-gospodarczych*, „Ruch Prawniczy, Ekonomiczny i Socjologiczny" 2008, vol. 2, p. 160.

[186] P. Idczak, *Wielowymiarowa koncepcja peryferyjności regionalnej. Identyfikacja regionów peryferyjnych w Polsce*, Difin, Warszawa 2013, p. 84–85.

[187] J. Wilkin, *Peryferyjność i marginalizacja w świetle nowych teorii rozwoju (nowa geografia ekonomiczna, teoria wzrostu endogennego, instytucjonalizm)*, [in:] *Regiony peryferyjne w perspektywie polityki strukturalnej Unii Europejskiej*, A. Bołtromiuk (ed.), Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2003, p. 45.

economy is the persistent differences in the economic potential of individual regions. The nature of interregional differentiation leads to a distinction in the spatial structure of the core and peripheral regions[188].

The concept of the peripheral region should not be limited only to spatial issues as the term has a broader context and takes into account characteristics not directly related to spatial factors. The issue of peripherality has been dealt with in numerous publications for many years. A team of researchers: J. Lixia Jin, W. Changjian, Z. Hongou, Y. Yuyao, D. Zhiwei, and Z. Yuling[189] performed a literature review on problems in peripheral areas. A similar challenge was taken up by M. Proniewski[190], and M.C.W. Solheim[191]. Similarly to M. Proniewski, the issues of European regional policy in the context of the development of peripheral areas are thoroughly considered by K. Głębicka[192]. The authors pointed out that various concepts have been developed to describe and understand the processes of initiation and stimulation of regional development. In the literature on the subject, the peripherality of a region is presented in different approaches[193]. At the forefront is the spatial-mobility approach, characterised by difficult accessibility to communication due to the unfavourable geographical location, low quality of technical infrastructure, high transportation costs, remoteness from economic cores. From that point of view, peripheral regions are identified with border regions[194]. However, proximity to a border does not exhaust the problem, which is more complex and may include[195]:

- low qualifications of human capital,
- fragmented ties between enterprises,
- low level of social capital,
- underdeveloped infrastructure of the information society,
- poorly developed network of institutions,
- poor links with the global environment.

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188 K. Leszczewska, *Aktywność ekonomiczna regionów peryferyjnych*, „Nierówności Społeczne a Wzrost Gospodarczy" 2010, vol. 17, p. 215–225.

189 L. Jin, Ch. Wang, H. Zhang, Y. Ye, Z. Du, Y. Zhang, *Evolution and Mechanism of the "Core–Periphery" Relationship: Micro-Evidence from Cross-Regional Industrial Production Organization in a Fast-Developing Region in China*, „Sustainability" 2020, vol. 12, p. 1–19, doi:10.3390/su12010189.

190 M. Proniewski, *Rozwój regionów peryferyjnych w Unii Europejskiej*, Wydawnictwo Uniwersytetu w Białymstoku, Białystok 2012.

191 M.C.W. Solheim, *Foreign Workers and International Partners as Channels to International Markets in Core, Intermediate and Peripheral Regions*, „Regional Studies, Regional Science" 2016, vol. 3(1), p. 491–505, doi: 10.1080/21681376.2016.1258324.

192 K. Głąbicka, M. Grewiński, *Europejska polityka regionalna*, Elipsa, Warszawa 2003, p. 21.

193 M. Proniewski, op. cit., p. 64–65.

194 A. Miszczuk, *Peryferyjność regionów*, [in:] *Europejskie wyzwania dla Polski i jej regionów*, A. Tucholska (ed.), MRR, Warszawa 2010, p. 236

195 Compare: W. Demianiuk, E. Szymańska, *Regiony peryferyjne i czynniki ich dynamiki w teoriach rozwoju regionalnego*, „Społeczeństwo i Ekonomia. Society and Economics" 2016, vol. 2, no. 6, p. 103–110.

When discussing peripherality, first of all, one should take the economic aspects and the level of economic development into account, which is the main determinant in the cohesion policy of the European Union[196]. The criterion for the economic peripherality of the EU regions is a low level of economic development, measured by Gross Domestic Product per capita. Regions, where this indicator is lower than 75% of the EU average, are considered to be peripheral regions. Moreover, the economic literature assumes that the group includes the following types of regions[197]:

- with a low level of economic development;
- characterised by a traditional economic structure and a poor production structure;
- characterised by a high level of employment in primary sectors;
- specialised in raw materials;
- with low added value and low levels of entrepreneurship;
- with a low level of exports of labour resources and imports of final goods;
- with an underdeveloped research and development sector.

Distinctive features of many peripheral areas of a socio-demographic nature are: low population density, poor urbanisation, depopulation processes, deformation of demographic structures, low quality of human and social capital.

Cultural peripherality can manifest itself in a low sense of regional identity, resulting in imitation and pressure to adapt cultural patterns from outside the region. Peripherality of a political and administrative nature is manifested by weak political representation in the centre, lack of governmental elites, limited competences of regional authorities and low financial potential of public authorities[198]. The economic dependence of peripheral regions on economic as well as political cores is often emphasised[199].

Based on the literature on the subject, the level of development of most regions affected by peripherality is different than that of the centres of dynamic growth, and, due to the lack of competitive advantage, they are unable to compete with highly developed areas[200]. Various concepts have emerged to describe and help to understand the processes of initiating and stimulating regional development[201]:

- classical theories of absolute advantage and comparative advantage;
- theories of localisation;
- theories emphasising the need for state interventionism (Keynesian);

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196 Information on the cohesion policy of the EU can be found at: https://ec.europa.eu/regional_policy/pl/faq/, accessed: 20 August 2022.

197 Compare: A. Miszczuk, op. cit., p. 237–238; A. Vaishar, *Regional periphery: What does it mean?*, [in:] *Regional periphery in Central and Eastern Europe*, T. Komornicki, Ł. Czapiewski (ed.), Centrum Studiów Europejskich IGIPZ PAN, Warszawa 2006, p. 7 [„Europa XXI", no. 15].

198 A. Miszczuk, op. cit., p. 237–239.

199 T.G. Grosse, *Innowacyjna gospodarka na obszarach wiejskich Mazowsza? Wyzwanie dla polityki publicznej*, „Studia z Polityki Publicznej" 2015, no. 4(8), p. 46–47.

200 P. Idczak, op. cit., p. 87.

201 W. Demianiuk, E. Szymańska, op. cit., p. 103–110.

- neoclassical theories of regional development;
- the theory of sustainable development, from which the theory of unsustainable regional growth arose.

The theory of absolute advantage by A. Smith[202] refers to explaining the reasons for gaining the economic advantage of one country (region) over another. To boost economic development, a country should choose a specialisation based on the resources at its disposal. It should result in an increase in the production of goods or services of the relevant country. The criterion for selection should be differences in manufacturing costs, which contributes to an international division of labour and the import of products from countries that specialise in their production and export of the goods that the country in question has decided to specialise in. The considerations of A. Smith were continued by D. Ricardo[203], who developed the theory of comparative costs (advantages), in which he juxtaposed two specific regions producing the same product; however, in both cases, the production is loss-making[204]. D. Ricardo identified opportunities for each country to benefit from trade, including situations where the products in question are produced more expensively than abroad. The above is possible because of the comparative differences of costs of production of goods and services between countries, which are known as comparative costs. Countries that trade with each other should import goods that other countries produce at a little higher cost than they themselves do, thus making better use of the productive potential in those areas where they themselves produce more cheaply and resulting in them being able to sell more of their own and also cheaper products abroad[205]. The concepts of A. Smith and D. Riccardo should be considered precursors to the theory of location, in which location is understood as the placement of established industrial and economic activity within the boundaries of a certain territory. The theory of location was first established while the agricultural economy was discussed. It concerns the determination of the type, number and size of economic actors operating in the area and considers the links between them. Classical factors for choosing the location of an enterprise were presented in the publication by A.I. Szymańska and M. Plaziak[206] and may refer to one entity operating in the region or to the group of entities. Additionally, they may relate to a single industry or branch or to all manifestations of entrepreneurship found in a particular area. The implementation of the theory of location in practice starts with the selection of a region suitable for services or production;

[202] A. Smith, *Badania nad naturą i przyczynami bogactwa narodów*, PWN, Warszawa 2021.

[203] D. Riccardo, *The principles of political economy and taxation*, Cosimo, Warszawa 2006. First edition: John Murray, London 1817.

[204] K. Głąbicka, M. Grewiński, op. cit., p. 21.

[205] M. Przygoda, *Atrakcyjność inwestowania w regionach słabo rozwiniętych*, Wydawnictwo Naukowe Wydziału Zarządzania Uniwersytetu Warszawskiego, Warszawa 2013, p. 78.

[206] A.I. Szymańska, M. Plaziak, *Klasyczne czynniki w procesie lokalizacji przedsiębiorstwa na wybranych przykładach*, „Przedsiębiorczość – Edukacja" 2014, no. 10, p. 71–84.

then, within its boundaries, a search for the best place to undertake a particular activity is conducted. The final stage involves the deployment of specific economic actors in the field[207]. The forerunner of the theory is considered to be J.H. von Thünen[208], who, in his theory of agricultural spheres, presented a model of the agricultural land-use (also called the theory of Thünen's circles) in which he depicted a hypothetical arrangement of different types of agricultural production around one centrally located market. The author noticed the dependence of regionalisation and the type of agricultural activity on the distance from sales markets. The hardest to produce and the least durable agricultural products are produced closest to the target market, as the cost of transporting crops is a major factor in the choice of location and the nature of agricultural production. Another factor is the shelf life of the products. According to the above-mentioned theory, clearly defined concentric rings are formed around markets, each of which differs from the others in the way and intensity of land cultivation. Products with a low shelf life, such as milk and milk products, and those relatively difficult, such as fruit, are produced close to where they are sold, in the inner rings. Within the outer rings, products suitable for longer transport and resistant to spoilage, such as crops, are produced. The profitability of land decreases with an increase in distance from the markets, while the intensity of cultivation and the degree of involvement of the technology used in the production are always highest near the centre of each circle. The resulting differential rent arises as a surplus of revenues over costs and is due to the advantageous positioning in relation to a centrally defined market. The rent is highest when the place of production is close to the places of consumption, while it is lower as the distance increases, and beyond a certain distance from the centre, production becomes unprofitable as the rent has negative values[209]. However, the theory of J.H. von Thünen's[210], which was considered innovative, also had its critics who accused it of, among other things, ignoring the physical-geographical differentiation of space, infrastructural differentiation and the possibility of the existence of more than one consumption centre[211].

Another concept, referring to the theory of J.H. von Thünen to some extent, is the theory of industrial location by A. Weber[212], which assumes that an industrial facility should be located either in the immediate vicinity of a major customer or close to the sources of supply of raw materials necessary for the production, thus reducing transportation costs. In case of different but comparable transportation costs of the raw material and the finished product, production can be located between the source of supply and the customer. In a situation where the sources of supply

[207] M. Przygoda, op. cit., p. 77.

[208] J.H. von Thünen, *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*, Forgotten Books, London 2018.

[209] P. Idczak, op. cit., p. 14.

[210] J.H. von Thünen, op. cit.

[211] P. Idczak, op. cit., p. 14.

[212] A. Weber, *Reine Theorie des Standorts*, Forgotten Books, London 2017.

of raw materials and materials are quite numerous and scattered, the median method should be applied when selecting the location for an investment, i.e. placing production at a point where half of the customers are located on one side of the plant location and the other half is located on the other side. According to A. Weber, the decision to choose a particular location for an investment depends on minimising the production and transport costs of the enterprise, while the optimal location is determined by the following factors[213]:

- the raw material index, defined as the ratio of the weight of raw materials to the weight of final products;
- the labour factor understood as the ratio of the labour cost of producing one tonne of a product to the total price of transporting a tonne of that product to the sales area;
- benefits resulting from the existence of a developed agglomeration.

A. Weber, in his theory, defines the term "periphery" as the area that is clearly unfavourable in terms of choosing the location of enterprises, i.e. areas that are poor when it comes to natural resources or territories that do not provide agglomeration benefits[214]. The theory of A. Weber is criticised for being based on very restrictive and thus unrealistic assumptions relating mainly to the invariability and completeness of information on the location of raw materials, the spatial distribution of consumer demand and labour availability, the homogeneity of the socio-economic system, as well as of the fact that it focuses exclusively on three location factors, without taking into account other determinants that also play an important role in a company's choice of location[215]. Therefore, in line with the principle of minimising costs, peripheral regions are eliminated in the process of assessing locational advantages due to the lack of both raw material resources and the desired presence of enterprises or markets[216].

The theory of A. Weber has been refined and greatly expanded. Today, additional factors influencing the choice of investment location are indicated, such as[217]:

- the characteristics and availability of raw materials;
- the expectations regarding the qualifications of the labour force;
- the advantages of being located in the vicinity of an urban centre;
- the cost of delivering finished goods and merchandise to the point of sale;
- the nature of the market.

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213 Idem, *Theory of the Location of Industry*, Chicago, Illinois, University of Chicago Press 1929, p. 24–29.

214 Ibidem.

215 K. von Stackelberg, U. Halne, *Teorie rozwoju regionalnego*, [in:] *Rozwój ekonomiczny regionów. Rynek pracy. Procesy migracyjne. Polska, Czechy, Niemcy*, S. Golinowska (ed.), Raport IPiSS, Warszawa 1998.

216 P. Idczak, op. cit., p. 17.

217 M. Przygoda, op. cit., p. 80.

According to the assumptions of the presented theory, special attention must be paid to the factors stimulating the development of industry and the minimisation of transportation costs. The initiation of an industrial process in an area may entail the interaction of various factors stimulating the development of that region, in consequence leading to the establishment of an increasing number of new enterprises in the near future. The choice of location is not random, as the benefits of proximity and interaction, i.e., agglomeration and urbanisation, are important in this case, which leads to locating enterprises in places where other enterprises already exist[218].

The importance of a close location as a factor generating additional benefits for enterprises in the form of an increase in the scale of production and spatial concentration of industry was also emphasised by A. Marshall[219], who argued that the close location of companies has a positive impact on the implementation of technical progress, division of labour and specialisation of enterprises serving the industry operating in a given area, which promotes specialisation of the labour market. Similar views were also presented by E. Hoover[220], who distinguished three groups of benefits resulting from the close location of enterprises:

- associated with an increase in the scale of production of a single company, the close proximity of enterprises operating within the same industry and the concentration of companies from different industries in the same place;
- resulting from the so-called complementary employment, the idea of which is that persons who are not employed in leading industries have the opportunity to find work in complementary sectors;
- related to the accumulation of different service institutions.

The benefits of close proximity to other businesses were also noted by W. Isard[221], who distinguished the benefits of location and urbanisation. The former arise when companies of a similar type congregate in close proximity. In this way, they can profit from more effective use of the existing pool of qualified workers, easy access to customers and more extensive use of specialised facilities. In contrast, the benefits of urbanisation arise between enterprises of different types concentrated in one area. According to W. Isard, these types of benefits, including the importance of infrastructure which is better used in large scale conditions, constitute spatial concentration benefits. Similar considerations in the context of the regional development of the European Union are undertaken by K. Gawlikowska-Hueckel[222].

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[218] R. Domański, *Zasady geografii społeczno-ekonomicznej*, Wydawnictwo Naukowe PWN, Warszawa–Poznań 2000, p. 109–110.

[219] A. Marshall, *Principles of Economics*, Authorhouse, London 2012; 1st edition: MacMillan and Co., London–New York 1890.

[220] E.M. Hoover, *Lokalizacja działalności gospodarczej*, PWN, Warszawa 1962.

[221] W. Isard, *Metody analizy regionalnej. Wprowadzenie do nauki o regionach*, transl. E. Vielrose, A. Wróbel, Z. Czerwiński, PWN, Warszawa 1965, p. 257–258.

[222] K. Gawlikowska-Hueckel, *Procesy rozwoju regionalnego w Unii Europejskiej, Konwergencja czy polaryzacja?*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2003, p. 17.

In the presented location theories, peripheries are defined as regions with characteristics that are clearly unfavourable for the choice of localisation of enterprises, as well as regions where there is a shortage of raw material resources, a small number of enterprises, weak markets. Representatives of location theories have focused on the reasons for the economic advantage of some regions over others. The proposed solutions for bridging the gap between regions were mainly related to the specialisation of regions (countries) and the spatial concentration of enterprises. The implementation of specialisation within the economy on the basis of the resources it possesses, as well as on the basis of the economic opportunities it has, i.e. the degree of economic development, the infrastructure or its experience in a given industry are, according to many economists, conducive to the economic development of the region. The basic criterion for the choice of specialisation is the difference in manufacturing costs, i.e. the minimisation of production costs. On the other hand, the spatial concentration of enterprises and population is a factor that generates benefits for the region through proximity and interaction. Most of the presented concepts emphasise the role of large urban centres, additionally located in close proximity to transportation hubs, which have a stimulating effect on the process of establishing new enterprises. According to the authors of the presented theories, the launch of a specific industrial process in an area entails the interaction of various factors that stimulate the development of this process. The concentration of economic activity raises the competitiveness between enterprises. A greater number and variety of offered products increases the attractiveness of the area from the consumer's point of view as well. This process leads to the phenomenon of cumulative demand, as a result of which the attractiveness of a given location in the opinion of other entrepreneurs increases and the concentration process intensifies[223].

While analysing the above theories, it should be noted that the benefits of concentration and specialisation do not occur in peripheral regions, where the concentration process does not take place, which is the reason for insufficient interest of investors in those regions. An explanation of the reason for the existence of regions with a low level of development, including peripheral regions, and the possibilities for their development is presented in the Keynesian approach. According to the assumptions of the theory by J.M. Keynes[224], peripheral regions are regions with a very low level of development, which are unable to overcome socio-economic problems on their own. It is therefore necessary for the public authorities to undertake public works, mainly large infrastructure investments, to establish institutions that would support the development of entrepreneurship, to improve the qualifications of the workforce and promote exports. Thus, the Keynesian doctrine assumed government interference in regional affairs and issues. The need for such action stems from the existing tendency of deepening inter-regional disparities within the free market economy. Highly developed regions are growing more rapidly and becoming richer. At the same time,

[223] P. Idczak, op. cit., p. 23.

[224] J.M. Keynes, *Ogólna teoria zatrudnienia, procentu i pieniądza*, PWN, Warszawa 2002.

underdeveloped areas develop more slowly or they even face stagnation or severe crisis[225]. In such situations, according to J.M. Keynes, state intervention is necessary and should cover the following areas[226]:

- underdeveloped regions in a peripheral location – the purpose of the activities of the authorities within such areas should be the elimination of obstacles and barriers to development, they should lead to stimulation of growth mechanisms;
- traditionally industrial regions that are affected by economic stagnation (the regions where one or two main industries are located) – the authorities should focus on diversification of economic activities by supporting innovative and competitive branches of economic activity and should concentrate on the development of services;
- regions of large urban agglomerations – because of their scale they influence not only the conditions in which they operate but also the economy of the whole country; therefore, the actions of the authorities should ensure the long-term economic growth of those areas while maintaining stable social structures.

According to J.M. Keynes, state activity should focus primarily on underdeveloped regions and work towards a targeted intensification of their economic growth through the following measures[227]:

- maintaining low interest rates;
- tax relief;
- readily available credits and loans for investors;
- training to improve the skills of the workforce;
- social and intervention works for the long-term unemployed;
- promoting local products;
- encouraging investment within own area;
- establishing institutions promoting the development of entrepreneurship;
- spending more on education and training;
- promoting modern management methods;
- implementation of innovative solutions[228].

The idea that national and local authorities should intervene to revive poor regions was also put forward by representatives of the theory of sustainable regional development. The starting point is the theory of poverty introduced by R. Nurkse[229].

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[225] M. Przygoda, op. cit., p. 96.

[226] J.M. Keynes, *Ogólna teoria zatrudnienia, procentu i pieniądza*, PWN, Warszawa 2012, p. 241–251.

[227] Ibidem.

[228] J. Feser, E. Malizia, *Understanding Local Economic Development*, Center for Urban Policy Research, New York 1999, p. 123–137.

[229] Compare: R. Nurkse, *Some Aspects of Capital Accumulation in Underdeveloped Areas*, Bank of Egypt, Kairo 1952; idem, *Problems of capital formation in underdeveloped countries*, Oxford University Press, Oxford 1953.

He attributed the reasons for the poor development of some regions to the low level of income of the population, which consequently causes the commitment to work and the productivity of the workforce in these regions to remain at a consistently low level, which also affects the condition of enterprises that are unable to generate profits and generate funds for the modernisation of production. Income shortfalls result in the abandonment of investments that are essential for the production facilities, for the region and, subsequently, for the state[230]. He argued that underdeveloped regions would be doomed to a "vicious circle" if left to their own devices. He believed that the inflow of external capital from outside the region would change this situation. R. Nurkse[231] assumed that the chance to get out of this circle is to obtain capital from savings accumulated by the society and from external sources, coming from outside the region, which allows creating appropriate conditions for its socio-economic development. He pointed out that despite the measures taken, the poorer peripheral regions have great difficulty in changing this state of affairs.

An attempt to seek a solution to the problem of poverty of peripheral areas was the "big push" theory of P. Rosenstein-Rodan. The studies concentrated on countries struggling with problems such as low income levels, high unemployment rates and low levels of population purchasing power. The researcher believed that the best solution was the rapid industrialisation of such countries[232]. According to the author, specialisation is the best way to achieve rapid industrialisation, and the entire investment process should be concentrated in one region and based on the use of large international business associations operating in the form of multinationals or transnational corporations. Investments in the development of selected branches of industry, stimulated and financed by the state, were expected to lead to an increase in production efficiency and a lasting modernisation of the manufacturing structures. The inflow of capital to poorer regions is achieved through external aid from the state[233].

In turn, the importance of highly developed regions for the process of regional growth was emphasised by the representatives of the theory of unbalanced regional growth. Among this group of theories, it is worth mentioning Francois Perroux's *growth poles theory*, described in his publication by Ł. Piętak[234], and Alfred O. Hirschman's *sector-regional polarisation theory*, outlined in 1958,[235] or Raul Prebisch's[236] *centre-*

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[230] Idem, *Problems of capital formation in underdeveloped countries*, Oxford University Press, Oxford 1966, p. 28–97.

[231] Ibidem.

[232] P. Rosenstein-Rodan, *Problems of Industrialization of Eastern and South-Eastern Europe*, „Economic Journal" 1943, vol. 53, no. 210/211; idem, *Uwagi o teorii „wielkiego pchnięcia"*, „Ekonomista" 1959, no. 2, p. 359–369.

[233] M. Przygoda, op. cit., p. 101.

[234] Ł. Piętak, *Teoria biegunów wzrostu François Perroux i implementacja jej założeń w Hiszpanii w latach 1964–1975*, „Ekonomia XXI Wieku" 2014, no. 1(1), p. 185–205.

[235] A.O. Hirschman, *The Strategy of Economic Development*, Yale University Press, New Haven 1958.

[236] R. Prebisch, *The Economic Development of Latin America and Its Principal Problems*, United Nations, New York 1950.

periphery theory. The creator of the first of these theories, F. Perroux, claimed that growth is not visible everywhere at the same time, it manifests itself with variable intensity in the form of growth points or poles, it spreads through different channels and with variable effects on the entire economy[237]. The theory of R. Prebisch–H. Singer, created in the 1950s, had far-reaching effects in practice. It can be considered that it was the basis for the creation of another theory – "terms of trade", in which the specialization of raw materials in developing countries leads to lower prices with an increase in production, while specialization in industrial products leads to higher prices. As a result, as economists Prebisch and Singer both argued, "the price scissors of raw materials and industrial goods are opening instead of closing." This fact was used to prepare the concept of anti-import or pro-export policy, but none of them passed the test, not bringing development thanks to international exchange, but also not contributing to the development of own technologies that could effectively replace imports. But something else happened in the global economy, "price scissors began to close." This is the result of several phenomena: an increase in consumption in the countries of Central and Eastern Europe (in post-communist markets), as well as the transfer of production from countries with high labor costs to markets with low labor costs. Therefore, from the perspective of about 70 years, it should be assessed relatively critically[238]. The theory assumed that the development of entire industries and branches of the industry depends on enterprises characterised by an exceptionally dynamic rate of development in relation to other enterprises. It is one company, or a group of companies, with a leading market share that creates a growth pole, e.g. through an above-average level of production they significantly influence their cooperators and other entities in the region and thus cause their development. The functioning of motor units as growth poles is referred to by the term "polarisation", which means, on the one hand, the process of enlargement of the motor unit, on the other hand, the results of positive or negative cooperation of other units, consequently of the whole economy of the region or country[239].

Similar views were expressed by A.O. Hirschman[240] in his sector-regional polarisation theory. He argued that economic growth is a chain process of sectoral imbalances, during which growth impulses are transferred from leading industries to other forms of economic activity. According to S. Korenik[241], these impulses take the form of both progressive couplings, understood as relations between cooperating economic entities, and regressive ones, meaning phenomena caused by the demand for goods

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[237] Compare: F. Perroux, *A New Concept of Development*, Routledge, London 1988; J. Grzeszczak, *Bieguny wzrostu a formy przestrzeni spolaryzowanej*, Wydawnictwo Continuo, Warszawa 1999, p. 11 („Prace Geograficzne" no. 173).

[238] D.I. Harvey, N.M. Kellard, J.B. Madsen, M.E. Wohar, *The Prebisch–Singer Hypothesis: Four Centuries of Evidence*, „The Review of Economics and Statistics" 2010, vol. 92, no. 2.

[239] J. Grzeszczak, op. cit., p. 11–13.

[240] A.O. Hirschman, op. cit.

[241] S. Korenik, *Dysproporcje w rozwoju regionów Polski – wybrane aspekty*, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław 2003, p. 24.

and services of other entities. Hirschman showed that the economic growth of a particular area tends to cause an imbalance between the industrial sectors operating within its boundaries. The more developed sectors cooperate only with selected companies that meet their needs. This results in faster and more dynamic development of only selected branches and industries. Entities and industries that do not receive this kind of stimulus develop at a significantly slower rate[242]. The assumptions of A.O. Hirschman's theory have been confirmed in practice, as exemplified by the existing differences between the highly developed countries of North America and the less wealthy countries located on the South American continent. The centre-periphery theory by R. Prebisch[243] assumes that the development of the periphery depends on the development of the centre, which influences the periphery in both positive and negative ways. This influence contains positive and negative elements, such as:

a) positive phenomena:
   - transfer of knowledge;
   - inflow of capital;
   - new investments;
   - acquisition of new technologies;
   - introduction of innovation;
b) negative phenomena:
   - unequal trade;
   - economic dependence;
   - lack of research centres.

According to R. Szul[244], the economic development of the central region should have a supporting effect on the economic performance of the periphery. These regions, deprived of growth opportunities, can only hope to develop by taking advantage of the growth factors generated by the centre. In contrast, recession has an inhibitory effect on the development of peripheral places, although this impact may be delayed relative to the centre.

In the middle of the last century, neoclassical theories of regional development emerged, which emphasised the role of market mechanisms in the deployment of resources. The new approach refers to classical economics and promotes the free play of market forces, which should lead to a blurring of regional differences and disparities[245]. The representatives of this approach are, inter alia: G.H. Borts and J.L. Stein[246],

[242] A.O. Hirschman, op. cit., p. 2–54.

