
Effectiveness of Shaping Multidirectional Functions of an Airport for the Development of the Region

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Joanna Hawlena¹, Grażyna Kowalska², Rafał Rowiński³, Monika Madej⁴.

Abstract:

Purpose: The study aims to supplement and specify the methodological assumptions to improve the comprehensiveness of research on the issues raised.

Design/Methodology/Approach: The configuration and scope of the methodological requirements of the research process were based on the available literature, statistical data, calculations and interviews with the staff of the Lublin airport, major entities in the region, and empirical research and assessments carried out periodically by scientists and local administration.

Findings: The implementation of the assumed goal requires verification of the methodology of conducting the research's discussed scope. Contemporary market conditions require a departure from fragmentary research towards a comprehensive assessment of the issues raised. In such a research model, the results of empirical research and interviews with representatives conducting a given activity and scientific authorities are of particular importance.

Practical Implications: The reliability and universality of research become an absolute requirement of the moment and a decisive attribute of the effectiveness level of analyses and assessments. The research methodology presented in the study, due to its universality, can be used in the study of the discussed relationship in each region, relating to any entity of transport activity.

Originality/Value: The presented research methodology on the issues raised enables comprehensive research, both based on theoretical and pragmatic assumptions. It extends the scope of its use as a simplified method of determining the desired results.

Keywords: Airport, region, methodological model, impact.

JEL codes: A13, C81, L93, O11, R58.

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¹University of Life Sciences in Lublin, Faculty of Agrobioengineering, Department of Tourism and Recreation, hawlena@pl;

²Corresponding author, University of Life Sciences in Lublin, Faculty of Agrobioengineering, Department of Tourism and Recreation, grazyna.kowalska@up.lublin.pl;

³University of Life Sciences in Lublin, Faculty of Agrobioengineering, Department of Tourism and Recreation, badaniaawf@wp.pl;

⁴Kielce University of Technology, Faculty of Mechatronics and Mechanical Engineering, Department of Mechanics, mmadej@tu.kielce.pl;

1. Introduction

In the situation of the increasing importance of air transport, the dynamic development of ports and the expansion of the network of connections as well as a regional and global family, tourist and business contacts, there is an urgent need to examine the effectiveness of the multifunctional impact of an airport on the specificity of the development of the region associated with it (Kujawiak, 2019).

Correct examination of this issue requires using a specific methodology for conducting analyses and assessments, both in terms of identifying the effects of the impact of universal and regional determinants (Hawlana, Dudek, and Kasztelam, 2019). Assuming that the research methodology should strictly correspond to real events and processes, its scheme was built on the knowledge of the functioning of the Lublin-Świdnik airport and its impact on the development of the region of the Lubelskie Voivodeship. The purpose of this article is not to calculate a specific dimension of benefits resulting from the mutual relations between the functioning of a port and the activities of environmental, economic entities related to it, but to present the method and scope of the necessary research to enable the correct assessment of the effects of this relationship. Therefore, it is a theoretical study, organizing and supplementing the research process based on a specific methodological procedure.

Documentation concerning the commencement of operations and the subsequent years of operation of this airport allow for reliable verification of the assumption according to which airports are credited with the emergence of one of the most effective, expected and effective stimulators of multidirectional environmental activity, which plays the role of a strategic factor in the comprehensive and complementary development of the region (Pancer-Cybulska and Olipra, 2016).

The methodology of researching this process requires not only determining the efficiency of port allocation but also a wider range of investments related to the construction of facilities in the immediate vicinity as well as regional economic and social, tourist, gastronomic, hotel and cultural space corresponding to the needs of the local and visiting community. This analysis scope aims to show which industries and entities will benefit from functioning and what benefit the airport will derive from their feedback (Banister and Berechman, 2000).

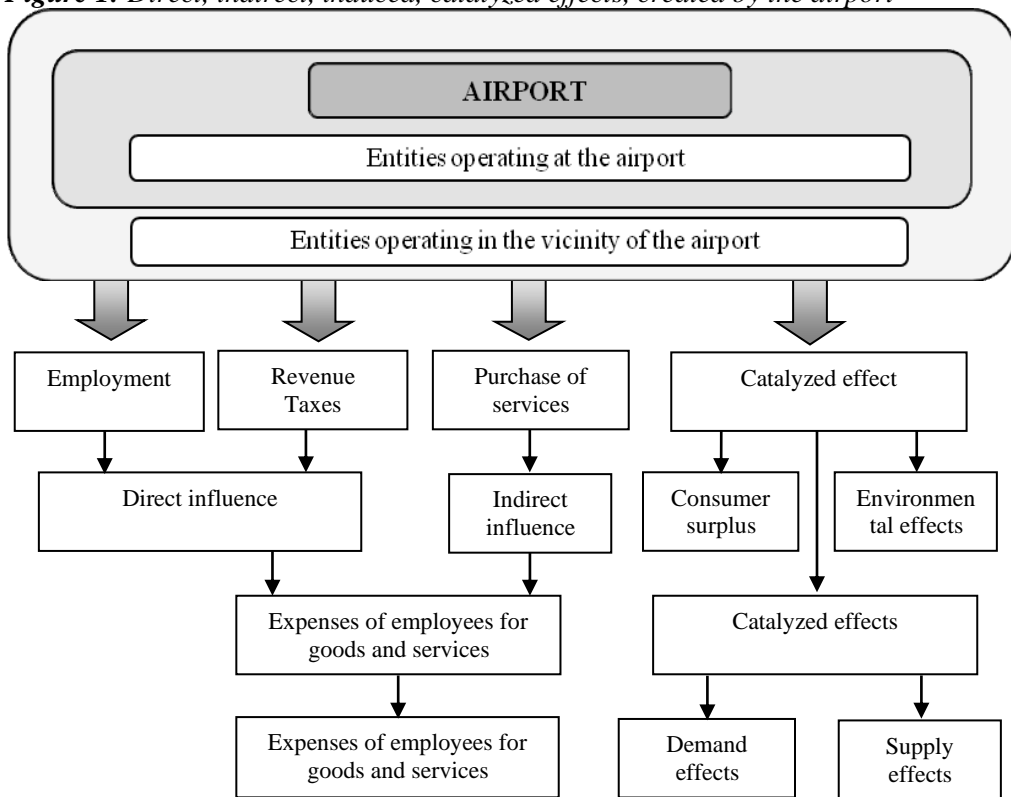
It is a process of determining the size of the effects of individual stimulators and conditions shaping the convergence of this relationship. This approach to the topic requires implementing a research methodology that demonstrates the effects of both the airport's allocation and operation, the benefits of using environmental infrastructure and the activities of business entities, and determining the revenues to the local budget (Augustyniak, 2019). The methodology of this area of research should use the method of literature and statistical data analysis (*desk research*), the method of calculating the effects with the use of specific mathematical formulas,

making estimates with the participation of scientific authorities and practitioners (*web research*), and the effective scope of empirical research. Besides, the multipliers method is used by International Airport Council to calculate individual categories of effects according to the M. Rekowski model and *cost-benefit analysis* proposed by the OECD (Rekowski, 2011). For the source and reliable research of the undertaken issues, it is necessary to conduct a specific scope of empirical research in the form of direct interviews with the organizers of economic and social life, to establish the real dimension of the effects generated by the functioning of the port and entities in the region operating in a specific connection with the airport (Thlon and Marcinak-Piotrowska, 2013).

2. Structure and Methodology of the Studied Effects

The methodology outlined in the presented study is used to determine measurable, estimated and immeasurable effects (Cooper and Smith, 2002). These are the effects resulting from the influence of direct, indirect, induced and catalytic effects, determined statically (Figure 1).

Figure 1: Direct, indirect, induced, catalyzed effects, created by the airport



Source: Own study based on Huderek-Glapska 2011.

This research aims to find answers to the questions: To what extent does the regional airport, as a key element of the transport infrastructure, influence the dimension of the generated effects, both in the immediate vicinity and in the region. As part of the adopted methodology, the research's subject structure has a significant value, allowing to identify not only economic, social and environmental effects, but also in terms of legal and material security of the conducted activity (Wilk, 2016).