[243] R. Prebisch, op. cit.

[244] R. Szul, *Teorie i koncepcje w polityce regionalnej*, [in:] *Rozwój, region, przestrzeń*, G. Gorzelak, A. Tucholska (ed.), Ministerstwo Rozwoju Regionalnego, Warszawa 2007, p. 114–115.

[245] A. Dąbrowski, *Wybrane teorie rozwoju regionalnego i ich znaczenie w polityce ekonomicznej*, [in:] *Dylematy i osiągnięcia polskiej polityki transformacji gospodarczej*, H. Ćwikliński, G. Szczodrowski (ed.), Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 1995, p. 198–202.

[246] G.H. Borts, J.L. Stein, *Economic Growth in a Free Market*, Columbia University Press, New York–London 1964.

H.W. Richardson[247], R.M. Solow[248]. In general, the factor shaping regional development that links these concepts is the marginal efficiency of the factors of production. A region's production and growth depend on the availability of factors of production such as capital and labour and, in addition, on the level of technological development of the regional economy and innovation. Excessive influence of a state in the sphere of distribution leads to a reduction in the mobility of production factors, which has a direct impact on the deepening of disparities in regional development. Therefore, the best way to overcome this phenomenon is to reduce state interventionism in the economy.

In the 1980s, within the framework of the theory of regional development, M.P. Romer[249] proposed *a new theory of growth* which assumes that the basic factor for creating long-term growth based on technological progress and innovation is human capital and its knowledge. The creation of knowledge, especially practical knowledge, occurs mainly within companies and then this process spreads, creating positive external effects in the production process of other companies. Poor regions can catch up mainly by raising the level of their technological development and investing in workers' qualifications. The activities of public authorities should focus on supporting education, human resources development, research and technological development and supporting small and medium-sized enterprises. Achieving a growth path, according to this theory, is possible – it just requires making the right choice about the type of production and directing subsidies towards research and development[250]. Supporters of the liberal trend in economics take the view that it is the free market that leads to the erosion of regional differences and disparities. Only the implementation of liberal concepts stimulates economic activity and can lead to dynamic economic development in peripheral regions.

Theories advocating a reduction in the role of the state in influencing the economy, however, do not predetermine its complete withdrawal from this influence. They indicate certain directions of state intervention which will allow and accelerate the development of peripheral regions, as a result of which, the development gap between these regions and highly developed regions will be narrowed. According to contemporary economists, the development of peripheral regions depends on the transfer from central regions of the following: capital, knowledge, new technologies and innovations. The investment process should be oriented towards specialisation, i.e. the development of selected branches of industry, as it is leading branches that transfer growth impulses to others. Leading enterprises cooperate with weaker enterprises, which

[247] H.W. Richardson, *The New Urban Economics*, Routledge, London 2013.

[248] R.M. Solow, *A contribution to the Theory of Economic Growth*, „The Quarterly Journal of Economics" 1956, vol. 70, no. 1, p. 65–94.

[249] P. Romer, *Increasing Returns and Long-Run Growth*, „Journal of Political Economy" 1986, vol. 94, no. 5, p. 1002–1035; idem, *Growth Based on Increasing Returns Due to Specialization*, „The American Economic Review" 1987, vol. 77, no. 2, p. 56–62.

[250] L. Arnold, *Endogenous technological change: a note on stability*, „Economic Theory" 2000, vol. 16, no. 1, p. 219–226.

contributes to the development of whole industries and, consequently, to the development of a given region. It should be noted that nowadays the international division of labor has transformed from inter-industry into intra-industry, which contributes to the deepening of international cooperation. Examples include the economies of China, India or Vietnam.

In response to the needs of the modern economy, a concept known as "aid for trade" (AfT) was born in the United Nations. The purpose of the AfT initiative is to provide support to developing countries (Least Developed Countries, LDCs) to help them develop their capacity to trade. The objectives are for countries to reduce trade costs, improve rules and administrative procedures, build infrastructure and enhance the productivity of their companies.

Economists can find many examples of regions and whole countries which, due to their location, are classified as peripheral, while in economic terms they are the centre of the development of modern technologies[251]. The activity of the state and local authorities should therefore focus on intensifying actions that will encourage entrepreneurs to invest in peripheral regions through a variety of activities, for example; the introduction of tax relief and remissions, the development of advisory and financial institutions, improving the qualifications of the workforce and, above all, assistance in the innovation processes and the promotion and support of knowledge-based enterprises.

2.2. Factors influencing the development of peripheral regions

In the literature on the subject, scientists indicate many factors for the development of peripheral areas. In general, they can be divided into internal factors, derived from a given region, and external factors. W. Czemiel-Grzybowska[252] defines a factor as an element causing a particular phenomenon or effect, and referring to development factors, they may be various events occurring within a region or events originating outside it but being the cause of significant changes taking place within its borders. Regional development factors are phenomena that significantly influence the development of a region. They can be either objective or subjective in nature, moreover, they are active and their impact is multidirectional and can affect the development

[251] An example of such a region is Taiwan, estimated to be the twentieth economy in the world. Compare: M. Bonikowska, *Wyspa środka: między Chinami a Zachodem*, available at: https://csm.org.pl/wp-content/uploads/2016/01/CSM-analiza-Bonikowska-Tajwan-16.01.2016.pdf accessed: 15 August 2022.

[252] W. Czemiel-Grzybowska, *Konkurencyjność regionów a czynniki sukcesu wybranych krajów europejskich*, „Administracja Publiczna. Studia Krajowe i Międzynarodowe" 2010, no. 1(15), p. 12.

of the region in a positive or negative way[253]. The term development factors is derived from the classical theory of economics, pointing to such factors of production as labour, land and capital. The rank of these factors may change depending on the adopted direction of economic development. However, it is beyond doubt that economic development contributes to raising the socio-economic standard of living of the residents of an area. In the circumstances of the free market, the development of particular regions takes place with different intensity as market forces influence the concentration of development processes and direct it to the most attractive places, which leads to the polarisation of socio-economic space and the emergence of disproportions in the level of development of regions. According to J. Kudełko[254], the concentration of economic activity is realised with the migration of population, the movement of capital and the location of economic activity in places that ensure the most economic efficiency or utility. The processes of reallocation of production factors lead to the differentiation of space in terms of its attractiveness and competitiveness. In the opinion of A. Balińska[255]"... they complement each other but the most important is the social capital of the residents, thanks to which the other factors can be utilised".

When looking for scientific studies on the factors of economic development in contemporary literature, nowadays they are most often associated with sustainable development[256]. Regional development factors, on the other hand, are also defined as components, a property of a region or an event taking place within its borders that influence changes in its state, i.e. influencing its socio-economic development. They can also be the resources of a territory, i.e. local population, environment, capital[257].

Classical and neoclassical theories of growth identified land, labour and capital as the primary factors of production. Capital, on the other hand, was seen as a fundamental factor in development. Referring to the contemporary realities of socio-economic life, the fundamental factors of regional development are[258]:

- Human capital;
- Social capital;
- Physical capital;

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253 J. Kudełko, *Uwarunkowania i kierunki rozwoju województw Polski wschodniej jako regionów słabo rozwiniętych*, Komitet Przestrzennego Zagospodarowania Kraju PAN, Warszawa 2013, p. 51.

254 Ibidem, p. 10.

255 A. Balińska, *Factors Determining the Development of Peripheral Areas of Eastern Poland*, „Journal of Agribusiness and Development" 2015, vol. 2, no. 36, p. 153–160, DOI: 10.17306/JARD.2015.16.

256 R.W. Kates, T.M. Parris, A.A. Leiserowitz, *What is sustainable development? Goals, Indicators, Values and Practice*, „Environment Science and Policy for Sustainable Development" 2005, vol. 47, no. 3, p. 8–27, DOI:10.1080/00139157.2005.10524444.

257 M. Russ, J.K. Jones, *Regional Economic Development Indicators for a Knowledge-Based Economy in a Knowledge Deprived Region*, „Journal of Regional Analysis & Policy" 2008, vol. 38, no. 2, p. 189–205; Z. Strzelecki, *Polityka regionalna*, [in:] *Gospodarka regionalna i lokalna*, Z. Strzelecki (ed.), PWN, Warszawa 2008, p. 80.

258 P. Churski, *Czynniki rozwoju regionalnego i polityka regionalna w Polsce w okresie integracji z Unią Europejską*, Wydawnictwo Naukowe UAM, Poznań 2008, p. 67–72.

- Financial capital;
- Introduction of innovation;
- External flows of persons, capital and goods.

Human capital, considered as the most important type of capital for the contemporary development process, created by a part of human resources actively or potentially participating in socio-economic activity due to their knowledge, qualifications and skills, considered from the point of view of: the situation of the population, the level of education and access to educational services, and the state of the labour market. In economic terms, human capital is defined as the overall stock of qualifications, skills and knowledge possessed by a given society or individuals, which determine the ability to perform specific work, adapt to changes in the environment as well as the ability to create new solutions[259]. It is based on tangible as well as intangible goods, value judgements, behavioural patterns, and also on institutions dealing with the organisation of human behaviour[260].

In the opinion of A. Balińska[261], the factors of regional development complement each other but the most important is the social capital of the residents, thanks to which other factors can be used. The above is confirmed by the latest research conducted in Turkey[262], inter alia. Social capital is a relatively new category of capital influencing regional development. It is assumed that social capital consists of norms, values, social activity and bonds between social groups and thus influences the development of entrepreneurship and the competitiveness of a region. It should be considered in the following aspects: social activity, activities of non-governmental organisations, entrepreneurship. The introduction of this subject to the social sciences is attributed to P. Bourdieu[263], who defined social capital as the sum of the resources currently held, as well as those that can be obtained, which are owed to an individual or group by virtue of having a relatively permanent, more or less institutionalised network of relationships. J. Coleman[264] proposes a different concept of social capital and states that it is norms and values that provide social benefits and are developed by individuals or social networks in such a way that they become a common good.

Physical capital includes tangible goods, mainly the means on which economic activity is based, namely: natural resources and the state of the natural environment, technical infrastructure, social infrastructure, fixed assets of enterprises. Financial

[259] W. Czemiel-Grzybowska, op. cit., p. 14.

[260] L. Białoń, *Metodologiczne problemy określania kapitału ludzkiego*, [in:] *Perspektywy kapitału ludzkiego jako czynnika wzrostu gospodarczego Polski*, S. Marciniak (ed.), Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2002, p. 12.

[261] A. Balińska, op. cit.

[262] H.M. Arslan, H.E. Duran, *Social capital and regional development in Turkey*, „Regional Science Policy and Practice" 2020, vol. 13(3), p. 878–920, DOI: https://doi.org/10.1111/rsp3.12318.

[263] Compare: P. Bourdieu, L.J.D. Wacquant, *Zaproszenie do socjologii refleksyjnej*, transl. A. Sawisz, Oficyna Wydawnicza, Warszawa 2001.

[264] J. Coleman, *The Asymmetric Society*, Syracuse University Press, Syracuse–New York 1982.

capital, in turn, is the total of free financial resources that can be allocated to the implementation of new investments that increase the physical capital of the region and the resources allocated by residents to consumption that increases internal demand. It involves money in various forms: cash, credit, securities[265].

Innovation, both "soft" (marketing, organisational) and "hard" (investment, new technologies) is currently considered to be the main factor in regional development. In economic literature, innovation is defined as[266] a process, including the creation of an idea, research, development and design, production, marketing and dissemination of goods, services, and also as goods, services or ideas that are perceived by the recipient as qualitatively new in the corresponding markets. It increases the profitability of capital and allows it to face the competition of developed economies. However, the condition for using innovations and research results is the financial base.

External flows of people, capital and goods are considered a complementary factor in regional development. The analysis of this factor is based on such aspects as: migration, foreign investment, foreign trade. The scope of factors and methods of measuring regional development, currently clearly related to the concept of sustainable development, from the point of view of their practical application, is constantly the subject of interest of European institutions[267], as confirmed by successive documents and strategies[268].

In general, the starting point for considering the factors contributing to regional development or underdevelopment are endogenous factors, related to the use of one's own internal economic and social potential. Exogenous factors, i.e. conditions resulting from the external environment, both domestic and international, are also important. Based on the classification proposed by J. Kudełko[269], exogenous factors include:

- natural resources, that is land and raw materials;
- assets, that is capital;
- labour resources;
- economic structure.

An important role is attributed to qualitative factors as they determine the optimal use of the region's potential. Those are: the quality of human capital (the qualifications of the workforce), the quality of assets (the technical and technological level), or the economic structure (the presence of modern and innovative industries).

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265 W. Czemiel-Grzybowska, op. cit., p. 14.

266 *Oslo Manual...*, 2018; M. Kozak, A. Pyszkowski, R. Szewczyk, *Słownik rozwoju regionalnego*, Polska Agencja Rozwoju Regionalnego, Warszawa 2001, p. 24.

267 Compare, among others: *Indicators on Regional Development. Aims and Questions*, https://www.uibk.ac.at/diamont/downloads/meetings/finalconference/schoenthaler.pdf, accessed: 23 May 2021.

268 *Development of a system of common indicators for European Regional Development Fund and Cohesion Fund Interventions after 2020*, European Commission, 26 July 2018, available at: https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/indic_post2020/indic_post2020_p1_en.pdf, accessed: 23 May 2021.

269 J. Kudełko, op. cit., p. 53.

Quantitative factors are related to natural and material resources. They are the primary source of the region's wealth. However, their presence does not ensure development.

The categories of factors of regional development, including the division into external and internal ones, are proposed by Y.S. Lee, Y.Ch. Tee i D.W. Kim[270], I. Bostan et al.[271], K. Głąbicka, M. Grewiński[272] and P. Hall[273].

With regard to peripheral regions, due to their low economic potential, it is difficult to initiate development processes related to capital accumulation, to develop an economy based on knowledge and innovation. External development factors depend on systemic factors such as the prevailing socio-economic system and its capacity, the economic policy of the state and the territorial organisation of the country. The innovation policy of the state, resulting from the adopted model of the socio-economic system, and determining the possibilities and limitations of regional development through actions and decisions made within individual sections of macroeconomic policy – financial, structural, sectoral and regional, is of particular importance[274]. The identification of development factors is particularly important from the point of view of regional policy, which consists in steering the development process by regional authorities (territorial self-government units).

The interconnection and integration of economies has become a premise for the development of globalisation processes associated with the flow of factors of production and various risks. This is due to the widely understood and increasing openness of the world economy, manifested in establishing all kinds of international contacts, including the readiness of economic entities, institutions and public authorities for economic cooperation, exchange of experience and seeking innovative solutions[275]. In the era of globalisation, the so-called modern development factors play an increasingly important role, in particular, the quality of human capital, scientific and technical progress, innovativeness in the area of production and services, the development of modern infrastructure and structural transformations increasing economic effectiveness, as pointed out by M. Proniewski, who indicates the following factors which are currently of decisive importance for the growth of regions[276]:

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[270] Y.S. Lee, Y.Ch. Tee, D.W. Kim, *Endogenous Versus Exogenous Development*, „Environment and Planning C: Government and Policy" 2009, vol. 27, p. 612–639.

[271] I. Bostan, C. Toma, G. Aevoae, I.B. Robu, D.N. Mardiros, S.C. Topliceanu, *Effects of Internal and External Factors on Economic Growth in Emerging Economies: Evidence from CEE Countries*, „Eastern European Economics" 2022, vol. 61(1), p. 66–85, DOI: https://doi.org/10.1080/00128775.2022.2109489.

[272] K. Głąbicka, M. Grewiński, op. cit., p. 17.

[273] P. Hall, *Urban and regional planning*, Routledge, London 2002.

[274] Y.S. Lee, Y.Ch. Tee, D.W. Kim, op. cit.; J. Kudełko, op. cit., p. 54.

[275] P. Brańka, *Determinanty internacjonalizacji gospodarki województw Polski – analiza czynnikowa*, [in:] *Rozwój regionalny w Polsce w świetle wyzwań XXI w.*, T. Kudłacz (ed.), PAN, Warszawa 2010.

[276] M. Proniewski, op. cit., p. 34–35.

- innovation and regional innovation systems – the role of innovation in the regional development of the EU regions is seen as an important driving force for development;
- human capital – investment in people helps to increase the productivity of human capital. An increase in the level of education of citizens usually leads to an increase in income and life satisfaction;
- scientific and research activities – the development of this type of activities relates to employment in the scientific and technological sector, employment in the advanced technology sector and patents;
- infrastructure management – a good transportation system is important for the development of regions. It facilitates access to markets for consumers, businesses and workers, thus influencing the attractiveness of regions for investment;
- access to high-speed ICT networks – this is a determinant of a region's ability to implement new technologies, electronic services and also a determinant of the regional ability to participate in the global market. The term ITC (information and communication technologies) is understood as all activities related to the production and use of telecommunications and IT devices and related services, as well as the collection, processing, and sharing of information in electronic form using digital techniques and all electronic communication tools[277]. ICT are particularly important for less developed regions;
- institutions and their quality in shaping development processes – this is related to efficient administration and high level of provided public services as well as the ability to manage development.

Nowadays, the importance of factors that stem from the globalisation process is growing, and the SARS-CoV-2 pandemic has made it clear to the global community. According to S. Shah[278], it is one of coronaviruses, similar to the earlier SARS virus of 2002, and a decade later MERS, until the spread of SARS-CoV-2 causing COVID-19 disease, which turned into a pandemic. A pandemic "is an epidemic, or the massive spread of an infectious disease that is out of control, covers an entire country, continent or world, killing millions of people and changing entire civilisations, constantly appearing in the pages of history"[279].

Knowledge and innovativeness are now being prioritised among development factors and are the most important instruments for increasing competitiveness. According to W. Kosiedowski, presently, innovations and investments are the driving force of the economy and their growth causes multiplier effects. Furthermore, labour resources are still a fundamental factor for development but its interpretation

[277] *Słownik pojęć*, Polski Fundusz Rozwoju, available at: https://pfr.pl/slownik/slownik-itict.html, accessed: 19 July 2023. The issue of their use will be discussed later in this chapter.

[278] S. Shah, *Epidemia. Od dżumy przez HIV po ebolę*, Znak Horyzont, Kraków 2019, p. 3.

[279] Ibidem.

is changing, where the emphasis is not so much on its size as on the quality of human capital[280].

Regions gain the ability to develop and compete by constantly increasing innovation, which involves the introduction of new technological and organisational solutions and new products[281]. The growth of the innovative potential of a region requires the presence of innovative enterprises and start-ups developing new products or services of high quality and great utility. The creation of innovations, however, does not depend only on enterprises operating in the region, as their activities are supported by R&D activities which are undertaken not only within companies but also at regional, national and international levels. The level of innovativeness of peripheral regions often depends on the support and creativity of national and local authorities, especially in promoting research and training personnel. However, the main driving force behind the economic development of peripheral regions are private enterprises, as local development depends on their competitiveness and innovation.

An instrument for supporting innovativeness and competitiveness is the creation of regional innovation strategies, which indicate the most important directions for the development of an innovative economy at a local and regional level. Finland can serve as an example, where the National Innovation Strategy[282] forms the basis for the work undertaken in individual ministries that define horizontal objectives, while operational activities are handled by government agencies. Since the early 1990s, the Finnish authorities have allocated high levels of funding to support research and development (R&D). Finland competes with Sweden in that area. In both countries, expenditure on the R&D sector exceeds 3% of GDP, which is one of the highest among the European Union member states. In Poland, for example, expenditure on R&D does not exceed 0.6% of GDP[283]. Various organisations and agencies assist entrepreneurs and researchers in their innovation implementation activities. The most important partners for innovative companies and research centres in Finland are the following institutions:

- Finnish Innovation Fund for Research and Development (SITRA)[284], which undertakes activities for the qualitative and quantitative economic development of Finland by promoting stable and sustainable national development, studying

[280] W. Kosiedowski, op. cit., p. 48.

[281] Z. Sadowski, *Wzrost gospodarczy, rola państwa i aktywność regionalna*, „Opolskie Roczniki Ekonomiczne" 1997, vol. 15, p. 15–22.

[282] *System wspierania innowacyjności w Finlandii wraz z przykładami dobrych praktyk*, Trade and Investment Promotion Section, Embassy of the Republic of Poland in Helsinki, Helsinki 2016.

[283] K. Ziętek-Kwaśniewska, *Nakłady na działalność badawczo-rozwojową w Polsce na tle państw Unii Europejskiej*, „Studia BAS" 2020, vol. 1(61), p. 9–25, https://orka.sejm.gov.pl/WydBAS.nsf/0/729CFDC55BD3CE86C125856F004CE520/$file/1.Katarzyna%20ZietekKwasniewska%20.pdf, accessed: 23 May 2021.

[284] Finnish Innovation Fund for Research and Development, https://www.sitra.fi/en/, accessed: 23 May 2021.

economic and social trends, supporting innovation and competitiveness of enterprises, health care, environmental protection;
- Academy of Finland[285], which is responsible for funding research and implementing its results in the real economy, training of researchers, scholarship programmes for researchers and students as well as international cooperation;
- Finnish Funding Agency for Technology and Innovation, (TEKES)[286] – is a funding agency for technology research and innovation, whose mission is to implement R&D projects and programmes.

The example of Finland shows that building the foundations of regional development is presently based on innovation, investment in human capital and support for R&D.

Attention paid to the level of education directly affects development, promotes entrepreneurship, pro-development motivations, acceptance of market institutions, and it is important that education goes hand in hand with the ability to apply knowledge in practice, which is particularly emphasised in the European Union[287]. A high quality of human capital contributes to increasing the efficiency of enterprises, which improves their competitive position as it guarantees a greater ability to implement innovations and modern organisational principles, and also promotes greater willingness to cooperate and thus leads to more effective management[288].

Poland's accession to the European Union in 2004 opened the possibility for Polish regions to benefit from the acquis communautaire and aid funds that increase competitiveness and reduce regional disproportions. The EU support under the cohesion policy, the main treaty objective of which is economic, social and territorial cohesion, is directed primarily to regions with a lower than the EU average rate of economic development (measured by GDP per capita). Under the EU regional policy, peripheral regions are typically classified based on location and economic criteria[289]:
- based on the location criterion – peripheral regions, i.e. areas that are the furthest away from the economic, political and social centres, characterised by distance from the mainland, isolation, a small territorial area with a small internal market, relatively narrow economic specialisation and difficult access to Community markets;
- based on the economic criterion – regions with a low level of economic development, measured by GDP per capita, which is less than 75% of the average for all European Union members.

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[285] Academy of Finland, https://www.aka.fi/en/, accessed: 23 May 2021.

[286] Finnish Funding Agency for Technology and Innovation, https://fundit.fr/en/institutions/finnish-funding-agency-innovation-tekes, accessed: 23 May 2021.

[287] Compare European Union aid programmes such as: HORIZON2020, Interreg, available at: Horizon2020: https://ec.europa.eu/programmes/horizon2020/en/h2020-sections, accessed: 13 June 2020; Interreg: https://www.interregeurope.eu/, accessed: 13 June 2021.

[288] J. Kudełko, op. cit., p. 62.

[289] European Funds Portal, www.funduszeeuropejskie.gov.pl, accessed: 25 November 2020.

The 2014–2020 perspective included two main development goals for the member states:

- investment in development and employment;
- European Territorial Cooperation.

The financial resources directed to regions and the scope of intervention vary according to the scale of economic development, as measured by the average GDP per capita. Accordingly, European regions were classified into three basic categories, with the following support criteria being adopted[290]:

- The "less developed" regions, the GDP per capita of which is less than 75% of the average EU GDP, will remain the main target of the investment strategy. The maximum co-financing rate in the less developed and peripheral regions was set at 75–85%;
- The "transition regions", with a GDP per capita of 75–90% of the average EU GDP, will have a co-financing rate of 60%;
- The "more developed regions", with a GDP per capita exceeding 90% of the average EU GDP, will have a co-financing rate of 50%.

In Poland, in 2018, the level of GDP per capita was less than 70% of the average level for all EU Member States, only Mazowieckie Voivodeship exceeded the threshold of 75% and got included in the group of more developed regions[291]. As a result, in the years 2014–2020, Poland was the largest beneficiary of the EU aid as the planned subsidies amounted to EUR 82.5 billion[292]. A new agenda is in place since 2021, according to which Poland receives significant funds from the budget of the European Union. Based on the European funds portal[293], Poland can obtain EUR 72.2 billion from the cohesion policy and EUR 3.8 billion from the Just Transition Fund over the years 2021–2027. This gives a total of EUR 76 billion**.** The funds are to be used for investment projects in such areas as innovation, entrepreneurship, digitisation, infrastructure, environment, energy, education and social affairs.

The conditions discussed above indicate that today's development of peripheral regions depends on both internal and external potential and opportunities. The extent to which this potential is used makes some regions more competitive than others. The increase in the competitiveness of peripheral regions and their ability for sustainable development depend not only on traditional production factors such as land,

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290 Ibidem.

291 *Polska w Unii Europejskiej. Portret statystyczny* [*Poland in the European Union. A Statistical Portrait*], GUS, Warszawa 2019, https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5501/35/1/1/polska_w_unii_europejskiej_portret_statystczny.pdf, accessed: 13 June 2021.

292 European Funds Portal, www.funduszeeuropejskie.gov.pl, accessed: 25 November 2020.

293 *Fundusze Europejskie na lata 2017–2021*, https://www.funduszeeuropejskie.gov.pl/strony/o-funduszach/fundusze-na-lata-2021-2027/, accessed: 12 May 2021.

capital and labour but primarily on knowledge and the ability to apply it in practice. The literature emphasises that knowledge and innovation are a priority among development factors.

2.3. Mobility problems in peripheral areas

For decades, scientists have been studying the problems of peripheral areas, among which the problem of mobility is considered to be one of the biggest issues. According to J. Sołtysek[294], mobility is a tendency to change one's place of residence or place of work. The issue of sustainable transport in natural and protected areas is taken up by a team of researchers in a monograph edited by F. Orsi[295]. Particularly noteworthy is the chapter presenting the sustainability potential of various transport modes in natural settings. The authors come to conclusions that a sustainable transportation system guarantees the satisfaction of multiple environmental, social and economic requisites across space and over time. E. Szymanska and Z. Koloszko-Chomentowska present the issue of the mobility of residents in Hajnówka County[296]. The research revealed a wide range of opinions on the expected changes to public transport in the region under study.

Developed public transport and road infrastructure are becoming more important in rural and peripheral areas from the perspective of local citizens. Multi-modal planning creates communities where walking, bicycling and public transport is possible. This provides various benefits to citizens. Current trends include an increasing demand for environmentally friendly mobility options in peripheral areas (Litman 2019). It is very important that mobility is available and affordable for all citizens, that rural and remote regions remain connected, and that the sector offers good social conditions and provides attractive jobs. With transport employing more than 10 million people in Europe and contributing around 5% to EU Gross Domestic Product, the transport system is critical to European businesses. Also, transport is not without costs to society: noise, greenhouse gas and pollutant emissions, road crashes and congestion. Transport emissions represent around one quarter of the EU's total greenhouse gas (GHG) emissions.

[294] J. Szołtysek, *Kreowanie mobilności mieszkańców miast*, Wolters Kluwer, Warszawa 2011.

[295] *Sustainable Transportation in Natural and Protected Areas*, F. Orsi (ed.), Routledge, London 2015.

[296] E. Szymanska, Z. Koloszko-Chomentowska, *Sustainable Innovative Mobility Solutions Preferred by Inhabitants of Rural Areas – The Case of Lithuania and Poland*, „Sustainability" 2022, vol. 14, no. 11, 6603, DOI: https://doi.org/10.3390/su14116603.

There are numerous mobility issues in Europe. This primarily concerns the peripheral regions. Therefore, the European Union members have decided that the fundamental transport transformation should become sustainable. The European Commission presented the plan for green, smart and affordable mobility, which consists of 10 key areas for action to make the vision a reality[297]:

a) to make it smart – innovation and digitalisation will shape how passengers and freight move around in the future if the right conditions are put in place. The strategy foresees:
   - making connected and automated multimodal mobility a reality – for instance by making it possible for passengers to buy tickets for multimodal journeys and freight to seamlessly switch between transport modes;
   - boosting innovation and the use of data and artificial intelligence (AI) for smarter mobility – for instance by fully supporting the deployment of drones and unmanned aircraft and further actions to build a European Common Mobility Data Space;
b) to make it resilient – transport has been one of the sectors hit hardest by the COVID-19 pandemic, and many businesses in the sector are seeing immense operational and financial difficulties. The Commission therefore commits to:
   - reinforce the Single Market – for instance through reinforcing efforts and investments to complete the Trans-European Network (TEN-T)[298] by 2030 and support the sector to build back better through increased investments, both public and private, in the modernisation of fleets in all modes;
   - make mobility fair and just for all – for instance by making the new mobility affordable and accessible in all regions and for all passengers including those with reduced mobility and making the sector more attractive for workers;
c) step up transport safety and security across all modes – including by bringing the death toll close to zero by 2050:
   - boosting the uptake of zero-emission vehicles, vessels and aeroplanes, renewable & low-carbon fuels and related infrastructure – for instance by installing 3 million public charging points by 2030;
   - creating zero-emission airports and ports – for instance through new initiatives to promote sustainable aviation and maritime fuels;

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[297] To make the goals a reality, the strategy identifies a total of 82 initiatives in 10 key areas for action ("flagships"), each with concrete measures; Compare: *A fundamental transport transformation: Commission presents its plan for green, smart and affordable mobility*, https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2329, accessed: 5 May 2021.

[298] TEN-T comprises two network „layers": The Core Network includes the most important connections, linking the most important nodes, and is to be completed by 2030; The Comprehensive Network covers all European regions and is to be completed by 2050. The backbone of the Core Network is epresented by nine Core Network Corridors, which were identified to streamline and facilitate the coordinated development of the Core Network. See: https://ec.europa.eu/transport/themes/infrastructure/ten-t_en, accessed: 16 May 2021.

- making interurban and urban mobility healthy and sustainable – for instance by doubling high-speed rail traffic and developing extra cycling infrastructure over the next 10 years;
- greening freight transport – for instance by doubling rail freight traffic by 2050;
- pricing carbon and providing better incentives for users – for instance by pursuing a comprehensive set of measures to deliver fair and efficient pricing across all transport.

A description of studies on mobility problems can be found in the literature. Such research is focused primarily on issues faced by selected regions. Researchers list numerous problems in the field of mobility and constantly try to answer to the question – Why are some regions deteriorating while others are developing? (Liu et al. 2019)[299]. Lucas (2018)[300] describes this situation as "transport poverty". Mobility barriers are often the result of dispersed settlement structures, which makes it difficult to ensure an efficient public transport system. Mobility in peripheral areas depends mainly on owning a private car (Sode and Peer 2018)[301]. Current trends include an increasing demand for non-auto travel options in peripheral areas (Litman 2019)[302]. E. Szymańska[303] compares the problems of mobility in different peripheral regions using two regions as an example: Hajnówka County in Poland and the Zaoneshye Region in Russia. Researchers indicate various causes of these problems and challenges (Z. Koloszko-Chomentowska; M. Zdziarstek 2019)[304]. Researchers emphasise the lack of cooperation in terms of transport planning between different entities, Büttner et al., (2018)[305].

[299] Ch. Liu, B. Yu, Y. Zhu, L. Liu, P. Li, *Measurement of Rural Residents' Mobility in Western China: A Case Study of Qingyang, Gansu Province*, „Sustainability" 2019, vol. 11, 2492.

[300] K. Lucas, *Editorial for Special Issue of European Transport Research Review: Transport poverty and inequalities*, „European Transport Research Review" 2018, vol. 10, article number 17.

[301] M. Soder, S. Peer, *The potential role of employers in promoting sustainable mobility in rural areas: Evidence from Eastern Austria*, „International Journal of Sustainable Transportation" 2018, vol. 12, p. 541–551.

[302] T. Litman, *Rural Multimodal Planning. Why and How to Improve Travel Options in Small Towns and Rural Communities*, Victoria Transport Policy Institute, 30 September 2019.

[303] E. Szymanska, *Problems of Tourist Mobility in Remote Areas of Natural Value – The Case of Hajnówka County in Poland and the Zaoneshye Region in Russia*, „Economies" 2022, vol. 10(9), 212, DOI: https://doi.org/10.3390/economies10090212.

[304] Z. Kołoszko-Chomentowska, M. Zdziarstek, *The potential of peripheral rural areas on the example of the Podlaskie voivodeship*, „Acta Scientiarum Polonorum Administratio Locorum" 2019, vol. 18, p. 73–80.

[305] B. Büttner, J. Kinigadner, Ch. Ji, B. Wright, G. Wulfhorst, *The TUM Accessibility Atlas: Visualizing Spatial and Socioeconomic Disparities in Accessibility to Support Regional Land-Use and Transport Planning*, „Networks and Spatial Economy" 2018, vol. 18, no. 3, p. 385–414, DOI: 10.1007/s11067-017-9378-6.

Mobility as a Service (MaaS), a multidisciplinary concept related to mobility, was developed based on various studies (Esztergár-Kiss and Kerényi 2019)[306]. Another concept is inclusive transport (Jeekel 2019)[307]. Also in the European Union, work to improve mobility has been consolidated and the European Platform on Mobility Management has been established (2013)[308]. In individual regions of the European Union, changes are introduced in accordance with the principles of sustainable transport or smart mobility (Gross-Fengels and Fromhold-Eisebith 2018)[309]. Moreover, the third priority of the Interreg programme[310] is dedicated to sustainable transport.

Research on mobility issues often relates to selected social groups. One of the examples is the research on mobility problems conducted by I. Szewczyk[311], which focuses on the group of people with disabilities, especially on the elderly, as they are the group that requires the most attention.

To sum up, it should be stressed that the development of peripheral regions should be sustainable and characterised by long-term permanence of parameters. At the micro-level, it should ensure an increase in the standard of living of households and the generation of profits for businesses. At the macro-level, it should contribute to the creation of a strong economy for a country.

2.4. Innovative mobility solutions in the European Union

Research on innovation in peripheral areas is a matter of concern in many countries, with significant efforts devoted to this purpose. Numerous studies have been conducted to address these needs, especially in the form of reports and strategies. Among the available publications, special attention should be paid to strictly scientific studies reviewed by J. Eder[312]. His article conducts a systematic literature review of the work on innovation in the periphery published from 1960 to 2016. J. Eder explores the recurring themes and key issues of the field and discusses the various

[306] D. Esztergár-Kiss, T. Kerényi, *Creation of mobility packages based on the MaaS concept*, „Travel Behaviour and Society" 2019, vol. 21, p. 307–317, https://doi.org/10.1016/j.tbs.2019.05.007.

[307] H. Jeekel, *Inclusive Transport*, Elsevier, Amsterdam 2019, DOI: 10.1016/B978-0-12-813452-8.00008-6.

[308] European Platform on Mobility Management – EPOMM, 2013. Mobility management: the intelligent way to sustainable mobility in: *European countries, regions and cities*, Brussels, Belgium, https://epomm.eu/sites/default/files/files/MMDefinition_PL.pdf, accessed: 17 June 2021.

[309] S. Gross-Fengels, M. Fromhold-Eisebith, *Adapting transport related innovations to rural needs: Smart Mobility and the example of the Heinsberg region, Germany*, „Advances in Transport Policy and Planning" 2018, vol. 2, p. 125–162, DOI: 10.1016/bs.atpp.2018.09.007.

[310] Information available at: https://www.interregeurope.eu/, accessed: 21 October 2022.

[311] Information presented at the SMART project summary conference held in Bielsko-Biała on 12 and 13 November 2019.

[312] J. Eder, *Innovation in the Periphery: Critical Survey and Research Agenda*, „International Regional Science Review" 2019, vol. 42(2), p. 119–146, DOI: 10.1177/0160017618764279.

periphery concepts applied, ranging from a geographic to a functional perspective on various scales. The main findings and recommendations for policymakers and future research resulting from his review are as follows[313]:

- the periphery concept needs more refinement;
- future studies should include systematic comparisons of regions;
- an evolutionary perspective might provide new insights;
- future work could explore the benefits peripheries offer for certain kinds of innovation;
- urban–rural linkages might be of higher relevance than assumed;
- research should go beyond the well-known examples;
- the analysis could be extended by applying a broader understanding of innovation.

A team of researchers[314] conducted a review of regions with a low level of innovation and the results were included in a book published in 2016, inter alia.

When discussing innovation in peripheral areas and narrowing it down to mobility-related innovation, as well as making a theoretical introduction to the presentation of research results obtained in the MARA project, it is necessary to refer primarily to the area of the European Union. The EU member states attach great importance to providing equal development opportunities for all regions. Supporting the development of peripheral areas has been of utmost importance since the very beginning of the European Economic Community. Numerous studies have been conducted and many theoretical papers have been published on this subject. These include works by A. Isaksen and J. Karlsen on seeking innovative solutions in peripheral regions[315]. After all, research is followed by aid funds for these regions.

As part of the study of mobility models, literature and European mobility programs in rural areas have been reviewed. The analysis concerned existing mobility models. A frequently used solution is junctions of all transportation methods (car, bicycle, railway, bus, and pedestrian, as well as high-speed rail, aeroplane and boat) by means of hubs (transit hubs), which will create a single integrated and sustainable mobility network with a multitude of choices for all users. Detailed studies were conducted in, e.g., the Czech Republic[316]. The results of the research conducted in the years 2008–2013, using comparative analysis and multiple regression analysis methods, showed a significant variation in the level of poverty between Western European peripheral areas and those located in Central and Eastern Europe. The latter is dominated by small

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313 Ibidem.

314 M. Trippl, B. Asheim, T. Bjørn, J. Miörner, *Identification of Regions with Less-developed Research and Innovation Systems*, [in:] *Innovation Drivers and Regional Innovation Strategies*, M.D. Parrilli, R.D. Fitjar, A. Rodríguez-Pose (ed.), Routledge, London 2016, p. 23–44.

315 A. Isaksen, J. Karlsen, *Innovation in Peripheral Regions*, [in:] *Handbook of the Geographies of Innovation*, R. Shearmur, Ch. Carrincazeaux, D. Doloreux (ed.), Edward Elgar, Cheltenham 2016, p. 277–285.

316 V. Zitek, V. Klimova, *Peripheral Innovation Systems in the Czech Republic at the Level of the NUTS3 Regions*, „Agricultural Economics" 2016, vol. 62(6), p. 260–268, DOI: 10.17221/170/2015-AGRICECON.

farms, which contributes to a much higher level of employment in agriculture, with low labour productivity. Thus, one may conclude that this contributes to perpetuating the peripherality of Central and Eastern European agricultural areas.

To address the great need for improved mobility in Europe, numerous research groups and consortia of researchers and practitioners have been established to take up the challenge of developing and implementing the appropriate solutions. Examples of projects financed from European funds, mainly under the Interreg Baltic Sea Region programme implemented by groups of entities, are: MAMBA, SUMBA, SUMBA+, BSR ACCESS and MARA[317]. The latter is the subject of broader considerations presented in subsequent chapters[318]. For example, the MAMBA project was designed to identify gaps in a polycentric structure and contact with nature. The project included consideration of the implementation of new solutions, such as Intra-rural areas AV, Air taxis, autonomous vehicles. In the case of the Polish partner, the city of Bielsko-Biała, the project activities consisted in the implementation of an intelligent transport system (ITS) – a tool supporting traffic management in the city. In the first stage, 50 low-emission buses were purchased as part of the implementation of the sustainable transport policy in the city. Setting up the ITS required laying fibre optic cables, developing a mobile application for passengers using the services of the Municipal Transport Company (MZK), as well as developing a traffic light control system and a monitoring system. The primary objective was to increase the attractiveness of public transport in the city (road capacity). The SCATS system has been implemented and special computers have been installed in city vehicles to provide the current location of vehicles. The system monitors whether the vehicles are on time and if they are delayed, information on their current location is sent to the headquarters. This makes it possible to prolong the green light cycle or shorten the red light cycle for such a vehicle at intersections. The second system, introduced in parallel, provides information for passengers at 22 bus stops where dynamic information boards have been installed. The buses transmit data to the network, which then streams it to the information boards. The boards are also equipped with a system to help visually impaired persons. Passengers can use a remote control to have the board information read to them. Additionally, passenger information is also available online and in a mobile app. The range of information available online includes car parks, traffic flow, traffic cameras, and lists of events on the road (road works, changes in traffic arrangement).

Another reference project is CiViTAS CARAVEL. It was implemented by the City Transport Company (MPK) in Kraków[319] and consisted in introducing the innovative TELEBUS service. In this case, the cooperation with Genoa turned out to be successful,

[317] The presented examples of projects were implemented under the Interreg Baltic Sea Region programme, in the 2014–2020 programming period, and are posted on the website of the project: https://interreg-baltic.eu/projects/, accessed: 30 August 2022.

[318] The remaining initiatives are described based on information gathered during the SMART project summary conference held in Bielsko-Biała on 12 and 13 November 2019.

[319] The information is available at: http://www.caravel.forms.pl/, accessed: 30 August 2022.

where such services were implemented a bit earlier as part of the GREENBUS project that involved the introduction of "transport on demand" or "transport on call" services. Since large (full-size) buses cannot reach some areas, small low-floor buses were introduced. Kraków has new buses with a capacity of up to 18 passengers, which are used mainly by persons with limited mobility, including disabled individuals, mothers with prams, as well as elderly persons who are still relatively physically fit. The buses do not have predetermined routes or timetables; however, there are designated bus stops for passengers to use and the buses can travel between them in any order based on passenger needs. The clients call the dispatcher and receive information on what time they should be at the bus stop of their choice. Such a flexible system creates excellent opportunities to service the needs of passengers in a given region. Initially, MZK was given a template to define the relevant goals; afterwards, special software was developed to fulfil them. Transportation orders are accepted on an ongoing basis or in advance. Passengers can also place standing orders, which are given priority. Orders must be placed at least 30 minutes before using the service. Passengers immediately receive a confirmation on whether the service will be available and at what time. Passengers who change their mind should notify the dispatch – no fees apply in such a case. Clients receive their individual codes upon placing the first order. As of today, 77 bus stops have been set up for this service.

SMARTA2, which builds on the results of the SMARTA project, is another interesting initiative. Those projects relate to sustainable rural mobility[320]. Project Urban vs Rural population trends. (SMARTA2 Pilots – Smart cities. The purpose of the project was to create low emission zones, as well as mobility as a service and on-demand solutions. The project had a pan-European character and was sponsored by the European Parliament. It involved 34 Partners from across Europe. The project tasks included such innovation and success factors as:

- public transport service;
- demand;
- responsive transport;
- shared mobility.

The introduction of smart innovations was also assumed – ridership up and costs down, as well as a platform for booking transport.

SUMBA and SUMBA+ (Sustainable Urban Mobility and Commuting in Baltic Cities – Multimodality for those at risk of transport poverty)[321] are projects to improve mobility in the cities of the Baltic Sea region. The first stage of the project was the development of a transportation system data collection guide. The assumed multimodality required the use of various means of transport. The expected outcome

[320] Detailed information about the project can be found at: https://www.eltis.org/in-brief/news/smarta-2-demonstrators-promoting-sustainable-shared-mobility-european-rural-areas, accessed: 30 August 2022.

[321] Information about the project: https://rpr.gov.lv/project/sumba/, accessed: 30 August 2022.

is a Commuting Master Plan – a supplement to the Sustainable Urban Mobility Plan. A map is to be created that will allow cities to find other cities with similar problems and adapt good solutions (benchmark). Several areas are investigated: political climate, tariff integration, parking policy, access to information. The goal of the project is to improve mobility in terms of commuting to a central urban location. An example of an area facing such problems is Warsaw's suburbs, therefore Warsaw's suburban municipalities are among the project partners. The project assumes approaching mobility from an opposite perspective – not from the point of view of the urban centre but rather its peripheral areas. The result is the Sustainable Urban Mobility Plan, which constitutes a platform for dialogue. Additionally, a dedicated colourful matrix map will be created to make it possible to find cities facing similar issues and those that have already resolved them[322].

The presented projects significantly contributed to the improvement of mobility in the peripheral areas of the European Union (in this case – the regions of the Baltic Sea basin) and constitute a model for further research and implementation.

[322] Project results and activity progress reports can be found at www.sumba.eu.

3. Research procedure, methodology and characteristics of the research area

The conducted empirical research was carried out using scientific research methods, which are presented in this chapter. The participants were residents of the Hajnówka region and tourists, mainly visiting the Białowieża Forest, whose characteristics are presented below.

3.1. Procedure of the research

The research on mobility in peripheral areas was conducted internationally and in several stages. The international context arose from the project assumptions for the Interreg Baltic Sea Region programme. The MARA project covered practically all countries of the Baltic Sea basin, i.e. Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Poland, Germany and Norway. The theoretical and practical nature of the project and the obtained results were also due to the structure of the participating entities, which represented both the science domain and local authorities and organisations. The area of interest was the issue of mobility of the residents of peripheral regions, as well as tourists visiting such regions. This publication focuses on the presentation of the results of Polish research that had the widest coverage of the mentioned regions, which allows for in-depth recognition of the problem.

The process of project implementation and the conducted research can be divided into three main stages, which are presented in Figure 3.1.

The research procedure involved three stages. Stage one consisted in establishing international cooperation, as well as analysing and assigning tasks, with its outcome being the preparation and submission of the project. Stage two concerned the implementation of project tasks, scheduled for the years 2019–2021. Stage three involved summarising the research and the entire project, preparing final reports, as well as formulating and presenting conclusions and recommendations.

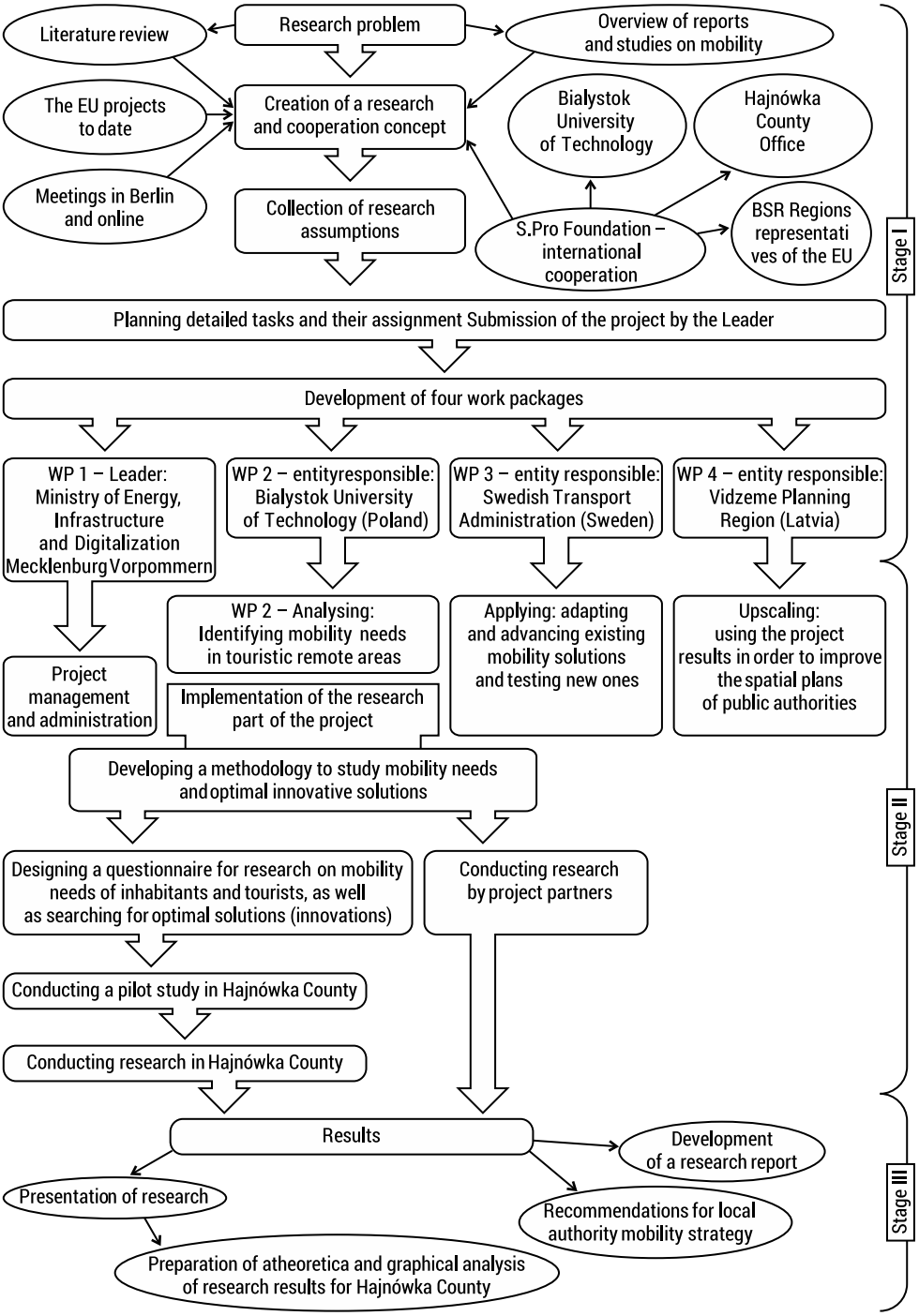

FIGURE 3.1. Research stages

SOURCE: Own elaboration.

Numerous sources of knowledge were used during the implementation of the first stage, which included research problem determination, literature review, concept-building and project development. Apart from scientific literature, such sources included mobility research reports and a review of results and recommendations from similar projects implemented under the Interreg programme. The *desk research* method consisting of analysing already existing and available data from various sources was also used in this stage. In terms of its factual scope, the collected data covered theoretical and practical issues related to economic innovativeness, as well as issues related to the characteristics of peripheral areas, with particular emphasis on problems related to mobility in those areas and the search for innovative solutions. Additionally, the factual scope covered the period with the most recent data available, mainly from the last 10 years. The adopted period was selected taking into account the availability of international studies, and above all, the availability of the research and implementation of innovative solutions resulting from the Interreg Baltic Sea Region programme, which can serve as a model for research and recommendations in this dissertation. At the regional level, the partners referred to both national and international scientific publications and regional reports commissioned by local government units. The selection of materials used in the desk research was dictated primarily by data availability and reliability.

The second stage, directly related to the implementation of the research (project) tasks, consisted of three main mutually intertwining parts, i.e. work packages (from 2 to 4) and separate tasks carried out by the leader within the first package. Based on the collected data, the regions were characterised, the research methods were selected and research tools were prepared. Two populations were selected for the study – residents of peripheral areas and tourists visiting such areas. All regions represented by the participants of the MARA project were peripheral areas characterised by natural and landscape features of high value. The natural and landscape conditions significantly increased the interest of tourists in these regions, therefore an assumption was formulated that tourist traffic has a positive impact on improving the economic situation of the regions and their inhabitants. According to A. Balińska, "tourism, and particularly its alternative forms such as active and countryside tourism, is a form of activity that stimulates multifunctional development by activating the endogenous potential of peripheral areas"[323]. Hence, the research covered both residents and tourists from peripheral regions participating in the project. Both quantitative and qualitative methods were used in the study. Quantitative research makes it possible to answer the essential question of "how much?". In quantitative terms, in the conducted interviews or surveys, questions are asked in such a way that it is possible to quantify the obtained answers using various numerical scales. Qualitative research focuses on an in-depth analysis of a specific phenomenon or characteristic. Qualitative research is typically descriptive in nature and does not involve using quantitative

[323] A. Balińska, *Factors Determining the Development of Peripheral Areas of Eastern Poland*, „Journal of Agribusiness and Development" 2015, vol. 2, no. 36, p. 153–160, DOI: 10.17306/JARD.2015.16.

measurement. In this stage of the study, the mobility models in the areas represented by the project partners were reviewed. The next step of stage two was to develop research methods to achieve the goal of diagnosing mobility needs and developing optimal, innovative mobility solutions – separately for each participating region – also taking into account the two groups of their beneficiaries, i.e. the residents and tourists in the region. Each of the partners proposed an individual research method, which is presented in Appendix 1.

With regard to empirical research conducted in the area of Hajnówka County, with particular emphasis on the Białowieża Forest, the following sequence of activities was followed:[324]

- defining the statistical population in terms of its factual, spatial and time scope;
- conducting a pilot study;
- improving the research tool;
- conducting the actual research, that is direct field studies of tourists using random sampling, and conducting surveys among the residents using mixed research techniques (the initial form of direct research was replaced with the research performed with the use of IT techniques, due to the limited availability caused by the pandemic and lock-down);
- collecting statistical data;
- processing the collected material;
- analysing the results and interpretation.

Defining the statistical population and selecting the research sample involved separating two groups (layers) of respondents – residents and tourists. The selection of respondents representing the inhabitants of a given area was made based on the data available in the Local Data Bank of Podlaskie Voivodeship[325], which presents the age structure. In turn, tourist surveys were conducted by random selection.

Pilot studies among inhabitants and tourists were conducted on August 5–9, 2019. The survey was completed by residents (8 people) of Hajnówka County, tourists (9 people) who were staying in this region for recreational and cognitive purposes and 9 experts from BUT (also completed recommendations and suggestions from Leader) as well as experts from SYKE, Tartu University and Dalarna University. The main problems concerned the availability of bus and rail transport. The results of the pilot study indicated the need to refine the questionnaire. Comments and suggestions of people participating in the research as well as comments of the project partners were discussed at the meeting of the Polish team of contractors and included in the development of a final version of the research questionnaire.

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[324] *Rozwój przedsiębiorstw. Zarządzanie i diagnoza*, M. Białasiewicz (ed.), Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2004, p. 177.

[325] Local Data Bank is available at: https://bdl.stat.gov.pl/BDL/dane/teryt/jednostka, accessed: 21 April 2022.

The survey was conducted according to a problem-based approach, which was to identify factors limiting mobility and to determine factors that may contribute to the improvement of the situation, with particular emphasis on innovative solutions related to the mobility of residents and tourists. The material scope of the collected data included such variables as:

- assignment to the community under study;
- age of the respondents;
- place of residence of the respondents (village, cities by size);
- frequency of use of various forms of transport;
- evaluation of existing mobility solutions;
- assessment of the proposal to introduce optimal innovative solutions.

The research was conducted in the years 2019–2021. The adopted period resulted from the duration of the project, the seasonal availability of tourists, the difficulties related to the Coronavirus-19 pandemic and the attempt to classify the data in a uniform manner.