According to the methodological assumptions set out in the study, it is important to determine the value of the potential in selected areas, both in the period preceding and following the launch of the port. Such a structure of research allows to identify the dimension of improvement or deterioration of benefits, i.e., the degree of impact on the development of the direct agglomeration and the entire region. The proposed method of comprehensive research is rational both from a scientific and a pragmatic point of view. Due to its universality, it meets the requirement of usefulness and broadens the knowledge of the subject. However, it should be noted that the level and effectiveness of these studies is determined by the scope and depth of their conduct, mainly the degree of clarification of the dimension of the influence of conditions and determinants on the final effect of the forming dependence (Gillen, 2004).

Based on the basic scope of knowledge and the available results of research on the effects related to the functioning of the Lublin-Świdnik airport, it can be concluded that the "driving force" of the economic and social development of the region was its allocation, and in subsequent years its development (Hawlina, 2016). In most agglomerations, such a port is the only or one of the few strong economic entities, decisively changing the existing market relations in the immediate agglomeration and the region, acting as a center for activating innovative tasks and goals (Trzepacz, 2008). Taking this into account, first, one should use those attributes of the methodology that enable effective analysis and evaluation of facts and achieve the intended goals. Such a methodological assumptions scheme makes it possible to clarify the measurement of the impact of a wide range of determinants and the degree of impact of individual elements of the airport's operation on the development of approving motivation to implement multidirectional tasks. It is visible in its gravity area, mainly in the economy, services, trade and tourism. In this sense, the research process must be subordinated to the complexity of the discussed process. Undoubtedly, it is a simplified research method. Still, the degree of its universality is a measure of the desired usefulness, enabling it to analyze similar relations in any regional airport catchment area.

A properly configured research methodology should also include the principle of determining specific risks, in particular those related to defective investment allocation, having a low fund of funds, mismanaged facilities or failure to adapt their infrastructure parameters to the current and future needs of all levels of market consumption. In this understanding, the research and organizational process must

have validity disciplines because they also identify the impact of negative determinants.

The available literature analysis shows that, both in global research and in Poland, we still find gaps in the model of the discussed methodology. For this reason, this study attempts to supplement some of its elements, mainly the unequivocal identification of determinants and the effects they cause, both in terms of port allocation and development. These include factors activating the demand and supply spheres developing in many subregions and measurable effects resulting from business initiatives, the role of public and private capital, benefits generated by the development of environmental transport infrastructure and quantifiable effects in terms of direct, indirect, induced and catalytic effects (Cooper and Smith, 2002). These are relatively simple and effective research methods to determine the dimension of changes in a specific environment and the role of ports in developing a region.

Adjustment of the research methodology appropriate for a given branch enables effective analysis and evaluation of the discussed issues. It increases the degree of effectiveness, reliability, and effectiveness of their implementation in measurable and non-measurable benefits. Therefore, it can be shown that they are the sum of the real and multiplier effects determined statically, although they can also be demonstrated in a dynamic approach.

The methodology system for studying the impact of an airport on the region's economy should also use the method proposed by Airport Council International, which establishes a forecast based on the formula according to which the airport generates 1.4 to 2.5% of regional GDP. Such a significant range of estimates depends on the dimension of air traffic, which depends on the balanced portfolio of carriers, including members of airline alliances, and the degree of participation in the available network of domestic and foreign connections. It can be assumed that incoming people's stay has a significant impact on local unemployment because the regional airport alone employs approximately two hundred fifty people. The activities of the tourist and catering industry entities operating in the region indirectly generate approx. 400 jobs. Another measure of the examined impact is the assumption that one passenger served at a regional airport generates an additional PLN 750 in the region.