The third and final stage of the research included the processing of the collected material, preparation of reports, conclusions and recommendations. An important element of this stage was the inclusion of the recommended innovations in the regional development strategy to implement them in the next programming period. Result analysis and interpretation were also conducted during this stage; they involved the following:

- typological grouping of the analysed variables according to the type of respondents (residents and tourists), age, and territorial characteristics to distinguish groups that are quantitatively and qualitatively different,
- calculating the statistical material and its presentation in the form of tables and charts;
- development of a square matrix of coordination and cooperation of transport services in Hajnówka County;
- formulation of research conclusions and recommendations for further research;
- formulating practical recommendations to be implemented by the transport companies of the region and by the local government – Hajnówka County Office.

A significant obstacle in research and communication was the SARS-CoV-1 pandemic, which "froze" the global economy from March 2020 until the time the author wrote these words. The pandemic made it impossible to continue the field research, which made it necessary to use IT techniques, especially in relation to the inhabitants of Hajnówka County. The problems resulting from this difficulty made it impossible for some partners to conduct field research as tourism was greatly restricted or completely shut down in most regions participating in the project. Direct access to residents was also much more difficult due to the lock-downs introduced in almost all partner states (apart from Sweden). Another obstacle in the implementation of the tasks was the reduction or even abandonment of direct contact between project participants.

Communication was possible only through online platforms (GoToMeeting, Teams, Zoom, Skype), which were used in the 2020–2021 period. These circumstances affected the selection of the research form, method and tools. In the case of Poland, the survey was carried out mainly with the use of the CAWI online questionnaire, which could have influenced the structure of the respondents. Individual partners used qualitative and quantitative methods, with the latter being used less frequently, as presented in Appendix 1. The final discussion at the time of completing this study was hindered by an even greater threat than the pandemic. 24 February will undoubtedly go down in the annals of Europe and the world as it was the day of the beginning of Russia's armed aggression against Ukraine. Fear and real concerns not only about the difficulties in the research process but also life related (relate) to the participation of Belarus in that conflict. This is due to the fact that the vast area of the Białowieża Forest, where the research was conducted, is located within the territory of the state under the influence of the aggressor and makes its territory available as a point of Russia's attack on Ukraine. The war triggered by the Russian Federation called into question the meaning of all scientific and research activities and overshadowed the threat of a pandemic.

3.2. Methodology of the conducted research

Various research methods were used in the conducted research, as mentioned in the previous chapter. The word "method" comes from Greek (*méthodos*) and denotes a way of doing things, it is a term which means "...a course of action, a selection of the type of action through the choice and sequence of elements of a complex action, which is consciously applied along with the possibility of its repetition in all cases of a given type"[326]. A research method is a specific, repetitive course of action consciously directed toward the attainment of a certain goal through the selection of means appropriate for this goal[327]. A method is also defined as a system of rules and assumptions which makes it possible to organise theoretical or practical activities to achieve the assumed goal[328]. Both quantitative and qualitative methods can be used in the social sciences, including in economics and finance, as well as management and quality sciences. In that context, one seeks to discover measurable variables concerning the studied phenomenon[329]. Quantitative methods, which involve studying the attitudes and opinions of a large group of respondents, focus on collecting

[326] *Encyklopedia PWN*, available at: https://encyklopedia.pwn.pl/haslo/metoda;3940107.html, accessed: 20 March 2020.

[327] S. Nowak, *Metodologia badań społecznych*, Wydawnictwo Naukowe PWN, Warszawa 2007, p. 19.

[328] J. Sztumski, *Wstęp do metod i technik badań społecznych*, Wydawnictwo Naukowe „Śląsk", 2nd edition, Warszawa 1984, p. 4.

[329] P. Tarka, *Specyfika i komplementarność badań ilościowych i jakościowych*, „Wiadomości Statystyczne" 2017, no. 3, p. 16–27.

numerical data that are subject to statistical analysis. Opinions and phenomena affecting the greater population can be inferred based on the results obtained in the case of the representative group.

Broadly defined quantitative methods are used to isolate regularities affecting a given phenomenon. Quantitative research, particularly surveys, are typically used to assess the state of a given phenomenon and determine trends (while ensuring repeatability). This method also makes it possible to perform inter-area comparisons. The conducted research relates to economic phenomena and processes, while an economic process is defined as a complex of constantly repeated human activities in the area of an economy, characterised by a certain regularity. This regularity can be decomposed into elements of constantly repeating relationships, called "economic laws" by O. Pawłowski[330] nearly half a century ago. Four types of regularities that can relate to structure, dynamics, time and space relationships can be distinguished in management and quality sciences, as well as economics and finance. The larger the sample size or the number of observations, the more accurately the systematic component[331] is revealed, with the deviations from the systematic component tending to cancel each other out. At this point, it should be noted that the use of quantitative methods depends on the nature of the collected data, and as such, also on the data collection methods. Both primary and secondary material can be used for this purpose. In the case of primary research, the quality of the collected material is of significant importance for the reliability of the results. Quality depends on whether the statistical population to be studied is defined correctly and requires verifying, whether measuring all units of the community is possible, and if performing such a study is feasible and purposeful. Measurement should be understood as assigning numbers to objects according to certain rules in such a way that the numbers reflect the relationships between the objects[332]. From this point of view, research can be divided into exhaustive research – when the population is not too large and all its elements are subject to observation – and partial research – when only some population units are subject to observation.

The identification of regularities within a certain state of affairs based on interviews or observations is possible through qualitative methods. The obtained results exhibit a high source potential and provide transparent information on the subject of the study. A combination of quantitative and qualitative methods, supported by literature review, makes it possible to obtain and interpret comprehensive empirical data.

One of quantitative methods, the diagnostic survey method, was used in the research on the problems and needs in the field of mobility in the area of Hajnówka County. It is considered to be one of the fastest and most accurate measurement methods and does not require engaging large research teams. The basic instrument of this method is a questionnaire, with the use of which the surveyed individual

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[330] O. Pawłowski, *Ekonomia polityczna*, vol. 1, PWE, Warszawa 1978, p. 74.

[331] Compare: E. Dolny, K. Sienkiewicz, *Podstawy statystyki*, Toruńska Szkoła Zarządzania, Toruń 2000, p. 8–9.

[332] Compare: T. Pawłowski, *Metodologiczne zagadnienia humanistyki*, PWN, Warszawa 1969, p. 54.

gives answers to the presented questions. There are two types of questions – scaled or closed-ended and unscaled or open-ended questions, depending on whether they require the respondent to choose from among readily provided answers or enter their own. Closed-ended questions contain predetermined answers, scaled using appropriate instruments. Basic scales include the following types of measurement scales[333]:

- nominal scales;
- ordinal scales;
- interval scales;
- ratio scales.

Both nominal and interval questions were proposed for use in the research. In turn, closed-ended questions include the following:

- multiple-choice answer questions (closed, open and semi-open), where the respondent can choose an answer from several predetermined ones;
- dichotomous questions, in which one of two answers may be chosen.

Both forms of multiple-choice answer questions were used in the conducted research. The obtained empirical material consisting of filled-in questionnaires was subjected to structure and interdependence analyses, with the subsequent interpretation of the results making it possible to answer the research questions.

With regard to qualitative research, the main identification criterion is the type of obtained information. Such research focuses on identifying opinions and attitudes toward market phenomena and processes, as well as the ways of their interpretation. Moreover, it is possible to understand the mechanisms of shaping positive or negative positions towards specific market phenomena. However, the extent to which these positions are typical or marginal in given populations is not resolved. Compared to quantitative research, the greater subjectivity of this research is primarily due to the lack of explicit criteria for analysis. In qualitative research, there are many possibilities of interpreting the results and many, more or less, probable interpretative assumptions, and a significant difference is the possibility to generalise the results obtained in the research[334]. The main disadvantage of qualitative research is primarily the inability to relate the conclusions of the research conducted on a given group of entities to the general population. In a qualitative study, it is impossible to draw conclusions about the intensity or frequency of the observed phenomena while those concerning the significance of these phenomena and relations between them can be generalised. However, the repeatability of observations is a necessary condition for such generalisations. Qualitative data collection methods include: individual and group interviews, projective techniques, observation and experiments with one or more variables. Both individual interview and observation methods were used in research on mobility issues

[333] A.D. Aczel, *Statystyka w zarządzaniu*, Wydawnictwo Naukowe PWN, Warszawa 2000, p. 37.

[334] Differences between qualitative and quantitative research are also described in: M.D. Meyers, *Qualitative Research In Business & Management*, Sage Publications, London 2013, p. 7–9.

carried out in certain partner regions (Appendix 1). The purpose of the first of those methods is to obtain detailed information from individual respondents. There are two forms of individual interviews: in-depth interviews that give respondents complete freedom of expression, as well as focus interviews, which are typically complementary to in-depth ones. On the other hand, observation involves the directed, deliberate, purposeful, and systematic perception of the examined objects and must also be guided by a predetermined plan. It is most often treated as a secondary measurement. It must be noted that in quantitative research observations are used to identify the problem and are mainly applied in the initial stage of the research. For qualitative research, on the other hand, observation is an essential method of identifying the studied phenomenon[335]. Qualitative methods are most often used in research covering new areas, when little is known about the subject of the study, or in order to deepen knowledge about particular cases, or when the research problem is very complex. In such a case, qualitative research can be the starting point for quantitative research, e.g., to identify issues raised in the survey, to formulate questions for the questionnaire – which are generally intended to verify the posed hypotheses and achieve the objectives – or may clarify and complement the quantitative research. Using both research forms, as in the case of the MARA project, leads to a deeper analysis and explanation of mobility problems and a better understanding of the obtained results, which makes it possible to propose appropriate, innovative solutions.

In the course of the research, the project partners used a variety of research methods (Appendix 1). Secondary sources of information were used, i.e., research publications and reports on mobility. It must be noted that some regions were subjected to that type of research for the first time. Those were partners from Finland and Russia. The use of diverse methods makes it difficult or impossible to compare the obtained results. In this monograph, mainly research carried out in Poland is used.

The research on the mobility needs of residents and tourists in Hajnówka County was conducted using the survey method (diagnostic sonar). Two research tools were used: questionnaire F2F (face-to-face) and CAWI (Call Assisted Web Interviewing). In both cases, respondents or interviewers were able to download the survey questionnaire on their mobile devices (smartphone, tablet) by means of scanning the QR code. From the perspective of F2F, the respondent had access to paper version of the questionnaire and were able to provide answers in the questionnaire or to the interviewer who recorded them in an electronic version. Two forms of questionnaire were used in the study, one for the tourists and the other for the residents in the county. The questionnaire for the study of tourists was prepared in two language versions – in Polish and English. The questionnaire consisted of three main parts: a cover letter explaining the main objectives of the research, a series of basic questions and metric questions. The middle section was a set of seven questions that addressed the issue of mobility of the respondents. The obtained information concerned the type of means of transport

[335] F. Mroczko, *Jakościowe metody badań. Obserwacja naukowa*, „Prace Naukowe Wałbrzyskiej Wyższej Szkoły Zarządzania i Przedsiębiorczości" 2014, vol. 1, p. 66.

used by the respondents to reach their destination. In addition, questions were asked about the types of means of transport used by the respondents to move around the region where they spend their free time, there were multiple options to choose from (car, bicycle, bus, scooter, train, taxi, motorcycle), with an indication of the frequency of use (from "very rarely" to "never") and the duration of the journey (less than half an hour, half an hour to one hour, more than an hour). Moreover, the level of satisfaction with individual elements of the local transport system was assessed. Tourists also assessed the need to introduce changes in terms of various aspects related to the functioning of transport, having 19 areas of possible changes to choose from (multiple choice), with the possibility of assessing the changes on a 5-point scale (from definitely necessary to definitely unnecessary). The most important question concerned the identification of innovative transport solutions that would increase the frequency of movement of the respondents in the region. Each of the nine proposed solutions had to be assessed on a 5-point scale (from "does not affect" to "affects to a very high degree", taking into account the "zero" option – "hard to say"). All questions, except the first one, were semi-open multiple-choice answer questions, giving the respondents the opportunity to make their own assessment/express their opinions. There were eight metric questions characterising the respondents, thanks to which information was obtained about their gender, age, place of residence, status on the labour market, education, place of permanent residence and place of residence during the stay in Hajnówka County, as well as the form of tourism and the nature of the current trip (alone, with family, friends or on business). The obtained results were entered by the interviewers into an electronic version of the survey.

The survey questionnaire for the inhabitants of the county was similar to the questionnaire for the tourists. Such an approach made it possible to compare the opinions of the two "layers" (groups of respondents). The same number of core questions was maintained. As in the case presented above, the first question in the survey addressed to the residents concerned the frequency of use of different means of transport, both private (private car, bicycle, scooter, motorbike, taxi) and public (train, bus). The further analysis concerned the amount of time spent while travelling by individual forms of transport, depending on the time required to cover a given distance. As in the case of tourists, the surveyed residents were offered three options: up to half an hour, from half an hour to one hour and over an hour. The next issue under consideration concerned the purpose of the movement of residents using particular means of transport. The respondents were asked to indicate the most frequently used mode of transport when going shopping, visiting the doctor, going to the bank, post office or other offices, visiting a place of worship, commuting to the workplace, and visiting family or meeting friends. For each of the destination points, the respondents had to indicate the most frequently used means of transport, a list of which was presented in the description of the previous question. The next issue referred to in the questionnaire was the assessment of the condition of infrastructure in the county under study. The respondents of the two groups provided information on their level of satisfaction with the proposed aspects of the local transport system, as follows: transport

improvements for disabled, travel safety, availability of information on public transport, cost of public transport, frequency of public transport, access to public transport, and technical condition of transport infrastructure. The assessment was made using a 5-point scale, from "very pleased" to "very unhappy". In the next section of the survey, the inhabitants of the county indicated their needs related to mobility, assessed the necessity to introduce changes in the proposed aspects related to the functioning of transport in the region where they lived. It was possible to select multiple options out of 19 proposals, with the possibility of presenting their own ideas. Among the presented options, there were proposals for improving: the technical condition of buses and bus stops, travel safety, the technical condition of roads, bus punctuality, the technical condition of railway stations and rolling stocks. The respondents had the possibility to indicate certain areas taking into account increasing the number of bus stops and railway stations, the frequency of buses and trains, the availability of information about bus communication, facilities for the disabled and the number of bicycle paths, as well as the reduction of the prices of bus and train tickets. The main question for both groups of respondents concerned the identification of optimal innovative solutions that would increase the frequency of their movement around the region. In this case, semi-open multiple-choice answer questions were also used, giving the respondents the opportunity to add their own ideas to the proposed list of nine options:

- a municipal/county bike system with a mobile application;
- e-car system with mobile application and infrastructure (base stations, charging modules);
- e-bike / scooter system with mobile application and infrastructure (base stations, bicycle paths);
- a mobile application that allows to search for transport in a ridesharing system;
- a mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-scooters, e-cars, etc. with buses and trains);
- a mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-cars, etc. with buses and trains) integrated with the internet payment system;
- "bus-on-request" service with a call center;
- integration of transport systems (one common ticket for all means of transport);
- a system of guaranteed connections between individual means of transport (e.g. the possibility of one vehicle waiting for another one which is late).

The metric questions for the residents concerned basic data and it was similar to the one for tourists, except for the details related to the means of transport used to travel to the county and information related to tourism.

Selecting the research sample is a vital part of any study. Statistical literature describes many sample selection methods but, generally, two categories can be distinguished, i.e. non-sampling methods, based on arbitrary rules (convenience, purposive, quota) and sampling methods, based on the calculus of probability (simple

random sample, systematic, stratified, cluster, multistage, multi-phase)[336]. The selection is made based on the specific characteristics of the studied subjects, which are necessary to understand the research problem. The sample should be representative of the whole (in terms of maintaining the relevant properties and regularity). The most important factors affecting the accuracy of the representative method are the structure of the population, the sampling scheme and the sample size. It is possible to set a minimum sample size based on certain parameters (including the quality of research results). Those parameters are:

- estimated fraction size, which is the percentage of units that exhibit a particular characteristic;
- assumed maximum error;
- significance level, which is interpreted as the probability of making an assumed maximum error of a given value;
- size of the general population (for a finite population).

The minimum sample size is determined differently depending on whether a finite or infinite population is being studied. As part of the research two populations were studied – a finite, albeit relatively large one (the residents) and an infinite one (tourists). Thus, both sample size calculation formulas, presented below, are applicable. The number of samples should be assigned in accordance with the following formulas (formula 1 and formula 2). For a finite population, the minimum sample size formula is as follows[337]:

$$N_{\min} = \frac{P(1-P)}{\frac{e^2}{z^2} + \frac{P(1-P)}{N}},$$

Formula 1.

For an infinite population, the formula is as follows:

$$N_{\min} = \frac{z^2 P(1-P)}{e^2},$$

Formula 2.

Symbols for both formulas:

P – estimated fraction size – infinite fraction size,

z – a value resulting from the assumed level of significance (α), calculated using the normal distribution function,

N – size of the general population (for a finite population),

e – assumed maximum error.

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[336] S. Mynarski, *Praktyczne metody analizy danych rynkowych i marketingowych*, Kantor Wydawniczy Zakamycze, Kraków 2000; idem, *Badania rynkowe w warunkach konkurencji*, Forga, Kraków 1995; P. Kisiel, *Społeczne aspekty badań marketingowych*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 2000, p. 43.

[337] *Kalkulator doboru próby*, available at: https://www.statystyka.az.pl/dobor/kalkulator-wielkosci-proby.php, accessed: 5 March 2019.

In the empirical study, the following assumptions were made for the infinite population – if the researcher is unable to estimate the size of the P fraction, its value should be set to 50% by default. Based on the above, the following assumptions were made:

- estimated fraction size P = 50%;
- significance level z = 5% (0.05);
- permissible error e = 5% (0.05).

The sample size calculator makes it possible to determine the minimum sample size and the obtained result should be a natural number; therefore, the size of the representative sample was calculated using the research sample calculator. Sample size calculations for infinite populations (in this case – tourists) are used in quantitative research and are widely applied in statistical research[338]. To calculate the minimum research sample size representative of tourists, the formula for an infinite (unspecified) population was applied with the following parameters:

- confidence level: 0.95,
- population size: undetermined,
- expected fraction size: 0.5,
- maximum error: 0.05.

Accordingly, similar assumptions as in the case of calculating the number of tourists were made when calculating the size of the sample representative of the residents of Hajnówka County; the data was only supplemented with the population size (N), which was 43,745 at the end of the year. It was determined that the minimum sample size for the infinite population (tourists) was 385 units, while for the finite population (residents) it was 381 units.

In the survey stage and in the course of the analysis of the results, the prioritisation was based on the indications of the respondents. The indicator differentiating the level of the impact of individual factors was the number of responses (on a specific scale) to a given factor. In this way, the structure indices and the weight of individual factors were calculated. In this case, a structure indicator means the number of statistical units characterised by the nth variant of a given characteristic in relation to the number of all statistical units included in the survey and shows the share of statistical units having the nth variant of the characteristic in the whole surveyed population; it is typically presented in the form of a percentage share. When assessing the needs and proposed innovative mobility solutions, structure indicators presented in the form of a percentage share were used, based on which the factors were prioritised, starting from grade 1, denoting the lowest position in the hierarchy, to the highest grade (5). Using the results of the surveys presenting the state of the studied

[338] Based on: https://www.statystyka.az.pl/dobor/kalkulator-wielkosci-proby.php, accessed: 18 November 2020.

phenomenon based on the opinion of the residents of Hajnówka County and the tourists visiting the region, the following rankings were made:

- ranking of factors impeding or limiting mobility in the region;
- ranking of factors conducive to the improvement of mobility in the region;
- ranking of preferred innovative mobility solutions.

Using the above tools for research purposes made it possible to discuss the issue in question in a comprehensive manner, as well as enabled its thorough and reliable assessment in terms of indicating the most important mobility needs, issues and optimal solutions for the selected peripheral regions.

The questionnaires addressed to both respondent groups had the same structure and subject matter. They consisted of several basic questions relating to the used means of transport, the needs and problems in the field of mobility, as well as the assessment and proposal of innovative solutions.

3.3. Description of the research area

The study area is located in north-eastern Poland, in the Podlaskie Voivodeship, bordering Belarus, and is characterised by great natural values. Hajnówka County, selected for the research, covers rural areas near the Białowieża Forest, designated by UNESCO as a World Heritage Site. It is one of the key regions considered as the green lungs of Poland, consisting of the remnants of several primeval forests. Many species of plants and animals present in the Białowieża Forest can be found only in few places worldwide. Białowieża Forest is a habitat of the largest free-living population of European bison in the world[339].

Therefore, the local transport and tourist transport are characterised by the dispersion of transit routes and a need for careful environmental protection. The area comprises rural areas where means of transport are not sufficiently developed however, the demand for moving around these specially protected areas is significant. Therefore, transport should be organised in such a way that the impact on the environment is minimal but the demand for transport services is satisfied. The border location of Hajnówka and Białowieża means that the county is removed from transit routes connecting the main centres of the country. The basic transport infrastructure of the county comprises National Road No. 66, which transits through the area of the county connecting the National Road No. 19, which is a primary

[339] *Report on the state of Hajnówka County for 2018*, Hajnówka County bulletin of public information, http://bip.st.hajnowka.wrotapodlasia.pl/raport_o_stanie_powiatu/raport_o_stanie_powiatu_za_2018_r/, accessed: 20 August 2020; *Report on the state of Hajnówka County for 2020*, Hajnówka County bulletin of public information, http://bip.st.hajnowka.wrotapodlasia.pl/raport_o_stanie_powiatu/raport_o_stanie_powiatu_hajnowskiego_za_2020_rok/, accessed: 13 June 2021.

national road for Eastern Poland, with the road border crossing with Belarus (Połowce––Pieszczatka) and four voivodeship roads (No. 685, 687, 693 and 689) with a total length of 131 km. The road network also comprises county roads (510 km) and municipal roads (427 km)[340]. The construction of the voivodeship road No. 685 connecting Hajnówka with Białystok is carried out by the Podlaskie Voivodeship self-government. The investment is co-financed from EU funds under the Regional Operational Program of the Podlaskie Voivodeship.

The implementation of road infrastructure is regulated by the following basic legal acts:

- Act on Public Roads – Dz. U. /Journal of Laws/ of 2020, item 470,
- Act on Financing Land Transport Infrastructure – Dz. U./Journal of Laws/of 2005, No. 267, item 2251.

The Hajnówka region shows a low percentage of the density of county and municipal roads. The length of hardened surfaces is 39.5 km per 1 km^2. This is much less compared to analogous indices for Podlaskie Voivodeship (65.1 km per 1 km^2) and all of Poland (94.1 km per 1 km^2). The low road density in the region of Hajnówka results mainly from the large area of forests (50.6%) and low population density, which is 27 people per 1 km^2 compared to 124 people per 1 km^2 in Poland[341]. Under these conditions, the management of public transport is quite a challenge, especially since the county is inhabited by approx. 150,000 inhabitants in 244 localities.

The transport infrastructure is supplemented by the following railway lines: No. 31 Hajnówka–Siedlce; No. 31, modernised on the section of the voivodeship border – Czeremcha–Hajnówka; No. 52, modernised on Hajnówka–Lewki section; No. 59, modernised on the state border–Chryzanów section. The nearest airport is in Warsaw, i.e. approximately 220 km from Hajnówka. The international coach station is located in Białystok (80 km). Connections are made to the Baltic States (Lithuania, Latvia, Estonia) and Western Europe (Germany, France, the Netherlands).

Currently[342], 4 road transport companies (including 3 private ones) provide transport services in the county. Two of them provide connections with the voivodship city, the other two provide mainly local connections. However, there are large disparities in the frequency of buses on particular routes. Most bus connections are provided on working days, or only on school days. Such an organisation of services means that part of the town is deprived of public transport not only on weekends but even on the remaining days during the school year. There are even localities where public transport is not provided at all. This is the most significant shortage of public road transport in the county.

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[340] *Report on the state of Hajnówka County for 2018...*; *Report on the state of Hajnówka County for 2020...*

[341] Statistics Poland, 2019, https://stat.gov.pl/en/databases/, accessed: 10 September 2020; Local Data Bank of Podlaskie Voivodeship, Hajnówka County: https://bdl.stat.gov.pl/, accessed: 13 June 2021.

[342] In 2022.

Bicycle paths are an alternative to motorised transport. They connect the commune seats and lead to places attractive for tourists. In Hajnówka County, there are 14 bicycle paths with a length of over 500 km. Four of them have a loop route, one, 58 km long, runs in Poland and Belarus and is used as a border crossing for pedestrians and cyclists in Białowieża.

The potential of bicycle touring will be increased by the ongoing reconstruction of voivodeship road No. 685, connecting Hajnówka (the capital of Hajnówka County) with Białystok (the capital of Podlaskie Voivodeship). The investment involves the construction of a bicycle paths running parallel to the road lane. Construction works on the bicycle path on the Hajnówka–Białowieża route are also underway. Currently, bicycle paths are used mainly for tourist purposes, but they can also be adapted for everyday use by residents.

The document of a supralocal nature is the Economic and Protection Programme for the Promotional Forest Complex "Puszcza Białowieska" in the years 2012–2021. This program assumes[343]:

a) creating a coherent network of cycling, walking, water and horse routes;
b) construction of tourist infrastructure (car parks, bicycle racks, etc.);
c) increasing transport accessibility of the region by synchronising public transport (road and rail).

In addition, each municipality has a Local Development Strategy, one of the important tasks of which is to improve transport accessibility.

The brief description of the region shows that it fully fits into the concept of a peripheral region. This is due to the low population level, poor accessibility and remoteness from the cultural and economic centre of the city of Białystok. The nature and described transport structure of the region show that mobility is a major problem both within the region and with the centres outside it.

3.4. Characteristics of the research samples – residents of Hajnówka County and tourists visiting the Białowieża National Park

Two groups of respondents were surveyed; that is, the residents of the region and tourists who visited the area in the period from 2019 to 2021. The main tourist attraction is the Białowieża National Park, therefore the research on tourism was carried out in that area. Extensive comparative research was hindered by the SARS-CoV-2 pandemic, which forced the introduction of significant restrictions on movement.

[343] *Leśny kompleks promocyjny „Puszcza Białowieska"*, Regional Directorate of State Forests in Białystok, https://www.bialystok.lasy.gov.pl/lesny-kompleks-promocyjny-puszcza-bialowieska-#.YMYQf6gzY2w, accessed: 13 June 2021.

The widespread availability of COVID-19 vaccination in 2021 allowed for a partial "unfreezing" of tourism, which turned out to be one of the most affected by the pandemic branches of the economy, and made it possible to complete the research.

Two groups of respondents were successfully recruited for the study, which, using the calculator for a research sample representative of a population of unknown or significant size (with the assumptions presented in the previous section), consisted of 385 units and 381 units for a known population. The size of the research sample representing tourists was 421 people, while in the case of the residents – it was 384 people; thus the condition of representativeness was met as both groups of respondents exceed the minimum sample size. While making comparative characteristics between the two groups, questions were asked about such variables as gender, age, education, employment status and place of residence.

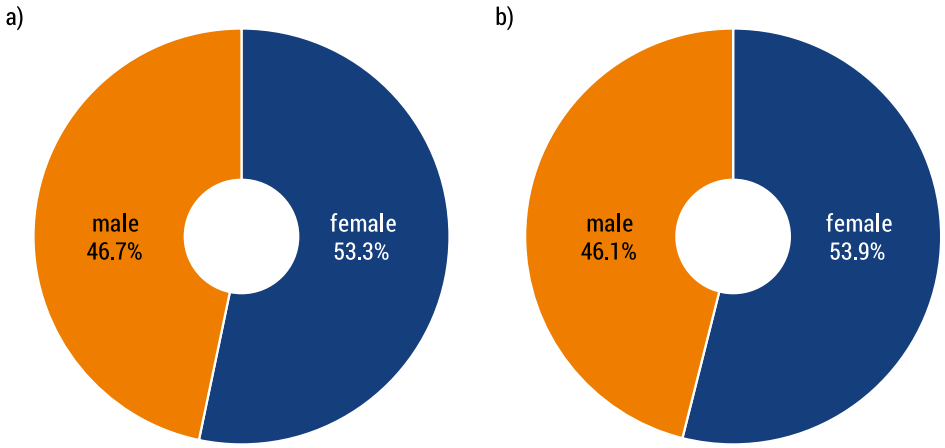

FIGURE 3.2. Structure of respondents in terms of declared gender: a) residents; b) tourists

SOURCE: Own elaboration based on empirical research

Comparing the structure of both groups of respondents, it can be noticed that a slight majority constitute women, in both cases. In the group of residents, it is 53.3%, while among tourists it is 53.9%, which generally (the difference is within the limits of the statistical error, less than 5%, and the difference between the structure of respondents and the actual structure of residents is about 1.5%) coincides with the overall gender structure of the county, which was inhabited by 21,963 women and 20,647 men in 2019[344].

When comparing the age of respondents, the researchers tried to reflect the structure of the region's inhabitants, taking into account the representativeness of particular age groups; however, due to limitations in the research with the participation

[344] Report *Statystyczne Vademecum Samorządowca 2020*, Hajnówka County, Statistical Office in Białystok, 2020, PDF document available at: https://bialystok.stat.gov.pl/vademecum/vademecum_podlaskie/portrety_powiatow/powiat_hajnowski.pdf, accessed: 28 September 2022.

of children and young people up to 15 years of age, this group is poorly represented. This choice was made deliberately due to the fact that children are unable to travel on their own, hence it was considered that mainly the answers given by adults would be significant. Based on the available statistical data, in 2019, the number of persons of non-working age[345] per 100 persons of working age was 75.5, and it is a downward trend compared to the previous two years (2017 and 2018). This group includes both minors and people over 60 years of age. In the case of tourists, it was not possible to refer to previous studies in terms of age; therefore, the representativeness was established by selecting respondents in the most attractive places in the region, that is in the Białowieża Forest and its closest surroundings – on the Polish side of the border.

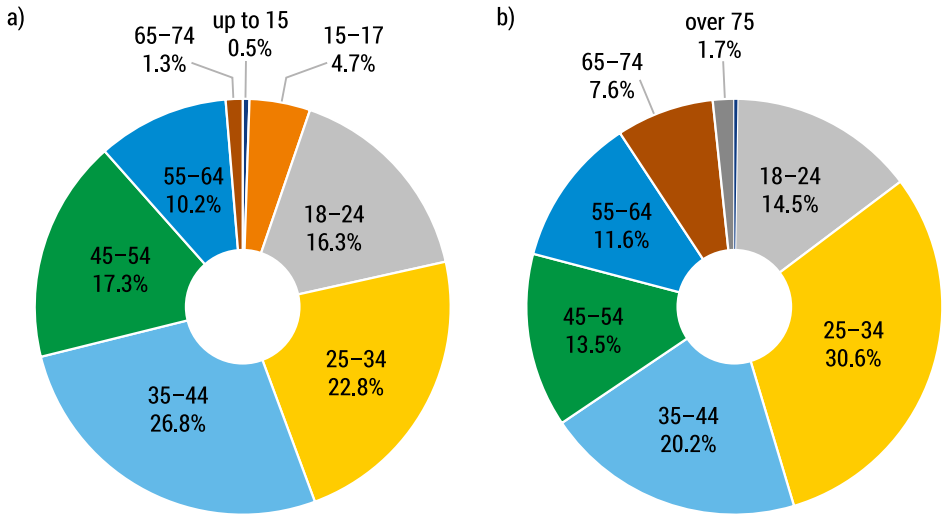

FIGURE 3.3. Age structure of respondents: a) residents; b) tourists

SOURCE: Own elaboration based on empirical research

Comparing the age of both groups of respondents, it should be noted that the majority are young people, i.e. under 35 years old, and they constitute almost 40% of the residents and more than 45% of the tourists, with the largest group in both cases being persons between 25 and 34 years old. It should be mentioned that the age structure of the respondents, the residents, may be slightly disturbed due to the coronavirus pandemic, as a different research tool had to be used for the study. The result is the low representativeness of seniors, and the number of surveyed senior residents

[345] According to Statistics Poland, "the non-working age consists of the pre-working age, when the population has not yet reached the ability to work, i.e. the age group 0–17 years old, and the post-working age – when people usually end their professional career, i.e. men at the age of 65 or more and women – 60 years old or more". The definition available at: https://stat.gov.pl/metainformacje/slownik-pojec/pojecia-stosowane-w-statystyce-publicznej/3946,pojecie.html, accessed: 28 September 2022.

was almost two times lower than the number of senior tourists. This inaccuracy is due to the inaccessibility of that group of residents, as they often remain inactive in the virtual space.

Another addressed topic was the level of education. The respondents had different levels of education, from primary through secondary to higher education, as shown in Figure 3.4.

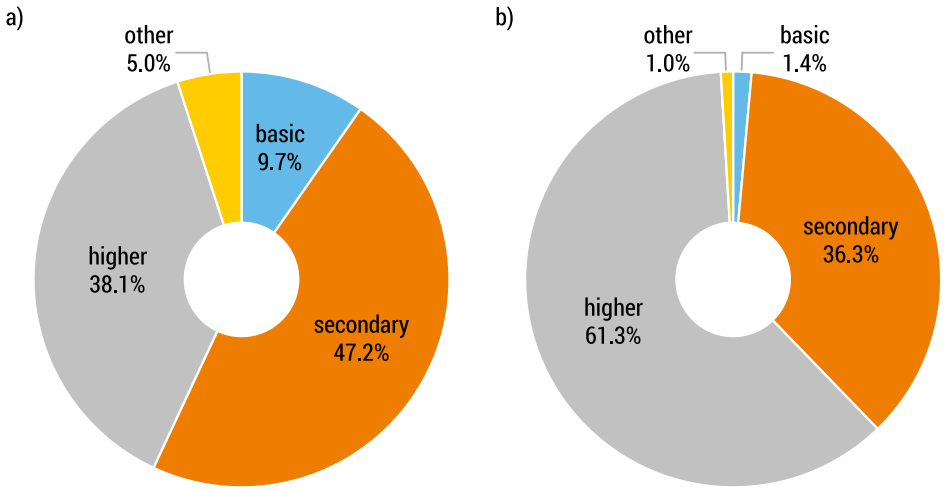

FIGURE 3.4. Declared level of education of the respondents: a) residents, b) tourists

SOURCE: Own elaboration based on empirical studies

Comparing the results, it should be stated that the level of education of the tourists was higher than the average level of education of the residents. Such a result is not surprising, although the observed differences are not that significant, which may also be the consequence of changing the research tool to study the group of the residents (from PAPI to CAWI). The greatest discrepancies are noticed in the case of persons with primary education, as the number of tourists with that level of education was almost seven times lower than the number of the residents. Significant differences were also noticed when comparing the number of respondents with higher education. There were more than 61% of such persons in the tourist group and a little over 38% among the residents. A slightly more numerous group of residents had secondary education, compared to tourists, and the difference amounted to approximately 10 percentage points. However, it is difficult to state what kind of education is considered as "other", where there are also some discrepancies, as 1% of tourists indicated such a level of education, while in the case of the residents the item "other" (no education?) was indicated by 5% of the respondents.

An important area for the characteristics of the research samples was to determine the status of the respondents (Figure 3.5).

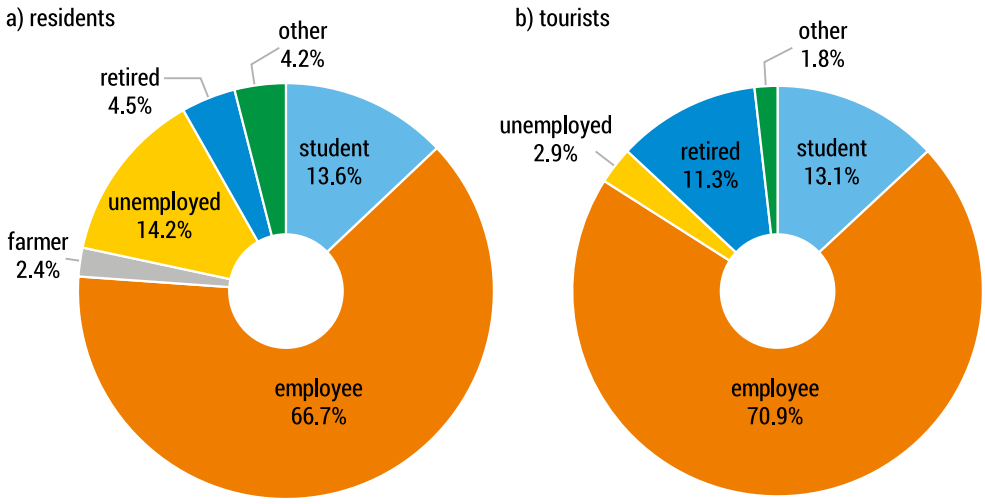

FIGURE 3.5. Status on the labour market

SOURCE: Own elaboration based on empirical studies

In both respondent groups, the largest number of the respondents are employed persons, as this group includes almost 67% and almost 71% of residents and tourists, respectively. The biggest difference concerns unemployed persons, as in the group of tourists they constituted less than 3%, and more than 14% in the group of residents, at the same time, an additional survey should be conducted among the respondents who declare retirement.

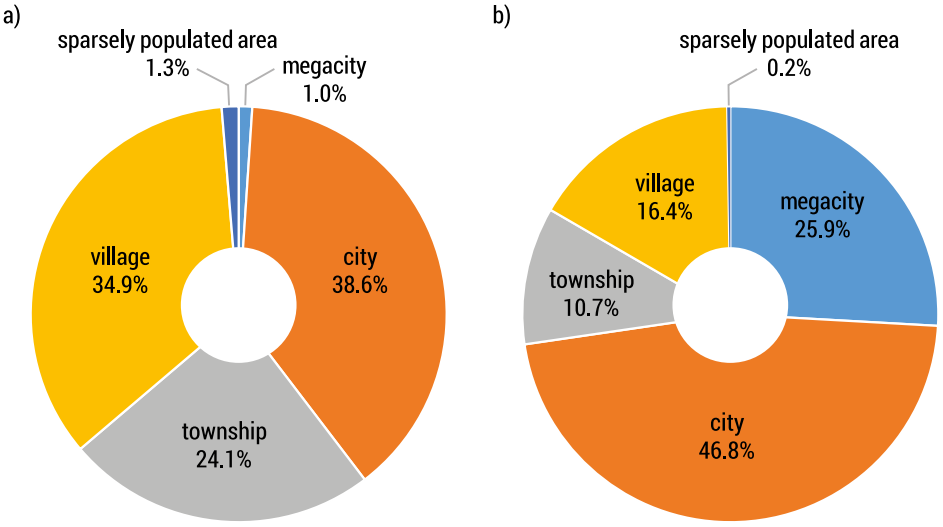

FIGURE 3.6. Place of permanent residence of a) residents, b) tourists

SOURCE: Own elaboration based on empirical studies

Figure 3.6 shows the structure of surveyed residents and tourists by their place of permanent residence. Tourists residing in large cities and big towns are the most numerous group (more than 70%), while most of the residents come from small towns (38.6%). The representation of rural areas was also relatively high, as more than 16% of tourists and almost 35% of residents indicated rural areas. Township was indicated by over 10% of tourists and over 24% of residents.

When making a summary comparison between the residents of Hajnówka County and tourists who visited the region in 2019–2021, differences in education level and employment status can be noticed, as the vast majority of tourists have a university education and belong to the economically active group.

4. Research on the mobility problems and needs of the citizens and tourists – the case of Hajnówka County

This part of the book presents the results of empirical research, which was carried out using the research methodology described above. The leading subject of consideration are mobility problems faced by the inhabitants of the Hajnówka District and tourists visiting this region. An attempt was made to find innovative solutions to reduce mobility constraints.

The research covered a relatively broad spectrum of mobility issues. First, the respondents indicated the means of transport they use and the frequency of their use. The next area of research was the needs of the respondents in the field of mobility, and the last issue – considerations regarding the recommended solutions to the indicated problems, including innovation. The results were presented in a form of dichotomous division of the respondents – into two layers, taking into account, first, the opinions of residents, and second – the opinion of tourists. The culmination of the presented research is the comparison of the results obtained from both groups of respondents.

4.1. Results of the survey, conducted among the residents, on mobility problems and proposed solutions in Hajnówka County

Firstly, the respondents were asked to indicate the frequency with which they used the listed means of transport. The responses of the residents to that question are presented in Figure 4.1.

Analysing the data presented in the figure, it can be noticed that most of the respondents move around daily or several times a week – they either walk (72.6% of respondents) or travel by car (79.6%). Only 5.6% of the respondents do not use the suggested modes of transport. In turn, 27.3% of the surveyed residents use a bicycle as a daily or at least frequent (several times a week) means of transport. Once or several times a month, a bicycle is a means of transport for 33.8% of respondents.

The others (38.9% of the respondents) do not travel by bicycle at all or do it very rarely (less frequently than once a month). Another means of transport used by the residents is a bus. 15.4% of the respondents travel by bus every day or frequently (several times a week), 20.4% rarely choose this means of transport (once or several times a month), while the others, i.e. 64.3%, travel by bus occasionally or do not use it at all. Other modes of transport are used much less often. The vast majority of the residents do not travel by scooters (94.8%), motorcycles (90.3%), taxi (83%) and trains (67.3%) or use those means of transport only occasionally (3.7%, 3.7%, 12.5% and 23.2%, respectively).

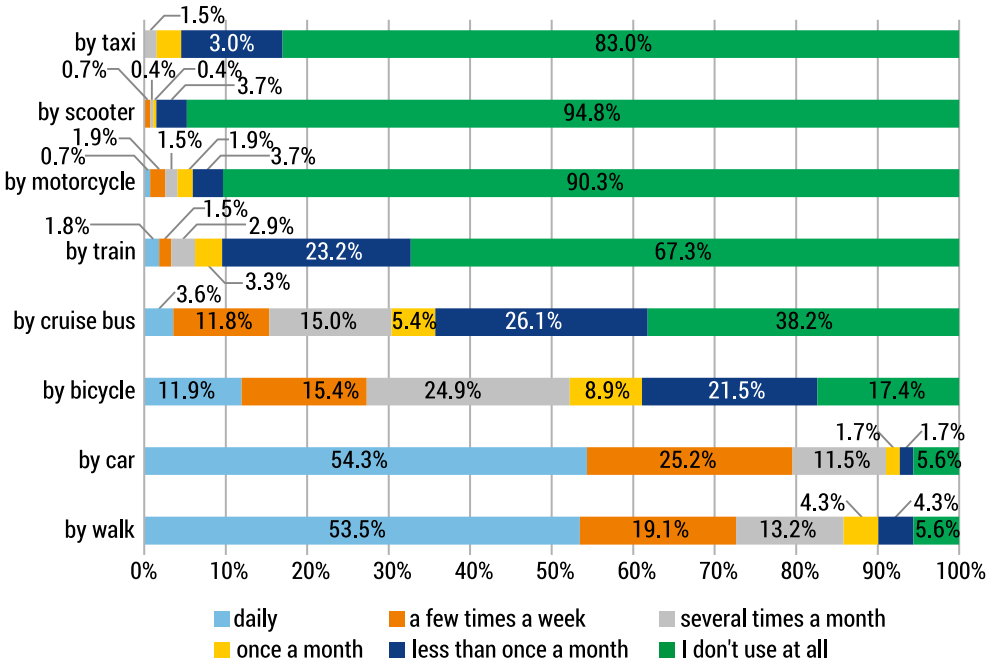

FIGURE 4.1. Modes of transport used by the residents of the region

SOURCE: Own elaboration based on empirical studies

In conclusion, it should be stated that the inhabitants mainly walk or travel by car, they rarely use a bicycle, bus or train, whereas a scooter, motorcycle or taxi are used only in exceptional circumstances.

Another analysis concerned the amount of time spent while using the various means of transport. The results are presented in Figure 4.2.

Analysing the results presented in Figure 4.2, it can be concluded that most of the surveyed residents travel by car. Walking was often mentioned by the respondents, however mainly when short-distance travel was involved. Other means of transport are used much less frequently, although respondents mentioned cycling for short-distance travel. Residents of Hajnówka County have the greatest accessibility to local urban transport. This is due to the concentration of institutional infrastructure and economic activity of the residents in the county city (in Hajnówka). The most

important public institutions are located there and the area is inhabited by 44% of the county population. The local public transport is also used by residents of a town located in the immediate vicinity of Hajnówka (Dubiny village). This solution (local public transport) is of vital importance in the daily mobility of residents. Connections with other towns, mainly with the voivodship town, but also with County villages, are provided by four transport companies concerning roadway traffic. Railway roads are significantly less important. The analysis of the location of bicycle paths in the area indicates that their importance is currently perceived, first and foremost, through the prism of their tourist use. Most of the residents of the county use the road infrastructure when travelling by bike.

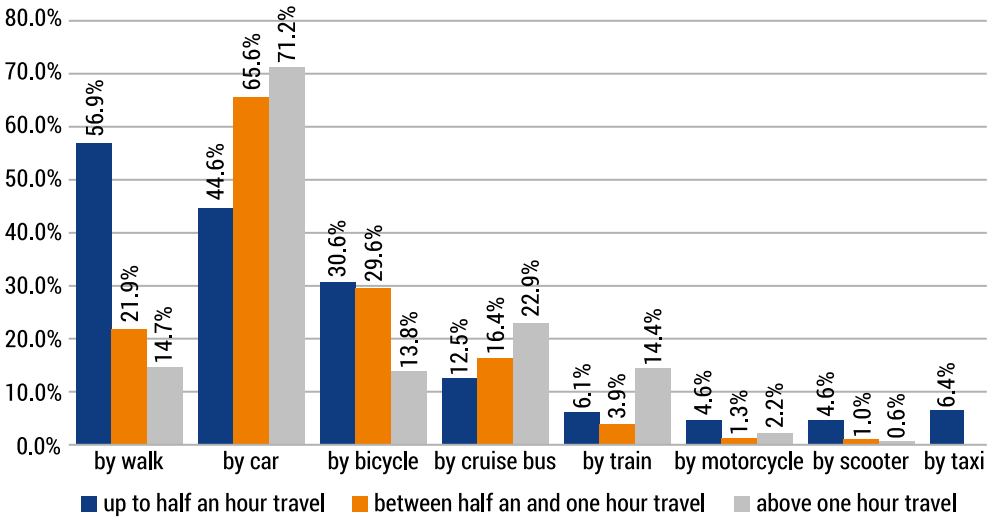

FIGURE 4.2. The means of transport used by inhabitants when traveling around the region, depending on the time of travel

SOURCE: Own elaboration based on empirical studies

The next analysed issue was the use of different modes of transport depending on the purpose of travel of the inhabitants of the region. The suggested purposes included the most important directions of society's movement, such as a shop, workplace, post office, bank, health centre, visiting family and friends, religious worship facilities. The obtained results are shown in Figure 4.3.

With regard to the modes of transport used for reaching any of the suggested destinations, cars are the most frequently selected option, followed by walking. Bicycles and buses were a much less frequent choice. Due to the fact that the respondents could indicate more than one mode of transport for reaching a particular destination, the scope of the use of the selected means of transport can be noticed. Interestingly enough, as far as shopping is concerned, residents use their cars equally often as they travel on foot. The use of other suggested modes of transport is marginal.

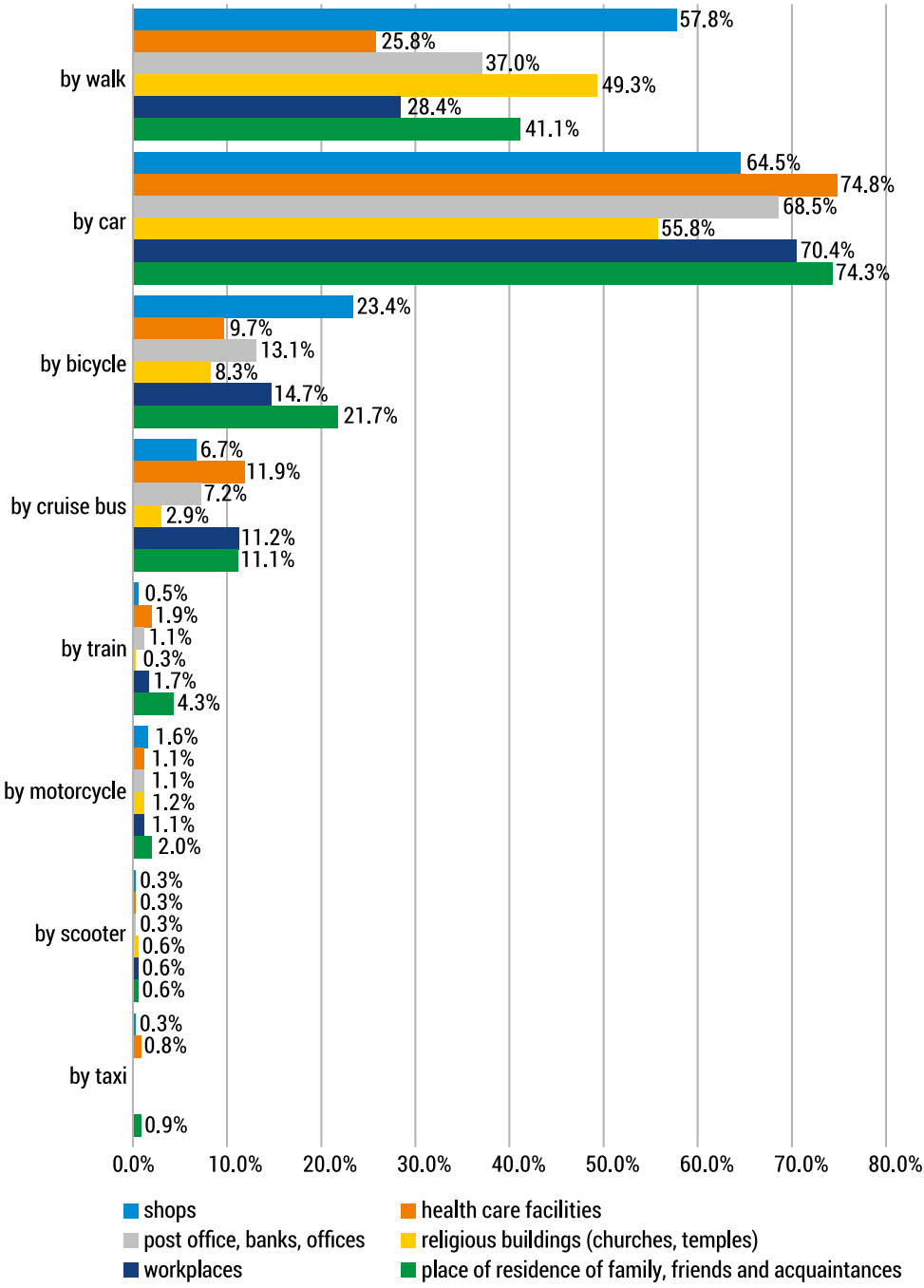

FIGURE 4.3. Means of transport used by inhabitants when travelling to specific places

SOURCE: Own elaboration based on empirical studies

The respondents also assessed the condition of public transport infrastructure in the county under study. They could assess seven areas of public transport, that is: suitability for the disabled, safety, availability of information, fares, frequency, availability of infrastructure and technical condition. The respondents could also choose one of five suggested ratings, with two negative and two positive ratings, with different strengths, and one neutral; the results are presented in Figure 4.4.

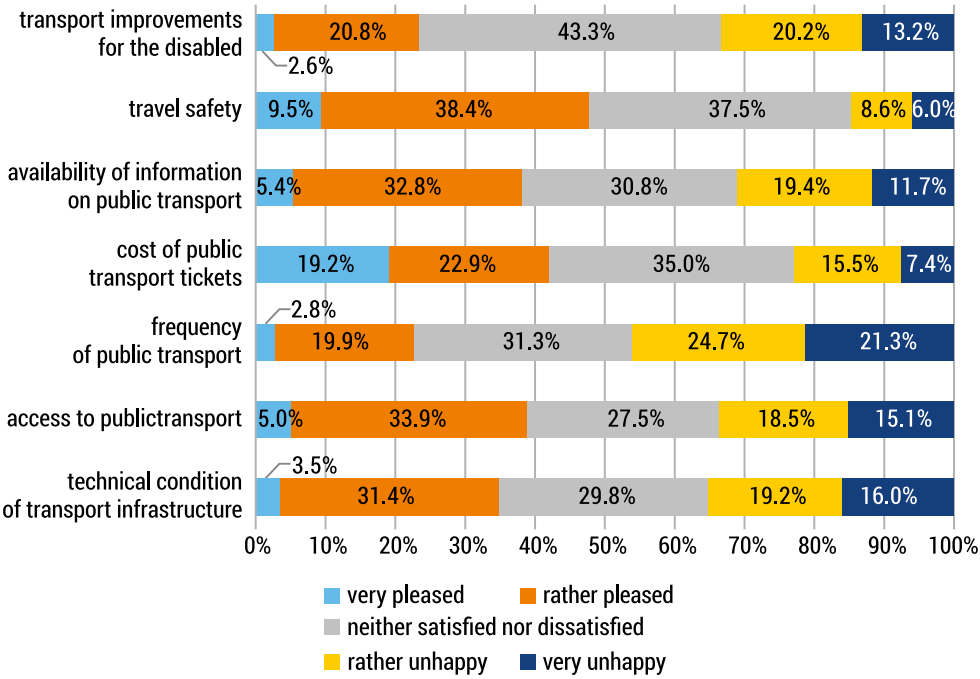

FIGURE 4.4. Level of satisfaction of the residents with the local transport system

SOURCE: Own elaboration based on empirical studies

The opinions of the residents of Hajnówka County about public transport infrastructure are very different. A significant portion of the respondents were unable to decide whether to assign a positive or negative rating to those services. However, it should be pointed out that almost half of the respondents feel very safe or quite safe while using the means of transport. As far as the remaining options are concerned, the opinions are not so clear, with the lowest level of satisfaction with the frequency of public transport.

One of the main challenges was to determine the mobility needs of the residents (Figure 4.5). The survey included a variety of suggestions to help formulate those needs and indicate optimal solutions. In this case, a five-item scale was used with a neutral value in the middle.