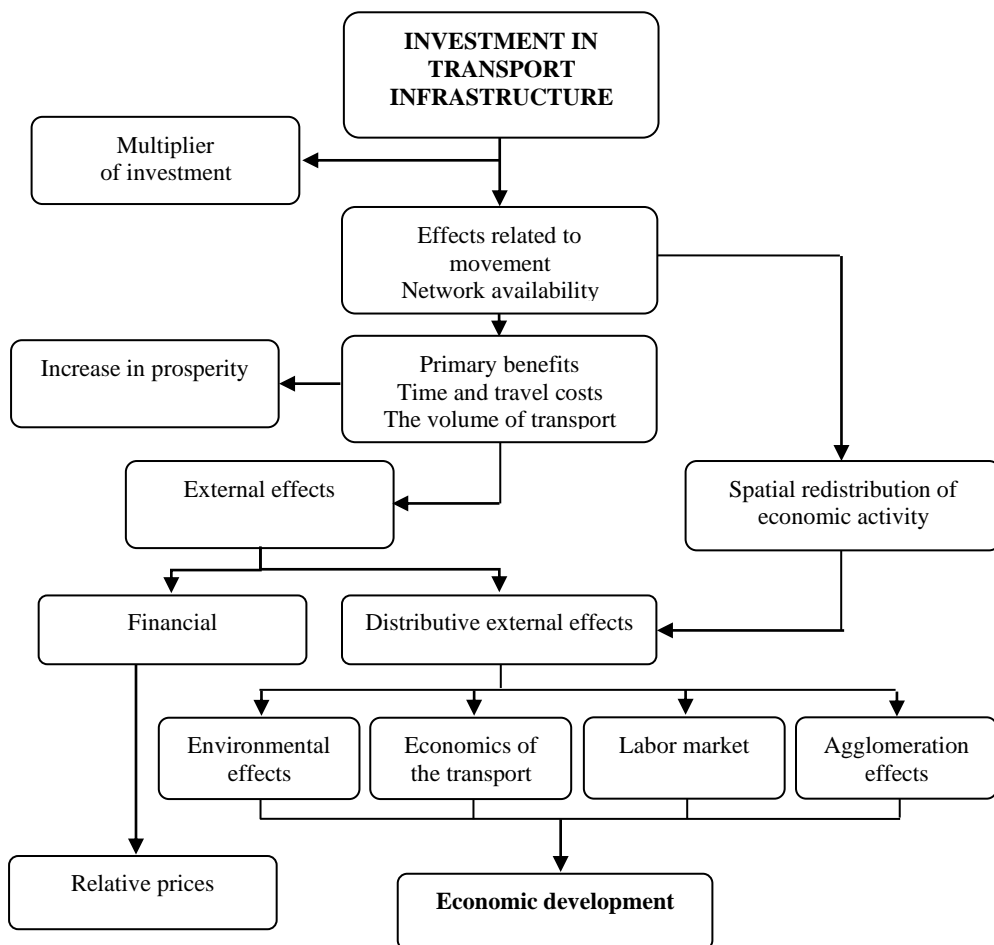
A properly configured research methodology for the discussed issues should include recommendations obliging to achieve the basic goals, which include:

- possibly accurate and communicative demonstration of the importance of mutual relations between the impact of the port and environmental, economic entities, and the effectiveness of local administration and human resources activities,

- proper identification of the most important determinants of shaping the studied events and the discussed process in relations of mutual dependence,
- working out the most accurate, effective and reliable method of measuring the effects of undertaken projects related to the relationship's functioning in question.

The diagram presented in Figure 2 gives a communicative view of implementing the assumed research goal and considering the subsequent stages of measuring the expected results.

Figure 2: A diagram showing the impact of transport investments on economic

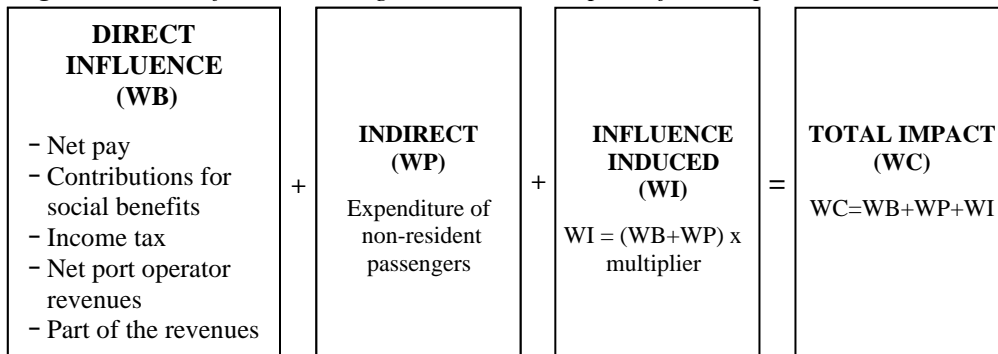


Source: Banister, and Berechman, 2000.