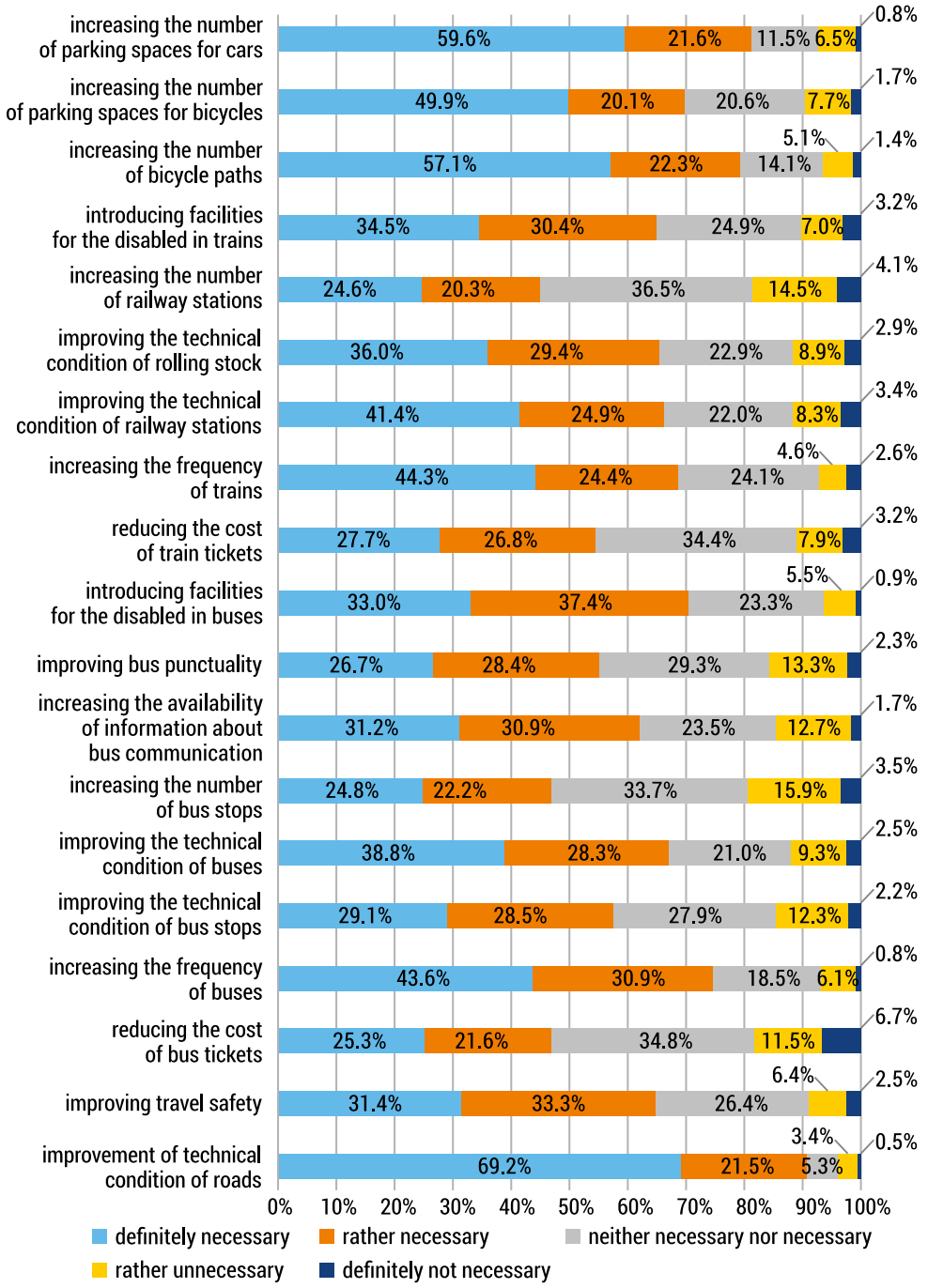

FIGURE 4.5. Inhabitants needs to introduce changes in the following aspects related to the functioning of transport in the region (transport mobility needs)

SOURCE: Own elaboration based on empirical studies.

The results presented in Figure 4.5 show the level of needs of the local community when it comes to the improvement of transport infrastructure. The respondents indicated that all means of transport and the infrastructure should be improved. The greatest problem and, at the same time, the area that needs to be improved, is the technical condition of the roads, as indicated by more than 90% of the respondents. What should be noted at this point is that this study was conducted during the performance of repair works on the main access road to Białystok – the capital of the region – and the related traffic obstruction was very inconvenient for the residents. The absence of parking spaces for passenger cars is slightly less noticeable, and it was indicated by more than 80% of the residents, and a slightly smaller number of them pointed to the absence of adequate cycling routes and spaces to leave a bicycle. The residents also indicated that the issue of the use of buses and trains by the disabled is neglected. It is important to note that relatively few respondents are satisfied with the transport infrastructure in the region, even though, in many cases, the share of respondents whose opinion is neither clearly critical nor clearly positive can be noticed.

The purpose of the study was to diagnose mobility problems and indicate innovative mobility solutions in Hajnówka County. Examples of these solutions, presented to the respondents, were developed based on the literature and solutions implemented in other regions with similar peripheral conditions. The respondents could indicate one of nine suggested innovations by assigning one of four ratings to it or by selecting a "neutral" answer or "hard to say" option.

The proposals of improvements and innovations presented in Figure 4.6. were assessed as positive. It can be noticed that the differences in ratings are not very significant; nonetheless, what comes to the fore is the need to introduce an innovation in the form of a combined ticket for different modes of transport and, above all, integrate means of transport (38%) to enable the use of different services based on a single ticket (35%) and synchronise their timetables. This change requires the cooperation of all interested parties, especially public and private transport companies providing transport services in the region and in communication with the neighbouring regions. The authorities of the county have committed to combining the services of individual groups of interested parties and there is hope that the plan will be implemented successfully. The third solution (31%) indicated by the residents as the best one is an application for travel planning and integrating various means of transport available in the country (e.g. e-bike system, e-car, etc.).

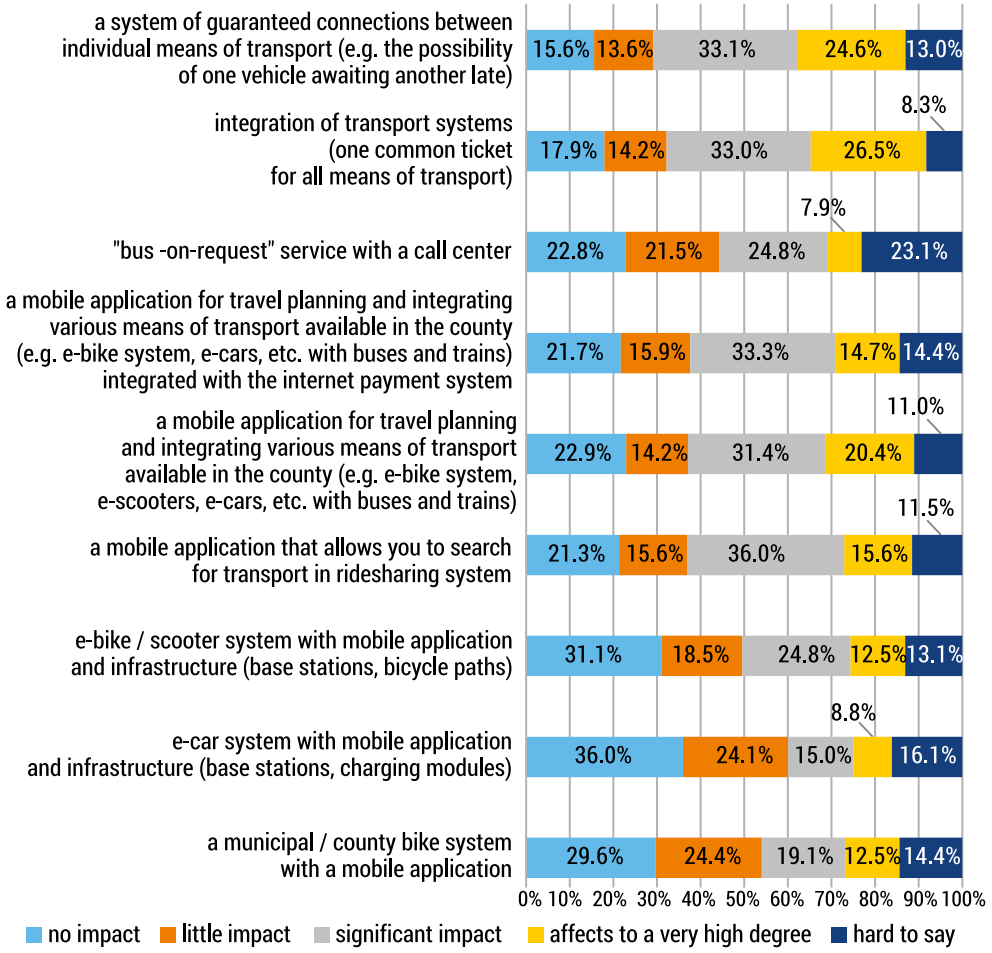

FIGURE 4.6. Innovative solutions increasing the frequency of movement of the residents around the region

SOURCE: Own elaboration based on empirical studies.

The obtained results should be compared with the opinions of tourists because the natural assets of the region allow for the development of one of the few forms of activity in this peripheral area, which is tourism.

4.2. The results of the survey, conducted among tourists, on mobility problems and proposed solutions in Hajnówka County

Mobility problems faced by the periphery affect not only residents but also tourists. The problems indicated by this group of respondents do not necessarily coincide with those reported by residents. Therefore, the basis for the comparison is collecting the opinions of tourists, which is presented in this chapter.

Another group of respondents, consisting of tourists travelling to Hajnówka County, was mainly interested in visiting the Białowieża Forest, which is the main attraction in the region and the world-class tourist destination. They were asked questions similar to those answered by the residents. The researchers asked about the mode of transport used by the respondents to reach the tourist destination and to travel around the region. The obtained answers are presented in two figures (4.7. and 4.8).

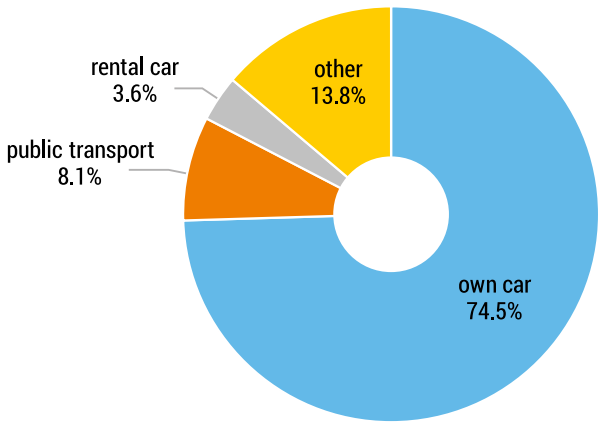

FIGURE 4.7. Mode of transport used by tourists to get to the region

SOURCE: Own elaboration based on empirical studies.

Comparing both figures, (4.7 and 4.8), it can be noticed that the means of transport used to arrive at the tourist destination (most often by car, as indicated by almost 75% of the respondents) is not the same one as the means of transport used to travel within the area. Tourists often travel around the region by bike or walk. Such means of transport as scooters or motorcycles are used extremely rarely.

An important issue relating to the mobility of tourists was the mode of transport used during their stay (leisure time) in the region. The question concerned the use of modes of transport according to the amount of time necessary to travel, ranging from "up to half an hour", "between half an hour and one hour", to "more than an hour".

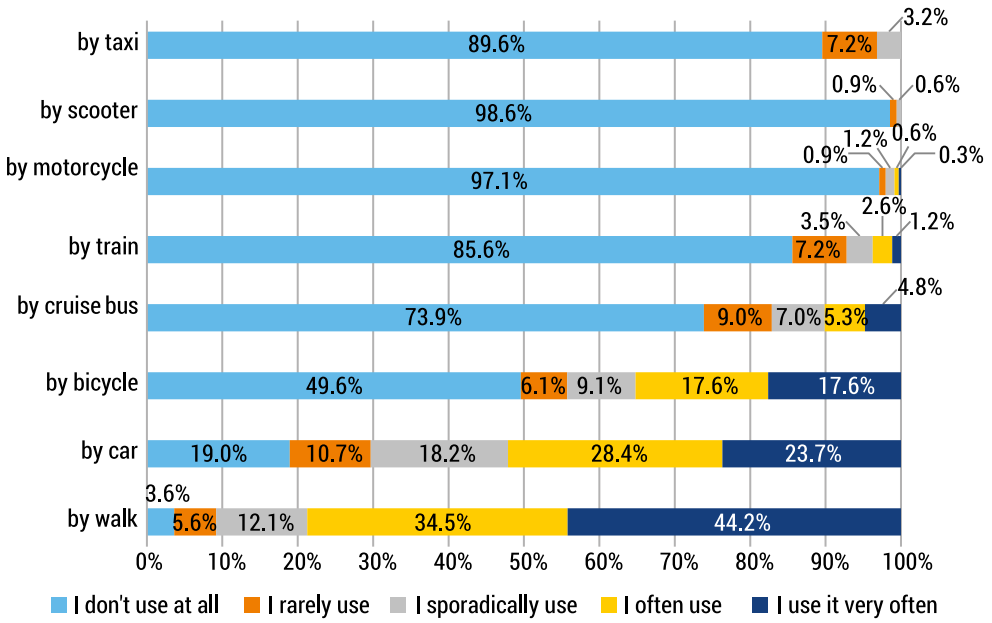

FIGURE 4.8. Transport modes used by tourists for moving within the destination

SOURCE: The study based on empirical research

In the region of Hajnówka, the vast majority of tourists walk (94.9%); 78.7% of them very often travel around the region on foot. Regarding the length of travel, 57% of tourists walk during tours that last more than one hour, 26.8% of the tourists move around the region on foot covering distances that last from half an hour to one hour, starting from their place of stay, whereas 30.4% walk on the distances of no more than 30 minutes. A car is used by 77.4% of tourists during their stay in the region and 51.1% of the tourists often, or very often, make use of that mode of transport. Depending on the travel time, 34.9% of tourists cover distances of more than one hour by car, while 23.8% from half an hour to an hour. The car is also used by 33.0% of tourists on short distances, lasting up to half an hour. The third dominant means of transport in the region is a bicycle. Within the region, 45.1% of tourists travel by bicycle, whereas 32.2% of them often and very often use this means of transport. The survey shows that 11.9% of tourists use it for trips lasting up to 30 minutes, 13.5% for trips lasting more than 30 minutes to one hour, and 28.3% of tourists travel by bike on distances requiring over 60 minutes of a ride. In total, 26.1% of tourists travel by local buses, 10.1% of them often and very often use this means of transport, while 14.5% of tourists have declared that they travel by train, 3.8% of them often and very often.

The results presented in Figure 4.9. prove a very interesting phenomenon, i.e., that tourists travel on foot most of the time, especially during trips that last more than an hour (57%) and this way of travelling, based on the calculations, is the most popular one in the region. The second most popular way of moving around is by car. A bicycle is also among the most frequently chosen options.

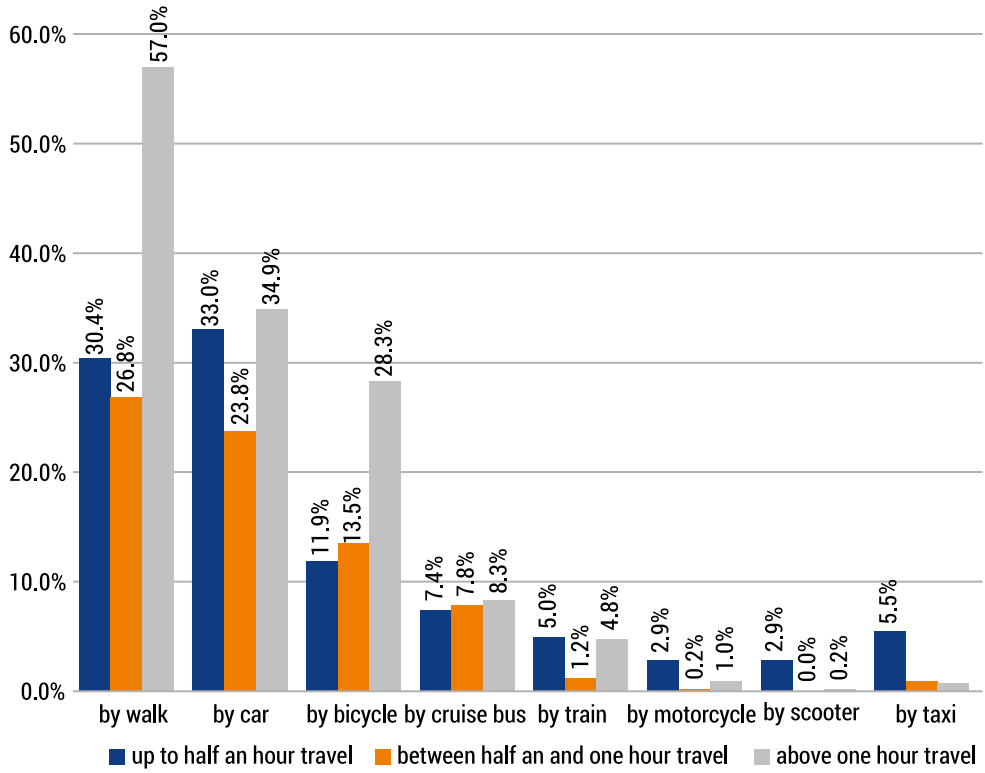

FIGURE 4.9. The means of transport used by tourists to travel around the voivodeship (region) depending on travel time

SOURCE: Own elaboration based on empirical studies.

A very important task was to find out the opinion of tourists about the quality of transport infrastructure in the region. The question was related to the satisfaction of tourists with the local transportation system. Tourists, as well as the residents, were asked to rate seven areas, with the use of a five-point scale, and the results are shown in Figure 4.10.

Based on the data presented in Figure 4.10, there is a relatively low level of satisfaction among tourists with the existing local transport services, as evidenced by the small sections marked in blue and orange. The exceptions are travel safety and technical condition of transport infrastructure, and 60% of the respondents seemed satisfied in those cases. Sadly, the main defect of the transport system is the facilities for the disabled, which definitely need to be improved. It should be emphasised that in four areas, the largest group of the respondents was unable to express a clear opinion, which was the result of the previously declared forms of movement dominant in that group, i.e. a car or hiking. Thus, the respondents often did not have the opportunity to get familiar with the offer of public transport.

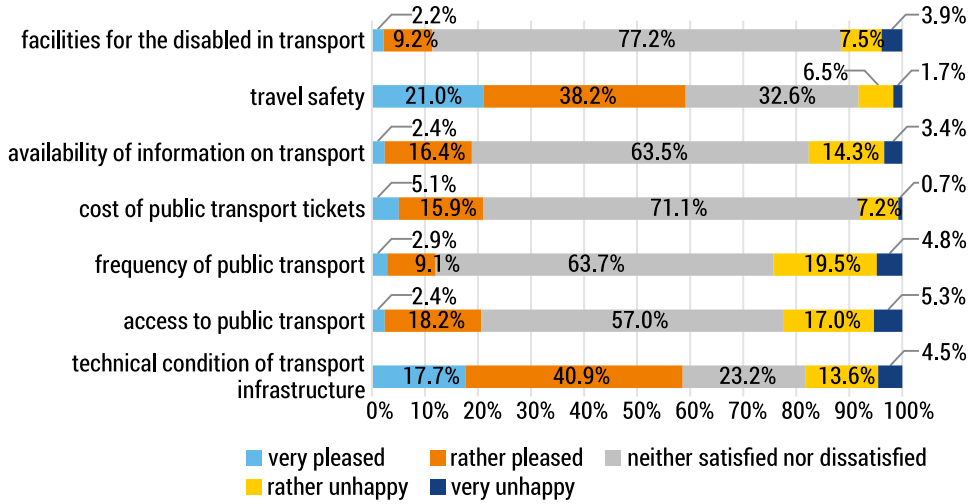

FIGURE 4.10. Tourists' satisfaction with the following aspects of the local public transport system

SOURCE: Own elaboration based on empirical studies.

The need to make changes and improvements is evidenced by the opinion of tourists presented in Figure 4.11 – 19 areas were rated by the visitors, with the use of a survey with multiple-choice questions. The questions covered elements of the public transport system (facilities for the disabled, ticket prices, punctuality, availability of services and information, frequency of services) and transport infrastructure (car and bicycle parking facilities, technical condition of roads, availability and quality of bicycle routes, safety).

Tourists notice the need to introduce a lot of changes to improve the transport system in Hajnówka County, especially in relation to the elements of that system – car and bicycle transport. The assessment concerning the need to introduce changes in the functioning of bus and railway communication as well as road infrastructure, including bicycle paths in Hajnówka County (Figure 4.11), shows that the vast majority of tourists do not have a definite opinion on the necessity of changes in the functioning of local bus and railway communication. The results are as follows, in terms of:

- bus communication: decreasing the cost of bus tickets (62.7%), increasing the frequency of buses (50.6%), improving the technical condition of bus stops (59.1%), improving the technical condition of buses (58.5%), increasing the number of bus stops (62.2%), increasing the availability of information about bus communication (59.8%), improving the punctuality of buses (62.7%), introducing facilities for disabled people in buses (63.6%),
- railway communication: decreasing the cost of railway tickets (74.1%), increasing the frequency of trains (65.00%), improving the technical condition of railway stations (67.9%), improving the technical condition of rolling stock (69.4%), increasing the number of railway stations (71.1%), introducing facilities for disabled persons in trains (65.1%).

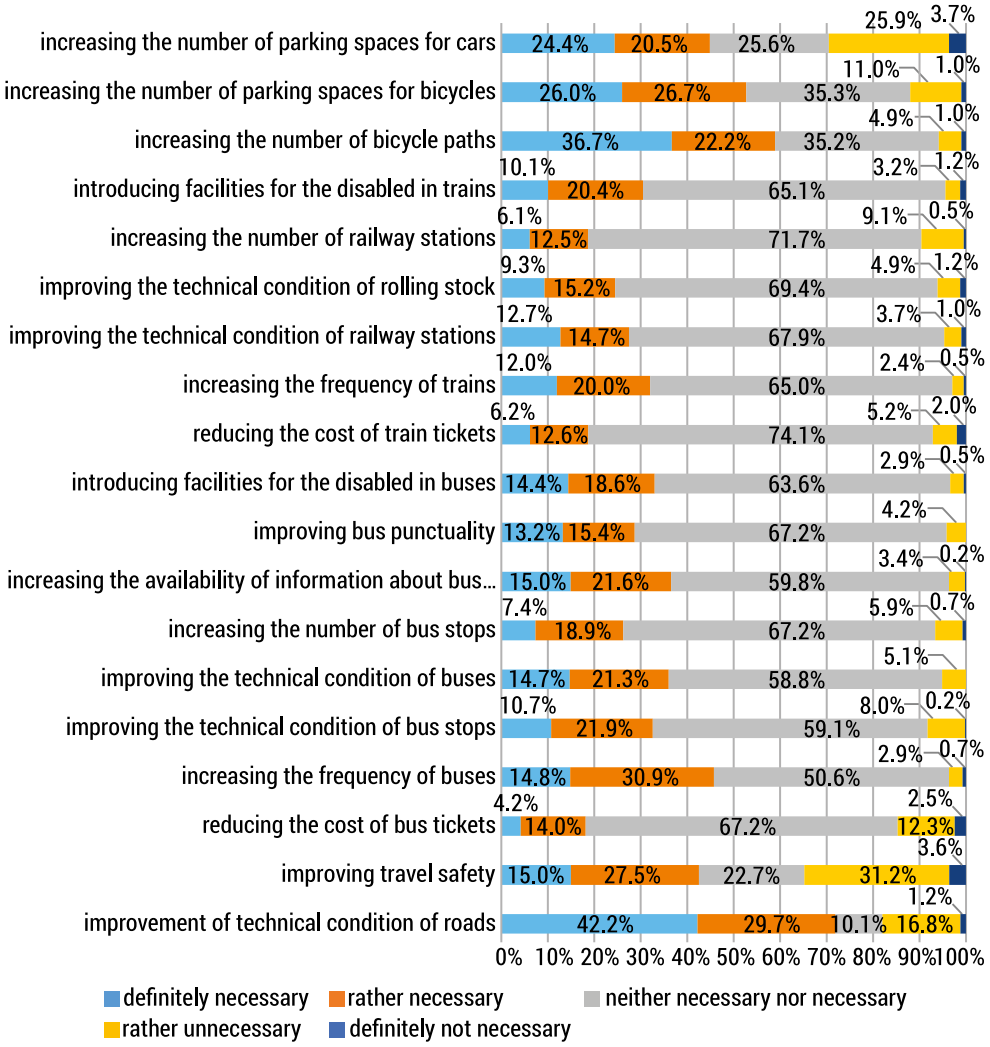

FIGURE 4.11. Assessment of the need to introduce changes related to the functioning of transport in the region (tourist mobility needs)

SOURCE: Own elaboration based on empirical studies.

According to 48% to 25% of holidaymakers, the analysed categories need improvement, including:

- bus communication: increasing the frequency of buses (45.7% of respondents), improving their technical condition (36.00% of respondents) as well as introducing facilities for people with disabilities (33.00% of respondents), improving the technical condition of bus stops (32.8% of respondents) and increasing their number (26.3% of respondents) as well as increasing the availability of information

about bus communication (36.6% of respondents). Bus communication also needs improvement in terms of punctuality (according to 28.6% of respondents),
- train communication: increasing the frequency of trains (32.00% of respondents), improving their technical condition (24.5% of respondents) as well as introducing facilities for people with disabilities (30.5% of respondents), improving the technical condition of railway stations (27.4% of respondents) and frequency of trains (32.00% of respondents).

The analysis of the evaluation of the condition of road infrastructure, including the technical condition of roads, indicates that it needs to be improved, in the opinion of 71.9% of the surveyed tourists, while in the opinion of 44.9% of tourists, the number of parking spaces for cars should be increased. With regard to the infrastructure of bicycle paths, 58.9% of tourists believe that their number needs to be increased and 52.7% believe that the number of bicycle parking spaces should be increased. The analysis of the results of surveys on improving travel safety shows that the respondents have differing opinions. There are 15% of tourists who believe that the safety of travel should definitely be improved, 27.5% who claim that is should rather be improved, 22.7% who do not have a strong opinion in this category, and 34.8% who feel safe when travelling.

The performed research indicated a key issue, which was the identification of the most optimal and innovative solution regarding the transport system in Hajnówka County. The review of the literature and previous projects, mainly under the Interreg programme, allowed the identification of the latest solutions proposed or implemented in the area of transport. Tourists, as well as local residents, were presented a list of innovative solutions, and their preferences are shown in Figure 4.12.

Tourists, with regards to the proposed innovations, generally share the same opinions as the residents, and they consider the integration of transport systems to be the most important task.

More than 56% of the respondents indicated that those changes would have a significant impact on improving the transport system in the region, a total of almost 86% of the surveyed tourists expressed positive opinion about the proposals, and with regards to the rest of the respondents – less than 7% did not have any opinion on the above. Tourists rated fairly highly several of the innovative solutions, primarily related to modern technology. Introducing a mobile phone application to plan travel and to integrate various means of transport available in the county (e.g. e-bikes, e-cars), combined with the internet payment system, were considered to be the most important tasks, according to the respondents. Another innovation was rated slightly lower: a mobile phone application that would allow searching for transportation as a ridesharing system. In both aforementioned cases, the percentage of undecided persons was relatively low, with regards to the first idea, it was 8.7%, and in the case of the second proposal – approximately every tenth respondent had no opinion. The number of persons that evaluated the ideas in a negative way was 8.9% in the first case and 9.6% – in the second case. Other proposals were also rated relatively high. The e-car system

with a mobile application and infrastructure (base station, charging modules) was evaluated in the most negative way (29.2% of "no impact" responses). A detailed comparison of the statements of both groups of respondents related to the proposals of innovative changes concerning mobility in the area of Hajnówka and Białowieża (in Hajnówka County) is presented in the next chapter.

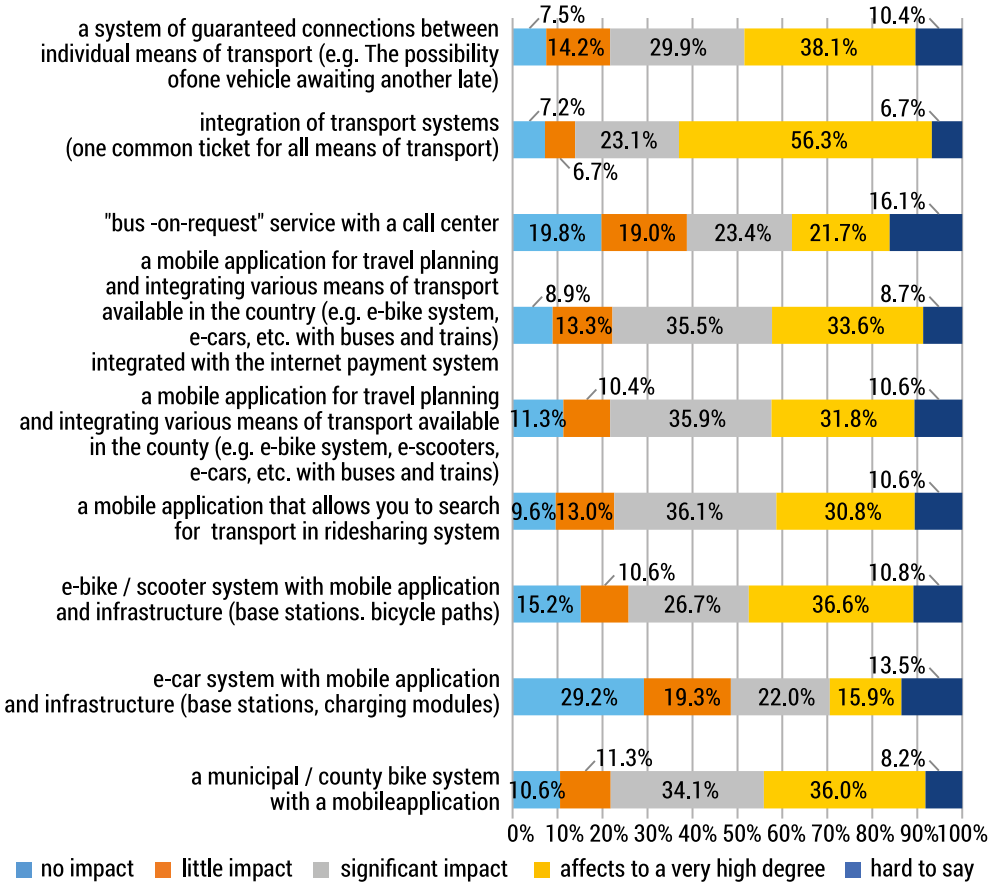

FIGURE 4.12. Innovative solutions which would improve tourists' mobility within the region and have a significant impact on improving the quality of traveling

SOURCE: The study based on empirical research

4.3. A comparative analysis of the opinions of the residents and tourists on the necessary changes to the transport infrastructure and proposals of innovative mobility solutions in the region

The research results obtained from both groups of respondents require comparison in order to diagnose optimal solutions for both groups and find the best innovative solutions in the field of mobility of residents and tourists in Hajnówka County. The results will be the basis for developing a model of a system of co-ordination and cooperation in the implementation of innovations in mobility.

The data collected during empirical research make it possible to perform comparisons and use various statistical methods. First, a comparative analysis should be carried out with regard to the most significant elements of the study; that is, the indicated problems in the peripheral area under study, from the perspective of both groups of respondents. Such comparisons can also be made taking gender into account, which is prompted by the interesting results of extensive research presented by C. Criado-Perez[346]. Although the book is not a standard scientific monograph (it has not been reviewed), it provides many scientific sources and refers to inspiring research, which undoubtedly makes all readers think and want to spend more time (make it credible) studying gender inequality (discrimination). A median value, mode, mean and standard deviation were calculated in the comparative analysis (see Tables 4.1, 4.2, 4.3 and 4.4). The comparison presented in Table 4.1 is the evaluation of the condition of the infrastructure of Hajnówka County by the residents of the county and tourists.

TABLE 4.1. Evaluation of the condition of infrastructure of Hajnówka County in the opinion of the residents of the county and tourists [median, mode, arithmetic mean, standard deviation]

Variable	Tourists				Residents			
	median value	mode	mean	Standard deviation	median value	mode	mean	standard deviation
Technical condition of transport infrastructure	4	4	3.54	1.07	3	4	2.87	1.13
Access to public transport	3	3	2.95	0.81	3	4	2.95	1.15
Frequency of public transport services	3	3	2.86	0.76	3	3	2.58	1.11

[346] C. Criado-Perez, *Niewidzialne kobiety. Jak dane tworzą świat skrojony pod mężczyzn* [original title: *Invisible Women. Exposing Data Bias in a World Designed for Men*], Karakter, Kraków 2020.

Variable	Tourists				Residents			
	median value	mode	mean	Standard deviation	median value	mode	mean	standard deviation
Cost of public transport tickets	3	3	3.17	0.66	3	3	3.31	1.17
Availability of information on transport	3	3	3.00	0.73	3	4	3.01	1.10
Travel safety	4	4	3.70	0.93	3	4	3.37	0.98
Facilities for the disabled in public transport	3	3	2.98	0.64	3	3	2.80	1.00

Source: The study based on empirical research.

As far as the technical condition of infrastructure is concerned, both groups of respondents see a need to improve the technical condition of roads, including an increase in the number of parking spaces. Both groups also see a need to increase the number of bicycle paths, including an increase in the number of bicycle parking spaces. However, it should be noted that the level of evaluation of the different elements of the infrastructure is slightly different, as shown in Figure 4.13.

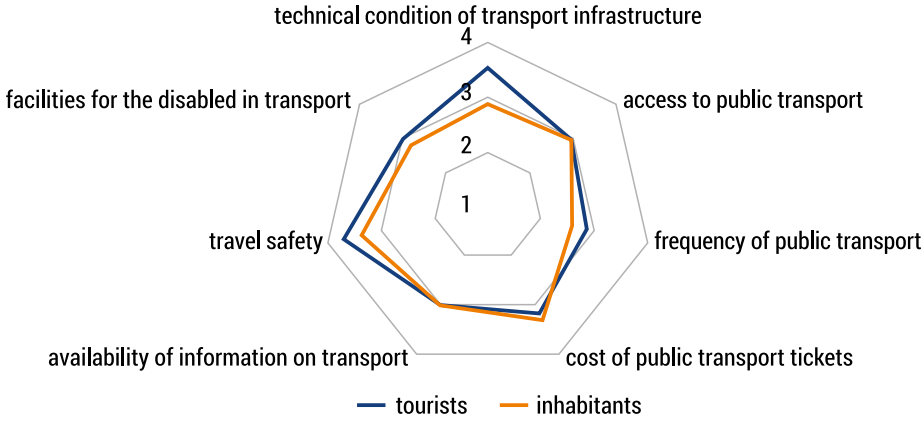

FIGURE 4.13. Evaluation of the condition of infrastructure in Hajnówka County in the opinion of the residents and tourists [according to the average of evaluations]

SOURCE: Own study based on empirical research.

Comparison of the degree of county saturation with tourist services between tourists' and residents' opinion (Figure 4.13) points out that the most significant barrier is the accessibility of public transport, its frequency and its adaptation to the needs of people with disabilities (an average of less than 3, on a scale from 1 to 5, where 5 means very satisfied). The analysis of the standard deviation values indicates that

the opinion of tourists is more homogeneous, while the residents' opinions differ significantly (Table 1). Moreover, the residents of Hajnówka County also indicate the technical condition of transport infrastructure as a mobility barrier. As with the previously identified barriers, their opinions are not compatible.

The respondents, both tourists and residents, definitely feel quite safe and do not see high risks. average scores: 3.7 and 3.37, respectively, and the value of standard deviation (0.93 and 0.98, respectively) indicates high compatibility of responses (Table 4.1). However, both the residents and tourists express the need to take measures to continuously improve safety (Figure 4.13).

The problems encountered by residents and tourists in the provision of mobile services and transport infrastructure constitute a gap (Table 4.2 and Figure 4.14).

TABLE 4.2. Assessment of tourists' and residents' of Hajnówka County concerning the conditions of transport infrastructure in the county and provided transport services

Variable	Tourists				Residents			
	median value	mode	mean	standard deviation	median value	mode	mean	standard deviation
Improvement of the technical condition of roads	4	5	3.95	1.14	5	5	4.55	0.79
Increase in travel safety	3	2	3.19	1.14	4	4	3.85	1.02
Reduction in the cost of bus tickets	3	3	3.05	0.72	3	3	3.47	1.18
Increase in the frequency of buses	3	3	3.56	0.80	4	5	4.10	0.96
Improvement of the technical condition of bus stations	3	3	3.35	0.79	4	5	3.70	1.08
Improvement of the technical condition of buses	3	3	3.46	0.80	4	5	3.92	1.09
Increase in the number of bus stops	3	3	3.26	0.71	3	3	3.49	1.13
Increase in the availability of information about bus communication	3	3	3.48	0.80	4	5	3.77	1.08

Variable	Tourists				Residents			
	median value	mode	mean	standard deviation	median value	mode	mean	standard deviation
Improvement of bus punctuality	3	3	3.38	0.76	4	3	3.64	1.08
Introduction of facilities for the disabled in buses	3	3	3.44	0.79	4	4	3.96	0.93
Reduction in the cost of train tickets	3	3	3.16	0.69	4	3	3.68	1.06
Increase in the frequency of trains	3	3	3.41	0.75	4	5	4.03	1.05
Improvement of the technical condition of railway stations	3	3	3.35	0.78	4	5	3.93	1.13
Improvement of the technical condition of rolling stock	3	3	3.26	0.74	4	5	3.87	1.09
Increase in the number of railway stations	3	3	3.15	0.68	3	3	3.47	1.13
Introduction of facilities for the disabled in trains	3	3	3.35	0.75	4	5	3.86	1.07
Increase in the number of bicycle paths	4	5	3.89	1.00	5	5	4.29	0.98
Increase in the number of parking spaces for bicycles	4	3	3.66	1.01	4	5	4.09	1.08
Increase in the number of parking spaces for cars	3	2	3.36	1.21	5	5	4.33	0.97

Source: Own study based on empirical research.

However, it should be noted that in all categories of the assessment, tourists see fewer mobility problems than the residents, as evidenced by the lower need for change (Figure 4.14).

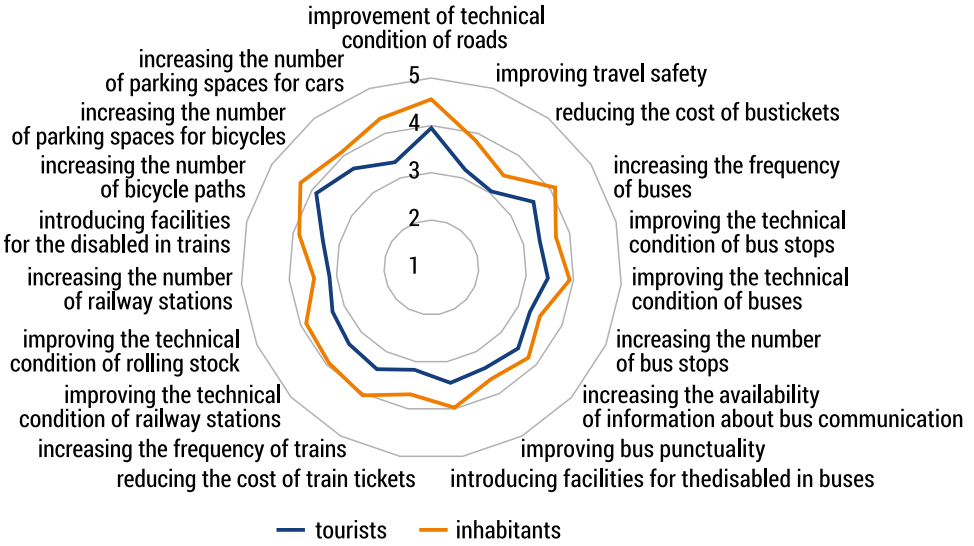

FIGURE 4.14. Assessment of tourists' and residents' of Hajnówka County concerning the conditions of transport infrastructure in the county and provided transport services

SOURCE: Own study based on empirical research.

The analysis of the results of a survey of tourists travelling around Hajnówka County and residents of Hajnówka County in terms of the problems concerning the offer and transport infrastructure indicates problems within the road infrastructure:

- the need to improve the technical condition of roads (4.55 – definitely necessary), the residents are very much in agreement on this issue, as evidenced by the low standard deviation (0.79), tourists express significantly differing opinions in this category, as evidenced by the high standard deviation (1.14),
- the increase in the number of parking spaces for cars (4.33 – definitely necessary), the residents are very much in agreement on this issue, as evidenced by the low standard deviation (0.97), while tourists do not indicate much need in this category, although their opinions differ greatly, as evidenced by the high standard deviation (1.21),
- the increase in the number of bicycle paths, both groups agree on this issue: residents, 4.29 – definitely necessary, with significant response compatibility (0.97 standard deviation), tourists, 3.89 – necessary, with response compatibility (1.00 standard deviation),
- increase in bicycle parking spaces, residents: (4.09 – definitely necessary), with response compatibility (1.08 standard deviation).

Additional problems concerning transport services experienced primarily by the residents, i.e.:

- the need to improve the frequency of both bus transport (4.10 – definitely necessary) and rail transport services (4.03 – definitely necessary), the technical condition of the means of bus transport (3.92 – definitely) and the technical condition of the railway stations (3.87 – definitely), as well as the need to adapt the means of bus transport (3.96 – definitely) and rail transport (3.86 – definitely) to the needs of people with disabilities,
- the demonstration of the perspectives of other groups of stakeholders (territorial local governments and transport providers) was an important addition to the survey carried out with the participation of the residents and tourists of Hajnówka County, the purpose of which was to identify the main problems in the field of mobility and accessibility of transport (assessment of supply services taking into account the needs of tourists).

Another area of research was the evaluation of the issues concerning mobility and availability of transport in Hajnówka County, as shown in Table 4.3.

TABLE 4.3. Evaluation of the issues concerning mobility and transport availability in Hajnówka County

Problem	Number of indications in the assessment of the importance of the problem on a scale of 1 to 5 (1-not important, 5- very important)					Average
	1	2	3	4	5	
Poor quality of road infrastructure	–		6	7	10	4.17
Poor offer of public road transport (insufficient network of bus connections, including vans, large disproportions within the frequency of buses at specific routes, insufficient number of direct connections)	1	1	6	7	8	3.87
Insufficiently developed offer of connections between neighbouring counties	1	1	4	11	6	3.87
Poor connection with other regions of Poland by means of mass transport (lack of developed offer of direct long-distance connections, which makes it difficult to plan leisure time and discourages tourists from visiting this region)	–	2	3	8	10	4.13

Problem	Number of indications in the assessment of the importance of the problem on a scale of 1 to 5 (1-not important, 5- very important)					Average
	1	2	3	4	5	
Marginal role of the rail transport (low density of railways and poor offer of passenger connections)	–	1	4	12	6	4.0
Lack or insufficient integration of transport systems (connections between trains and buses in Białystok and Hajnówka), which leads to a prolonged waiting time for transfers	1	2	8	7	6	3.78
Unsatisfactory system of publishing timetables by road carriers on websites (chaos in publishing timetables, lack of Internet service with such a local range that ensures uniform publication of collective timetables of all carriers, outdated or incomplete data), which significantly hinders travel planning for tourists	3	5	7	4	4	3.04
Poor accessibility of Hajnówka County in terms of individual motorization (low motorization rate, low expenditures on road maintenance, long distance from a network of express ways and motorways)	–	–	10	6	8	4.09
Insufficient development of bicycle infrastructure (poor number of marked bike routes, parking shelters, self-service bicycle mending stations, lack of self-service bike rentals, including electric bikes)	1	4	5	8	5	3.52

Source: Own study based on empirical research.

The most important problems that received the highest rating (above 4) were identified: poor quality of road infrastructure (4.17), poor connection of Hajnówka County with other regions of Poland by means of mass transport and low accessibility of Hajnówka County in terms of individual motorization (4.09).

The most important question in the survey conducted among the residents and tourists was: which of the innovative solutions would improve mobility in the region? The distribution of the responses in percentage terms is shown in Table 4.4.

TABLE 4.4. Evaluation of the issues concerning the proposals related to the mobility innovative solutions in Hajnówka County, from the perspective of the residents and tourists [in %]

Innovative solution	Respondents	No impact	Little impact	Significant impact	Affects to a very high degree	Hard to say
A municipal / county bike system with a mobile application	tourists	10.6	11.3	34.1	36.0	8.2
	inhabitants	29.6	24.4	19.1	12.5	14.4
E-car system with mobile application and infrastructure (base stations, charging modules)	tourists	29.2	19.3	22.0	15.9	13.5
	inhabitants	36.0	24.1	15.0	8.8	16.1
E-bike / scooter system with mobile application and infrastructure (base stations, bicycle paths)	tourists	15.2	10.6	26.7	36.6	10.8
	inhabitants	31.1	18.5	24.8	12.5	13.1
A mobile application that allows you to search for transport in ridesharing system	tourists	9.6	13.0	36.1	30.8	10.6
	inhabitants	21.3	15.6	36.0	15.6	11.5
A mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-scooters, e-cars, etc. with buses and trains)	tourists	11.3	10.4	**35.9**	**31.8**	10.6
	inhabitants	22.9	14.2	**31.4**	**20.4**	11.0
A mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-cars, etc. with buses and trains) integrated with the internet payment system	tourists	8.9	13.3	35.5	33.6	8.7
	inhabitants	21.7	15.9	33.3	14.7	14.4
"Bus -on-request" service with a call center	tourists	19.8	19.0	23.4	21.7	16.1
	inhabitants	22.8	21.5	24.8	7.9	23.1
Integration of transport systems (one common ticket for all means of transport)	tourists	7.2	6.7	**23.1**	**56.3**	6.7
	inhabitants	17.9	14.2	**33.0**	**26.5**	8.3

Innovative solution	Respondents	No impact	Little impact	Significant impact	Affects to a very high degree	Hard to say
A system of guaranteed connections between individual means of transport (e.g. the possibility of one vehicle a waiting another late)	tourists	7.5	14.2	**29.9**	**38.1**	10.4
	inhabitants	15.6	13.6	**33.1**	**24.6**	13.0

SOURCE: The study based on empirical research

In the figure, three most popular indications, jointly for both groups of the respondents, are shown in bold print on a gray background. While analysing the indications of the residents and tourists on innovative solutions that would increase the frequency of movement in the region, it should be noticed that the solution that would have the greatest impact is the integration of transport systems (one ticket for all means of transport). 79% of the surveyed tourists indicated it as significant. The interest of the residents is slightly lower, although also clear (60% were in favour).

Other solutions that may significantly or very significantly contribute to the increase in travelling within the region were a municipal / country bike system with a mobile application (70% visitors and only 32% residents), a mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-cars, etc. with buses and trains) integrated with the internet payment system (69% visitors and 48% residents), a mobile application for travel planning and integrating various means of transport available in the county (e.g. e-bike system, e-scooters, etc. with buses and trains) (68% tourists and 52% citizens) and a system of guaranteed connections between individual means of transport (e.g. the possibility of one vehicle a waiting another late) (68% visitors and 58% citizens), a mobile application that allows you to search for transport in ridesharing system (67% tourists and 52% citizens), e-bike / scooter system with mobile application and infrastructure (basestations, bicycle paths) (63% of tourists and only 37% of residents). The solution: e-car system with mobile application and infrastructure (basestations, charging modules) was the least popular among tourists and residents.

In order to check whether the indications of the importance of individual solutions depend on the age of the inhabitants, due to the nominal nature of the data, a chi-squared independence test was carried out, analysing the relationship between the answers and age. The test showed that there are no significant dependencies for most of the questions, both for tourists and residents. They were observed only in relation to a few questions, although here they were small relationships, which mainly resulted from a greater lack of decisiveness among the elderly (over 55) compared to younger people, who were also more likely to indicate that the given innovations did not have meaning. Nevertheless, these differences in the percentages

of indications in individual age groups are small, and the obtained V-Cramer's dependency coefficients are low (close to the level of 0.2 or lower).

A similar analysis was performed for the inhabitants of large cities, towns and villages. Again, no clear dependencies were generally observed here. They only applied to a few questions, and were low. In individual questions, only the responses of rural residents were slightly more conservative (they more often indicated the answer "hard to say" compared to other groups), but the differences are small. On the other hand, comparing the answers of women and men, apart from a few questions, no significant relationships were observed. Where these correlations occurred, they mainly consisted in the fact that women more often than men chose the "hard to say" answer, while men more often than women indicated that these technologies would not have an impact on the frequency of their travel. However, as in the case of other features, the relationships are shown to be small.

Implementation of the proposed innovations requires, first of all, their inclusion in the strategic plans of individual peripheral regions. Local self-government authorities should then prepare innovation implementation projects and cost calculations so that they can apply for co-financing from European funds (except for Russia and Norway, which are not members of the European Union. In the case of the Russian Federation, after its aggression against Ukraine, the implementation of innovations in the field of mobility will probably not be possible due to the government's decision to limit spending on purposes other than financing the war, which is called a "special operation in Ukraine" for Russia's internal needs). Local authorities should also plan their own financial contribution to the planned project and the principles of coordination and supervision of the investment after its launch.

Summarizing the results of the survey, it should be stated that there is great demand in the region of Hajnówka to search for sustainable and innovative mobile solutions, including e-mobility.

4.4. The innovative mobility solution proposal for Hajnówka County

The main objective of the research conducted for this peripheral region was to develop optimal innovative mobility solutions. The actual implementation of the project is the responsibility of local authorities and entrepreneurs. The innovative solutions were selected from among others proposed to the respondents. Based on their opinions, the most necessary solution is the synchronisation of transport connections in the region, then, the system of guaranteed connections between individual means of transport, and the third element – a mobile application for travel planning, integrating various means of transport available in the county (e.g. e-bike system, e-scooters, e-cars, etc. with buses and trains). The proposed solution is also in line with the European Union policy of increasing means of electric mobility. The idea

of the pilot case (innovation) embraces a transportation system with a rental of e-cars and e-bikes available by the means of registering in the application designed for this purpose and by using a special card. The e-cars and e-bikes pick-up/delivery zones would be located in the points traversing different communication routes and serving as a link in the intermodal passenger transportation network (close to bus and train stations and often used routes), enabling seamless continuation of transportation. Therefore, it can be concluded that various means of transport, both traditional, such as train and bus, and modern, such as e-bike and e-car, should be improved. The breakdown of the means of transport is shown in Figure 4.15.

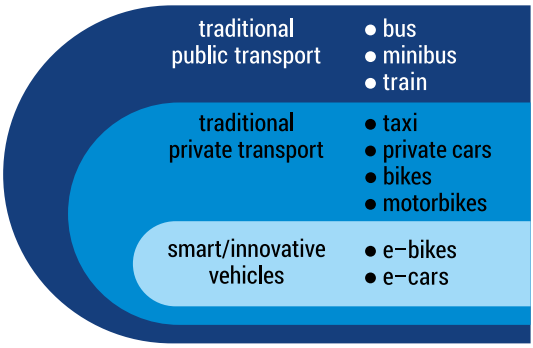

FIGURE 4.15. Traditional and innovative forms of passenger transport used and proposed for use in Hajnówka County

SOURCE: Own elaboration based on research results.

The innovations presented in the third – the last part of the figure – relate to e-bikes and e-cars. However, the economic and cultural realities of the region and the interested parties must be taken into account, which is why the main emphasis was placed on the research on e-bikes. Since electric vehicles provide a substitute for traditional transport offering less noise and detrimental pollutions (zero exhaust emissions), implementation of this kind of transport in sparsely populated, environmentally precious and tourism-oriented area is substantiated. An efficient e-charging infrastructure would facilitate tourists in particular, to move further inland to explore the remote areas of the region. E-bikes are an especially excellent means of transport to the Białowieża Forest. Each pick-up/delivery zone would be equipped with a charging station. The charging stations would be also distributed among the routes enabling charging an e-car or e-bike when necessary. The optimal distribution of the charging station as well as pick-up and delivery zones have to be designed. A user-friendly application would be used to book an e-bike and a rental code would be sent to a user on a smartphone. The application should contain information about the route, its length, and coordinates of bicycle stops. Furthermore- it should be compatible with GPS navigation, which will allow you to connect routes freely. In addition, in order to congruence the application with other means of transport (the principle of parity, departure from thinking about routes only as a form of recreation),

the application should contain data coordinates of buses and trains stops available on a given bicycle path along with information about the timetable, routes served and contact to the carrier.

The development of e-mobility in the region of Hajnówka should be focused on the development of e-bikes. This requires the preparation of a detailed concept of e-mobility development, which should ultimately assume the implementation of many activities in the field of bicycle infrastructure development, in particular:

- increasing the number of marked bicycle routes and improving the technical condition of the existing routes;
- improving the safety of cyclists;
- improving the accessibility of trails for different groups of recipients with different needs (e.g. disabled or elderly);
- improving the accessibility of existing public roads for bicycles;
- creating a mobile application (with marked bicycle infrastructure and tourist attractions of the region) as a prelude to the development of e-mobility;
- creating a system for renting bicycles with an electric drive;
- construction of electric bike charging stations (eventually for other electric vehicles);
- creating a city bike system in Hajnówka;
- construction of bicycle parking places;
- creating bicycle service points;
- development of places of rest and recreation for cyclists;
- promoting other forms of e-mobility (electric scooter, e-car, electric means of public transport.)

The introduction of each of the innovations presented to the respondents, including the three options that received the highest scores, requires close cooperation of the local government with the coordinators of public transport (state-owned enterprises or with the participation of the state budget) and entrepreneurs. Any changes should be based on a thorough analysis of the needs of tourists and local residents and discussed, in particular, with the latter group of interested parties. A proposal for cooperation and coordination in the field of transport services in Hajnówka County is shown in Figure 4.16.