The above diagram presents the next steps illustrating the methodology of conduct in studying the impact of transport investments, including the airport, on the economic and social development of the region. However, staying at this level of research

would be an insufficient assumption. In the comprehensive implementation of such a goal, it is also necessary to use the experience of other researchers to date, including M. Rekowski, indicating that the analysis of this issue requires the use of the method of measuring the direct, indirect and induced impact on the development of the economy in the closer and more distant surroundings of the port. It is one of the most important research areas, enabling the determination of an airport's economic impact on the shaping of the economy of the city and the region (Rekowski, 2011). The calculation model presented in Figure 3 should be used to achieve this goal.

Figure 3: Model for calculating the economic impact of the airport



Source: Huderek-Glapska, 2011.

It should be noted that it is relatively easy to determine the effects of direct impact based on data collected in ports and entities operating in its area and the immediate vicinity (De Salvo, J. 2002). Indirect impact requires a certain level of respect based on the length of stay of arriving travellers and departing persons' interviews. The greatest difficulty is related to estimating the induced effect multiplier for a given region because these data are most often prepared only at the country level (Hawlena, 2012).

3. The Methodology of Studying Direct and Indirect Effects

The previously presented methodology for calculating an airport's economic impact requires supplementing with research results and statistical data collected in the documentation of the local administration. These information sources allow for more accurate estimates of the regional induced effect multiplier. However, to a limited extent, the regional statistics collect data on regional inter-industry flows (e.g., the value of production, income, employment), compiled mainly at the country level. For the region, this multiplier is estimated at between 1.1 and 1.3.

The above observations show that in the available literature, considering the impact of an airport on the region's development requires comprehensive analysis and verification. It is important because, from the commencement of construction, there is a significant revaluation of environmental relations in subsequent operation

periods. It can be seen both in the entirety of environmental economic, social and cultural relations and in building the principles of functioning of the changing model of the region's development.

In the era of market liberalization and integration of regions activating peripheral areas, the airport becomes a key investment (Jankiewicz and Huderek-Glaska, 2016). Due to it, new directions of activity in local and regional initiatives are created, both for economic entities, institutions and business teams. They constitute the current source of motivation and material base necessary to create a new model of strategy related to the improvement of competitiveness and innovation in port gravity (Strobach, 2010). The research methodology understood in this way should consider the analysis of demand and supply, the impact of transport infrastructure on the region's economic development, recommended by Rietveld and Bruinsma (Rietveld and Bruinsma, 1998). The classification of the effects performed by these authors considers the time of their impact and the channels of influence (Table 1).

Table 1. *Classification of the effects of infrastructural investments in transport taking into account the time and channel of impact*

	Demand effects	Supply effects
Temporary effects	The effects of the investment Push effect	-
Non- temporary effects	The effects of functioning and maintenance of infrastructure	Impact on productivity and location of the activity

Source: *Rietveld, and Bruinsma, 1998.*

Their value results from the fact that the area and period of the research of the effects relate both to the airport construction phase (short-term development impulse) and the permanent impact of its functions on regional development in the long-term use of the created infrastructure (Kamińska and Rusak, 2000).

The research can also be extended using the measure of acceptance of these changes, i.e., willingness to pay, which is a function of the surplus of the consumer's funds over the costs incurred. This scope of the analysis should be based on examining the criteria proposed by the OECD, presented in Table 2.

Table 2. *Effects of development and use of transport infrastructure*

Economic effects	Socio-economic effects	Environmental effects	Safety effects
- Impact on the level: <ul style="list-style-type: none"> • costs of construction, maintenance, operation and repair of infrastructure • costs of purchase and operation of means of transport • revenues from fees for using 	- Changes in the transport accessibility of the region - Changes in employment and income in the region - Redistribution of employment and income	- Impact on the level of soil and water air pollution and noise - Impact on the preservation of cultural	- Impact on safety on transport routes

<p>the infrastructure</p> <ul style="list-style-type: none"> - User benefits <ul style="list-style-type: none"> • change of travel time • change in the consumables costs of vehicles - Transport network effects <ul style="list-style-type: none"> • creating new transportation • inter-branch demand shifts • improvement of transport reliability • change in the quality of the transport service 	<p>between regions and socio-economic groups</p> <ul style="list-style-type: none"> - Increase in economic activity caused by the undertaking - Changes in efficiency and production - Migration of production factors - Changes in social integration - Changes in the value of the property 	<p>heritage</p> <ul style="list-style-type: none"> - Impact on flora and fauna - Change in spatial development 	
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Source: Kamińska and Rusak, 2000.