The matrix shown in Figure 4.16 presents the proposal for cooperation related to transport services, which is a response to the main expectations of the respondents. The matrix shows the correlation with the central connection, which is the integrated mobility system, in the cyclical progress. In the central part, there are four fields inside a circle, that is: regional government, public transport, passenger transportation companies and stakeholders (inhabitants and tourists, private transport). Each quarter of the circle is assigned a rectangle indicating the area (range) of a given entity or group of entities. The elements of public transport in the region under study include trains and buses, although other modes of public transport may be taken into account in other peripheral regions. In this case, state-owned enterprises or enterprises

with the participation of the state budget are included here. The other segment of the circle (lower right) corresponds to private transport of the residents and tourists. Based on the research, the most frequently used means of private transport are passenger cars and traditional bicycles, less often motorcycles, but also scooters or other private means of transport. The third section relates to private passenger transport companies, which, in Hajnówka County, are private taxis, buses, vans. Apart from those mentioned above, this group may include, for example: horse-drawn carriages, "melexes", tut-tuks, sleighs, rickshaws, etc. The section of the circle referring to the local government unit, i.e. the Hajnówka County office, is purple. Both European models and previous experience prove that local government units should act as coordinators of similar, multi-faceted projects, where the priority is to reduce the devastation of the ecosystem, especially in naturally valuable areas such as the Białowieża Forest, while the anticipated financial profitability is not clear (or the project is on the verge of profitability). Coordination of an undertaking related to the introduction of innovations in the field of mobility in compliance with the principles of sustainable development requires cooperation with other entities and consultation with experts, as well as the ability to obtain funds, for example, European funds.

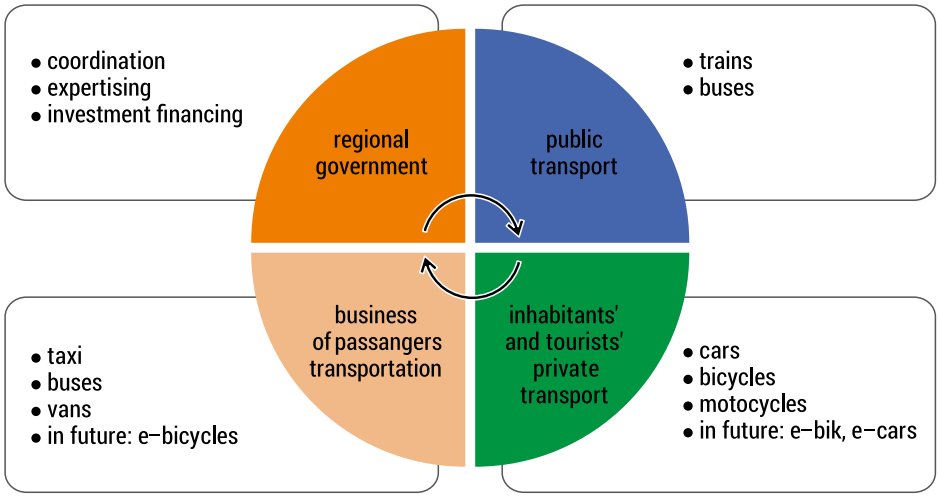

FIGURE 4.16. Proposal for cooperation and coordination of transport services in Hajnówka County

SOURCE: own study based on the conducted research.

All collected information on the way to move around the region using different, mainly environmentally friendly, modes of transport, coordinated by the local authority (here the District Council), can be used to design an app. Additionally, the information should be displayed on electronic boards placed at railway stations, bus stops and major locations in the cities, towns and villages and at tourist attractions. Due to the demographic structure of the local community and the fact that not all residents have access to the Internet, and not everyone is able to use the application, apart

from providing information, it would be advisable to appoint a coordinator/coordinators with an assigned phone number dedicated only to that task. This proposal follows considerations taking into account the age structure, especially of the residents, most of whom own a mobile phone and are able to use it at least at a basic level. The implementation of a mobile application can be treated as an introduction to the design of further solutions to improve a new mobility model. The application should contain information on various forms of transport in the region and the possibility of collision-free use of their offer. Moreover, the application will undoubtedly contribute to the increase in the popularity of the bicycle as a means of transport, which will affect the image of the region as an environmentally friendly place, levelling communication white spots. In turn, the compatibility of the route network with other forms of transport – will give the routes the status of an alternative means of communication. The application is also an easy tool to update data, which is important from the point of view of information access. This app will encourage tourists to use the bicycle as a means of transport, and the demand for bicycle services may contribute to the development of cycling tourism. It can be a stage to expand this mobility model in the future, designed using the causative capabilities of municipalities and private business (in the form of city bikes, electric bikes). It is also an excellent tool for the development and implementation of a tourism management system in the region of Białowieża Forest. Implementation of the application as a tool to improve the region's communication accessibility to solutions that fall within the institutional and financial capabilities of the county self-government.

Expected impact of the innovation on the existing transport system in the region is that the changes should be included in strategic documents. Currently, there is no synchronisation of transport services in the region. Furthermore, the introduction of e-bikes and coordination and information boards is a definite novelty (innovation) in the studied area, and their introduction requires the input and cooperation of many entities. The first stage is planning. The system does not function in the strategic space of the county, the starting point for the implementation of the task will be its establishment in binding documents of the local government. The main task is to conduct a feasibility study to find out the costs of the possible investment as well as the energy and spatial possibilities of the region of Hajnówka (locations of information boards and potential location of the loading station – related legal and financial costs, including bicycle routes). The implementation of a feasibility study – included in the long-term activities of the local government in the newly created Strategy, will be a benchmark for future activities of the local government – including in the field of promotion in the region and potential agreements with local governments to implement the innovation. At the same time, the local government should promote bicycle transport as an alternative means of transport – using interactive tools (an application including bicycle stops, enabling the future expansion of points with charging stations) in order to popularize eco-friendly types of transport among tourists and residents.

Conclusions and recommendations

The conducted study is part of an attempt to solve the research problem of mobility limitations in peripheral areas. The main objective, which was to identify innovative solutions in the field of mobility of residents and tourists in peripheral areas on the example of Hajnówka County, has been achieved. The final result of the research is the theoretical model, designed by the author of the study, presenting a system of coordination and cooperation in the field of mobility in a peripheral area (Figure 4.16). Thanks to the implementation of the MARA project (Mobility and Accessibility in Remote Areas – a new approach to developing mobile expressions in remote areas), under which this research was performed and completed, it is possible (even recommended) to introduce eco-friendly innovation, which is the possibility to use e-bikes by the residents and tourists.

All specific objectives of the study have also been achieved. An evaluation of mobility problems and needs of the residents and tourists in Hajnówka County (P1) was performed. An assessment of the degree of saturation of Hajnówka County with transport services (P2) was also completed. The research has shown that the expectations of both residents and tourists are greater than the current offer. The need for introducing changes and innovations in the field of transport infrastructure and mobile services (P3) was identified.

The main method applied in the research process was the diagnostic survey method with the use of a questionnaire. Some of the tools used in the study were the chi-square independence test and V-Cramer's dependency. The use of this test allowed the indication of correlation between the answers given by the respondents and their age. The results of the test showed no statistically significant correlation (discrepancy) between the opinions (answers to individual questions) and the age of the respondents. This result applies to both residents and tourists. The limitations of field study with the participation of the residents caused by the pandemic should again be mentioned here. Differences were observed only in relation to a few questions, although here they were small relationships, which mainly resulted from a greater lack of decisiveness among the elderly (over 55) compared to younger people. These differences in the percentages of indications in individual age groups are small, and the obtained V-Cramer's dependency coefficients are low.

Implementation of innovative solutions in the field of e-mobility and other environmentally friendly means of transport requires the exchange of experiences between entities that have already implemented such solutions. The proposed solution,

presented as a matrix (Figure 4.16), is recommended for the representatives of the local government and transport companies (public and private) in the region, participation in e-mobility study visits is advisable, which will allow a better understanding of modern communication solutions. In addition, promotional activities for electric mobility should be undertaken, both directed to the outside (to tourists or investors) and to the inside (to inhabitants), which will help to shape pro-ecological communication patterns.

The results of the survey conducted with the participation of two groups of respondents, i.e. residents and tourists in Hajnówka County, lead to the following main conclusions:

- The current model of transport accessibility in the region of Hajnówka, taking into account public transport, should be assessed as insufficient in many respects.
- The region of Hajnówka is poorly connected with other regions of Poland, which limits the mobility of its residents and discourages potential tourists from visiting the county, which, consequently, weakens the local economy.
- The most popular means of public transport is the bus. It is the basic model of organisation of local and supra-local transport. Therefore, the investment activity of local authorities focuses mainly on improving the condition of local and supra-local roads. However, the offer of bus transport does not fully meet the needs of residents. In the network of connections within the county, there are large disparities in the frequency of buses on particular routes. This contributes to the social exclusion of those residents who do not have private cars.
- In terms of the broadly-understood mobility of the residents of Hajnówka County, the used means of transport are directly related to the distance that residents and tourists have to cover to reach their destination. The population definitely travels by walking and by car for short distances to the same extent. The greater the length of the route, the greater the number of residents using a car as their main means of transport. This trend is also observed with regard to the use of public transport, namely buses and trains.
- The current offer of transport services indicates that the frequency of public transport constitutes the main issue. To a lesser extent, the problem lies in the condition of the transport infrastructure, accessibility of public transport and availability of information on public transport. The cost of public transport tickets and travel safety are definitely positively evaluated.
- It is observed that there is a need to improve transport infrastructure, including: the technical condition of roads and an increase in the number of car parks, as well as the number of bicycle paths and parking spaces, in particular adapted to the journeys of local people. In terms of an improvement in the provision of public transport services, there is a need to increase the frequency of both bus and rail transport, improve the technical condition of bus transport, the technical condition of railway stations as well as to adapt bus and rail transport to the needs of people with disabilities.

- Both groups of respondents are of a similar opinion as to the need to introduce two solutions; that is, integration of transport systems (one common ticket for all means of transport) and a system of guaranteed connections between individual means of transport.
- The innovation in the form of the e-car system with mobile application and infrastructure (base stations, charging modules) was the least popular one among tourists and residents but the e-bike system with an application was assessed as one of the best ideas.

The introduction and development of new, environmentally friendly means of transport (in particular electric vehicles, such as e-bikes) in Hajnówka County will significantly enrich the existing transport system with innovative and more environmentally friendly solutions. It will increase the transport accessibility in the region (both external and internal), which will positively affect the attractiveness of the region and improve mobility in the area. These solutions meet the expectations of tourists who report a high demand for funds and infrastructure for bicycle transport. The development of bicycle infrastructure (including bicycle paths) may also have a positive impact on increasing the frequency of cycling among residents, as it will be a strong alternative to individual car communication and traditional means of public transport. The development of e-mobility in the region of Hajnówka will make it possible to solve the problems related to mobility and accessibility of transport to the residents and tourists and will also promote pro-ecological and pro-health attitudes related to the mobile activity. It is particularly important for the region of the Białowieża Forest (one of the most valuable forest complexes in Europe, entered on the UNESCO list). It will make it possible to reduce exhaust emissions (including carbon dioxide and other pollutants) and thus improve air quality and reduce noise related to road transport. Currently, car traffic is one of the main sources of air pollutant emissions in the region. Electric means of transport may in the future become one of the most important forms of transport in the region. The proposed innovation can also be applied in other partner countries.

The conducted research makes it possible to formulate recommendations for further studies and in relation to economic practice. The necessity to conduct research on the issue of mobility in peripheral areas and to search for innovative solutions in that field seems unquestionable. Therefore, the author recommends that the following issues (research problems) are taken into account in the studies:

- It is advisable to conduct comparative research, taking into account both time and in space – on mobility problems in different peripheral regions.
- The research should be extended to the international level, ideally conducted in collaboration with the participants of the MARA project.
- The reduction in the movement of tourists and residents in the region under study, due to the SARS-CoV-2 pandemic, forced the researchers to perform some of the research in the virtual space. This might have had an impact on the obtained results, especially with regard to the representativeness of the structure

of the respondents – the residents of the region of Hajnówka, who do not always have access to the Internet or are unable to navigate it. Therefore, the team of researchers (E. Szymańska and Z. Kołoszko-Chomentowska) undertook a study of seniors of a given region after the pandemic, to compare the obtained results and develop recommendations taking into account the average results and separate results for seniors[347].

- It would be advisable to study the impact of the pandemic on the changes in the mobility of the residents of peripheral areas and tourists visiting those regions. Based on preliminary observations, there is an increased interest in peripheral areas among city dwellers (longer stays related to, e.g., remote work, short-term trips, purchases of the so-called second homes). Therefore, a question arises – Can those changes have a positive impact on the development of peripheral regions, including mobility in those areas?

With regard to economic practice and, in particular, taking into account the enterprises and local authorities operating in peripheral areas, the author formulated the following recommendations:

- It is recommended to systematise foreign and domestic experience in the field of responding to the needs of the inhabitants of peripheral regions, with particular emphasis on people who require assistance (seniors, children).
- It is recommended to increase the utilisation of alternative transport in improving the mobility and accessibility of the region by expanding the existing infrastructure as well as expanding the cycling infrastructure (increasing the number of cycling routes, bicycle stations, bicycle rentals, e-bikes).
- Promoting the model of using a private car for persons travelling together.
- Promoting the model of using a e-bike for tourists and local citizens travelling.
- The most important issue, from the perspective of both groups of respondents, is the integration of transport systems, which was the basis of the developed model.
- It is recommended to increase the utilisation of alternative transport in improving the mobility and accessibility of the region by expanding the existing infrastructure as well as expanding the cycling infrastructure (increasing the number of cycling routes, bicycle stations, bicycle rentals, e-bikes).
- Promoting the model of using a private car for persons travelling together.

It should be noted that there are some limitations regarding the assessment of the obtained results of research relating to the opinions of the inhabitants of the region. Due to the undoubted peripherality of the research area, there is a reasonable assumption that the pollsters failed to reach many elderly residents who are not mobily active. Therefore, it would be advisable to deepen the research with this group of respondents and make a comparison with the results presented here.

[347] While having the monograph printed, the survey for seniors was in the process of development and the results should be published next year.

The conducted research and its results contribute to the theory of management and quality sciences as well as economy and finance. The theoretical contribution is the suggested methodology of the quantitative research conducted in Hajnówka County. In addition, the contribution includes two models, one of which presents a coordination and cooperation system for passenger transport in a peripheral region, while the second model proposes an innovative solution to the mobility problem in the form of shared e-bike and e-car. At the same time, the results of the research can be used by the practitioners operating in peripheral areas; that is, by local authorities in cooperation with economic operators (representing public and private transport) and in close contact with the target beneficiaries – the residents and tourists. Furthermore, the research has shown that there is a strong demand for such innovative mobility solutions, therefore this issue should be further explored, especially at an international level.

Acknowledgment

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Summary

Mobility barriers in peripheral areas cause significant limitations in their economic development. The restrictions affect primarily the inhabitants of these regions, but also tourists. The subject and research problem of this study are limitations in terms of mobility in peripheral areas. The main goal of the research is to come up with innovative solutions in the field of mobility of residents and tourists of peripheral areas on the example of Hajnówka County and to develop a model of a system of co-ordination and cooperation in the area of implementation of innovations in mobility. Transport in particular should be adjusted to the needs of residents so as to provide them with free access to basic social needs and other diversified demands (decreasing population and growing demand diversification). To minimise these problems, it is necessary to undertake measures that may allow the obtaining of comprehensive information on the needs of residents in terms of mobility. This information will assist local authorities in undertaking measures within the growth in the efficiency of transport systems by implementing innovative solutions which, in turn, should contribute to improved accessibility of these areas.

The following specific research purposes were formulated in the study:

- P1 – Evaluation of residents' and tourists' mobility problems and needs in Hajnówka County
- P2 – Assessment of the degree of saturation of transport services in Hajnówka County (How does the current offer of transport services meet the expectations of residents and tourists?)
- P3 – Assessment of the need for introducing changes and innovations in transport infrastructure and mobile services
- P4 – Development of a model of a system of coordination and cooperation with regard to implementation of innovative mobile solutions in Hajnówka County.

This monograph is divided into main two parts: theoretical and practical. It consists of four chapters, an introduction and conclusions. The first chapter presents an introduction to the innovative theoretical aspects as the background of further consideration. The second chapter describes specific problems of peripheral areas, including mobility issues. The next chapter contains the characteristic method and procedure of citizens and tourists' mobility problems and needs research. The fourth part is the presentation and systematization of the results of research on mobility services for residents and tourists of the Hajnówka poviat, which became the basis

for the construction of a model of a coordination and cooperation system for the implementation of innovative mobile solutions in peripheral areas. The research was conducted in Hajnówka County, mainly in the Białowieża Forest, which is the county's most attractive area. The research on the mobility needs of residents and tourists in Hajnówka County was conducted using the survey method (diagnostic sonar). Two research methods were used: F2F (face-to-face) and CAWI (Computer Assisted Web Interviewing). In both cases, respondents or interviewers were able to download the survey questionnaire on their mobile devices (smartphone, tablet) by means of scanning the QR code. From the perspective of the F2F method, the respondent had access to a paper version of the questionnaire and were able to provide answers in the questionnaire or to the interviewer who recorded them in an electronic version. The use of various research techniques was a consequence of the unexpected pandemic on a global scale. The SARS-CoV-2 pandemic, which resulted in the introduction of significant restrictions on movement, forced researchers to transfer a part (continuation) of the research to the virtual space. To calculate the correlation between individual variables the Chi-square test of independence and Cramer's V-test were performed. The considerations were concluded with detailed and general conclusions. The summary also indicated some limitations that occurred during the research, especially those resulting from the SARS-CoV-2 pandemic. Recommendations for further research and business practices were also proposed.

The results of the conducted research contribute to the theory of science, i.e. to the disciplines of *management and quality science* as well as *economics and finance* in the form of the proposed methodology for assessing mobility status and needs in this area, as well as a research tool. The Author's individual contribution is primarily the development of a theoretical model – a system of coordination and cooperation of innovations in the field of mobility (passenger transport) in a peripheral region. The practical application of the results of the research includes recommendations for cooperation of the interested parties in the field of mobility and recommendations for a mobility strategy in Hajnówka County.

Streszczenie

Mobilność na obszarach peryferyjnych stanowi często barierę w ich rozwoju. Ograniczenia dotykają przede wszystkim mieszkańców tych regionów, ale również turystów. Przedmiotem i problemem badawczym niniejszej pracy są ograniczenia w zakresie mobilności w obszarach peryferyjnych. Głównym celem badań jest wypracowanie innowacyjnych rozwiązań w zakresie mobilności mieszkańców i turystów obszarów peryferyjnych na przykładzie powiatu hajnowskiego oraz opracowanie modelu systemu koordynacji i współpracy wdrażania innowacji w zakresie mobilności. W szczególności transport powinien być dostosowany do potrzeb mieszkańców, tak aby zapewnić im swobodny dostęp do podstawowych potrzeb społecznych. Żeby zminimalizować te problemy, konieczne jest podjęcie działań, które pozwolą uzyskać pełne informacje o potrzebach mieszkańców w zakresie mobilności i które pomogą władzom lokalnym podejmować działania w zakresie wzrostu efektywności systemów transportowych poprzez wdrażanie innowacyjnych rozwiązań, co z kolei powinno się przyczynić do poprawy dostępności tych obszarów.

W opracowaniu sformułowano następujące szczegółowe cele badawcze:

- P1 – Ocena problemów i potrzeb mobilności mieszkańców i turystów w powiecie hajnowskim.
- P2 – Ocena stopnia nasycenia usługami transportowymi powiatu hajnowskiego – czy i w jaki sposób obecna oferta usług transportowych spełnia oczekiwania mieszkańców i turystów?
- P3 – Ocena potrzeby wprowadzania zmian i innowacji w infrastrukturze transportowej i usługach mobilnych.
- P4 – Opracowanie modelu systemu koordynacji i współpracy w zakresie wdrażania innowacyjnych rozwiązań mobilnych w powiecie hajnowskim.

Monografia podzielona jest na dwie główne części – teoretyczną i praktyczną – i składa się ze wstępu, czterech rozdziałów i wniosków. W pierwszym rozdziale przedstawiono wprowadzenie do teoretycznych aspektów innowacji jako tło dalszych rozważań. Rozdział drugi opisuje specyficzne problemy obszarów peryferyjnych, w tym kwestie mobilności. Kolejny rozdział zawiera charakterystykę metod i procedury badania problemów i potrzeb mobilności mieszkańców i turystów. Czwarta część to prezentacja i systematyzacja wyników badań usług w zakresie mobilności mieszkańców i turystów powiatu hajnowskiego, które stały się podstawą do konstrukcji modelu systemu koordynacji i współpracy w zakresie wdrażania innowacyjnych rozwiązań

mobilnych na obszarach peryferyjnych. Badania prowadzono na terenie powiatu hajnowskiego, głównie w Puszczy Białowieskiej, która jest najatrakcyjniejszym obszarem powiatu. Badania potrzeb ruchowych mieszkańców i turystów powiatu hajnowskiego przeprowadzono metodą sondażu (sonaru diagnostycznego). Zastosowano dwie metody badawcze: F2F (*face to face*) oraz CAWI. W obu przypadkach respondenci lub ankieterzy mieli możliwość pobrania kwestionariusza ankiety na swoje urządzenie mobilne (smartfon, tablet) poprzez zeskanowanie kodu QR. Zastosowanie różnych technik badawczych było konsekwencją nieoczekiwanej w skali globalnej sytuacji. Pandemia SARS-CoV-2, która spowodowała wprowadzenie znacznych ograniczeń w poruszaniu się, wymusiła na badaczach przeniesienie części (kontynuacji) badań do przestrzeni wirtualnej. W celu obliczenia korelacji między poszczególnymi zmiennymi przeprowadzono test niezależności chi-kwadrat oraz test V-Cramera. Całość rozważań zakończono wnioskami szczegółowymi i ogólnymi. W podsumowaniu wskazano także na pewne ograniczenia, które wystąpiły w trakcie prowadzenia badań, szczególnie wynikające z pandemii SARS-CoV-2. Zaproponowano również rekomendacje do dalszych badań oraz praktyki gospodarczej.

Wyniki przeprowadzonych badań wnoszą wkład do teorii nauki, czyli do dyscyplin *nauki o zarządzaniu i jakości* oraz *ekonomia i finanse* w postaci proponowanej metodyki oceny stanu mobilności i potrzeb w tym zakresie, a także narzędzia badawczego. Indywidualnym wkładem autorki jest opracowanie modelu teoretycznego – systemu koordynacji i współpracy innowacji w zakresie mobilności (transportu pasażerskiego) w regionie peryferyjnym. Praktyczne zastosowanie wyników badań obejmuje rekomendacje współpracy zainteresowanych stron w zakresie mobilności oraz rekomendacje strategii mobilności w powiecie hajnowskim.

Appendix 1

Description of the methods and procedure of citizens and tourists mobility needs research conducted by partners of the MARA project "Mobility and Accessibility in Rural Areas – New Approaches to Developing Mobility Concepts in Remote Areas"

No	Country	Region	Organisation	Research methodology
1.	Germany	Mecklenburg-Vorpommern based on case study of Ludwigslust – Parchim district	The Ministry of Energy, Infrastructure and Digitalization	• desktop and research evaluation of studies, policy and planning documents: • literature review of spatial and transportation concepts and plans/ statements from expert interviews to identify mobility needs; • examples of best practices for flexible transportation offers; • recommendations to improve mobility in rural areas with the help of flexible transportation offers and further measures; • aims/recommendation out of policy and planning documents and their verification/check-up regarding up-to-dateness regarding actual mobility and regional development challenges; • the results of Population Mobility Monitor developed by University of Tartu; • the results by mapping created by University of Dalarna
2.	Poland	Hajnówka and Białowieża Region	Bialystok University of Technology and Hajnówka Regional Government (Powiat Hajnowski)	To identify tourist and inhabitants mobility needs diagnostic survey method with using "face to face" and CAWI research techniques were conducted. In both cases respondents or interviewers will be able to download the survey questionnaire on their mobile appliances (smartphone, tablet) by means of scanning the QR code. From the perspective of the "face to face" technique, the respondent will have access to the paper version of the questionnaire and be able to provide answers in the questionnaire or to the interviewer that will record them in an electronic version

No	Country	Region	Organisation	Research methodology
3.	Norway	Setesdal	Setesdal Regional Council (intermunicipal public body consisting of the four municipalities of Bykle, Valle, Bygland, and Evje and Hornnes)	For analysing the status-quo of the mobility situation in our region a survey was conducted among the inhabitants (Bykle and Bygland municipalities) of the region, and, also a mapping of existing national and regional plans concerning mobility and transport issues
4.	Latvia	Vidzeme	Vidzeme Planning Institute	To identify mobility needs in the region, a desk study was performed reviewing conducted studies and analysing results of the pilot projects (transport on demand and e-bike rental). Analytical methods were used for selection, compilation and analysis of statistical data from various databases (road administration, road transport administration, bureau of statistics and others). Also, a number of experts were interviewed about the local mobility options, the level of service and necessary improvements
5.	Russian Federation	Karelia	Tourist Information Center of the Republic of Karelia on the case of Zaonezhye area	The collection and processing of data on the study of accessibility in Zaonezhye as part of the project was organised in two stages. The first stage of the work was carried out in summer 2019 together with the Kizhi Museum-Reserve and the "Kizhi Ozherel'e" (necklace) and "Karelia Excursion Bureau" travel companies as part of a survey aimed at identifying the motivation of tourists from different regions of Russia and foreign countries to visit Kizhi Island. The second stage was organized during the summer 2020 when the research expedition aimed to conduct a survey of residents and tourists to identify the motivation to visit these places and the accessibility of the area, as well as to process the data obtained. In 2020, the interviewers were interested in the purpose of the trip, the availability of transport services, the services demanded in the remote areas of Zaonezhye. The survey was conducted in the village of Oyatevshchina, Velikaya Guba and on the islands of the Kizhi skerries. This is the first time such work has been done in the territory of Zaonezhye in the last few decades The field phase of the study was organised in June-September by the Centre of Social Tourism Development at the request of the Tourist Information Centre of the Republic of Karelia. "Zaonezhskaya Izba" NGO and the Sailing Federation of Karelia were involved in collecting information. Tools development, data processing and analysis (data entry, data processing and analysis, report preparation) were carried out by sociologist A.G. Chukhareva (Sociological Laboratory of PetrSU). The quantitative data obtained was processed and analysed in SPSS in October–November 2020

No	Country	Region	Organisation	Research methodology
6.	Lituania	Druskiennikai and Birstonas	Birštonas municipality and Druskininka municipality and Transport and Logistics Competence Centre, Vilnius Gediminas Technical University (VGTU)	Within the methods used, three groups were distinguished, i.e. quantitative methods (Pen-and-Paper Personal Interviews (PAPI) and Computer-assisted Web interviewing (CAWI)), qualitative methods (In-depth Interview (IDI), Case Studies and Desk research method)

7.	Finland	Kymenlaakso Region	Finnish Environment Institute SYKE	SYKE has developed a transport model (SYKE transport model) and population and housing prediction model (KASSU), of which SYKE transport model is applied in regional use for the first time in Kymenlaakso. Also, the use of KASSU model is a tool for estimating the future and potential of different parts of Kymenlaakso. KASSU enables making regional and local population predictions and scenarios. It helps in finding out the most efficient land use planning strategies. In Kymenlaakso KASSU is used for:
				• estimating the effect of changing the attractive shore locations for summer house use to permanent housing. One question is whether this will attract new inhabitants to those locations. If so, this would enable also better public transport, as well as new immigrants;
				• scenarios made with KASSU are directed to rural areas and currently include two scenarios:
				  • trend scenario: the population trend during the last five years continues similarly from 2020 onwards,
				  • after COVID-19: Increased telework opportunities and digitalisation of work will increase the attraction of villages and other rural areas in Kouvola especially within families with small children and people in working age. The in-migration of these age groups begin to rise in rural area types from 2020 onwards

Source: compiled based on the MARA project WP2 final report.

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