The methodological assumptions' effectiveness means that the structure and scope of the effects specified in the table are intended to indicate that the main measurement tool is a cost-benefit analysis based on the economic calculation using the formulas recommended by ACI Europe (Huderek, 2011). According to these recommendations, the total impact of the port on the development of the region is determined as the sum of the inflows generated in the area of direct (W_b), indirect (W_p), induced (W_i) and catalytic impact, also referred to as stimulated (W_k). Based on these figures, the total economic effect will be calculated according to formula 1.

$$W_c = W_b + W_p + W_i + W_k \quad (1)$$

where:

W_c - total impact,

W_b - direct impact,

W_p - indirect impact,

W_i - induced impact,

W_k - catalytic influence.

The data used to calculate this value also allows for a reliable estimation of the size of created jobs, resulting from the airport's operation in the area of its gravity. According to research carried out at European airports, this dimension is expressed in formula 2.

$$W_{kz} = \frac{W_p + W_i}{W_b} \quad (2)$$

where:

W_{kz} - the size of jobs created by the operation of the airport in the region,

W_b - direct impact,

W_p - indirect impact,

W_i - induced impact.

The employment size calculated in this way at European airports fluctuated within the limits set by the multiplier from 1.8 to 3.0. In the conditions of the Polish airports' influence, the value of this multiplier can be set at 2.1.

Using the components of the underlying formula used by ACI Europe, the GDP growth rate can also be estimated with high probability. Studies carried out at European airports have shown that the combined effects of direct, indirect and induced impact ($W_b + W_p + W_i$) generate 1.4 to 2.5% of GDP. It is also worth paying attention to the reasons that negatively affect the rate of GDP growth. The most important ones include the lack of port infrastructure development, insufficient capacity, resulting in limited interest in the port of new carriers and reduced air traffic. These reasons may reduce the previously estimated GDP growth by around 0.5% per annum.

The scope of the analysis is worth referring to the situation before the airport was opened, because in such a reference one can determine its probable impact on the dynamics of regional GDP growth in the next years of operation. As part of this analysis, a formula should be used to calculate the rate of economic growth (formula 3).

$$Swq = \frac{\Delta Y}{Y} \quad (3)$$

where:

Swq - economic growth rate,

ΔY - annual change in GDP,

Y- annual GDP.

In the analytical assessment of this problem, one can also use the formula for calculating the average GDP growth rate in the studied region, in relation to other regions or the country. This ratio can be calculated as the ratio of the GDP growth rate in a given region to the average increase in the GDP rate in the reference area (formula 4).

$$\hat{S}_{sw} = \frac{W_i}{W} \quad (4)$$

where:

\hat{S}_{sw} - average GDP growth rate in the i-th region,

W_i - GDP growth rate in the i-th region,

W - average growth rate in the area of greening.

Both indicators make it possible to identify the degree of benefit or regress expressed in terms of the region's economic potential. It is a measure that confirms

the legitimacy of the functioning of the discussed investment, among others, its importance for the region.

It should be emphasized that the scale of effects generated by an airport depends on the role it plays in the local and national transport system and its type. Ports with local traffic generate a smaller dimension of effects, while the largest international ones and hubs. Around these airports, multifunctional production, commercial, service and business and conference zones are created, of significant economic importance for the region and its inhabitants. The latest trend is to build port cities near these airports.

4. Summary

Correct use of the assumed methodology for carrying out the necessary analyzes is necessary to build a solid foundation for making key executive decisions in the port and region. It also makes it possible to select key areas eligible for the location of new investments or modernization of existing ones and the necessity to initiate the necessary participation of administrative bodies and society in projects aimed at the development of the entire voivodeship. The research methodology proposed in such a convention will make it possible to clarify the view on the impact of conditions and determinants on shaping the potential, perspectives and barriers to the development of initiatives, both relating to the port, existing and new entities in various branches of the economy and the participation of local administration, scientists and local business in this process.

References:

- Augustyniak, W. 2019. Ocena działalności portu lotniczego. In: Zarządzanie rozwojem portów lotniczych. Huderek-Głapska (eds). Warszawa: CH Beck, 125-152.
- Banister, D., Berechman, J. 2000. Transport Investment and Economic Development. London: Routledge, 173.
- Cooper, A., Smith, P. 2002. The Economic Catalytic Effects of Air Transport in Europe. EUROCONTROL Experimental Centre, 12-17.
- De Salvo, J. 2002. The Direct Impact of an Airport on Travelers' Expenditures: Methodology and Application. Growth and Change, 33(4), 485.
- Gillen, D. 2006. Airline Business Models and Networks: Regulation, Competition and Evolution in Aviation Markets. Review of Network Economics, 5(4), 367.
- Hawlena, J. 2012. Rynek niskokosztowych przewozów lotniczych a rozwój sektora turystyki. Radom: Instytut Naukowo-Wydawniczy SPATIUM, 191-194.
- Hawlena, J. 2016. Znaczenie lotniska Lublin-Świdnik w procesie rozwoju regionu. Autobusy-Logistyka, 12, 1574-1578.
- Hawlena, J., Dudek, M., Kasztelan, A. 2019. Determinanty jakości w świadczeniu niskokosztowych pasażerskich usług lotniczych w Polsce. Radom: Instytut Naukowo-Wydawniczy SPATIUM, 60.
- Huderek-Głapska, S. 2011. Wpływ portu lotniczego na rozwój gospodarki regionu. Uniwersytet Ekonomiczny w Poznaniu, 114-131.

- Jankiewicz, J., Huderek-Glapska, S. 2016. The air transport market in Central and Eastern Europe after a decade of liberalization - Different paths of growth. *Journal of Transport Geography*, 50, 45-56.
- Kamińska, T., Rusak, M. 2000. Kryteria społeczno-ekonomiczne decyzji infrastrukturalnych w transporcie. *Przegląd Komunikacyjny*, 3, 16.
- Kujawiak, M. 2019. Strategia rozwoju portów lotniczych. In: Zarządzanie rozwojem portów lotniczych. Huderek-Glapska (eds). Warszawa: CH Beck, 181-226.
- Pancer-Cybulska, E., Olipra, Ł. 2016. Porty lotnicze jako strategiczny czynnik rozwoju regionów w świetle regionalnych dokumentów programowych. *Studia Oeconomica Posnaniensia*, 4(7), 127-149.
- Rekowski, M. 2011. Regionalne porty lotnicze w Polsce – charakterystyka i tendencje rozwojowe. *Uniwersytet Ekonomiczny w Poznaniu*, 9-340.
- Rietveld, P., Bruinsma, F. 1998. *Is Transport Infrastructure Effective? Transport Infrastructure and Accessibility: Impacts on the Space Economy*. Berlin: Springer-Verlag 43.
- Strobach, D. 2010. Competition among Airports and Overlapping Catchment Areas: An Application to the State of Baden-Württemberg. In: *Airport Competition. The European Experience*. Forsyth P. (eds). Farnham: Ashgate, 261-269.
- Thlon, M., Marcinak-Piotrowska, M. 2013. Perspektywy i bariery rozwoju powiatu świdnickiego w otoczeniu Portu Lotniczego Lublin, *Projekt systemowy Kapitał Intelktualny Lubelszczyzny 2010-2013*, 13-16.
- Trzepacz, P. 2008. Regionalne uwarunkowania funkcjonowania portów lotniczych w Polsce. In: *Przekształcenia regionalnych struktur funkcjonalno-przestrzennych. Europa bez granic – nowa jakość przestrzeni*. Dozblasz, D. and S. Raczyk, A. (eds). Wydawnictwo Uniwersytetu Wrocławskiego, 202-209.
- Wilk, P. 2016. Polityka bezpieczeństwa w porcie lotniczym. *Studia Bezpieczeństwa Narodowego*, 317-339.
- Zioło Z. 2009. Przestrzenne uwarunkowania spójności regionów europejskich In: A. Prusek: *Problemy i efekty polityki spójności w polskich regionach*. Wydawnictwo Wyższej Szkoły Gospodarki i Zarządzania w Krakowie, Cracow, 70-77.