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Regional aviation for local development in the context of public funds investment

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Abstract

This article presents an analysis of the effectiveness of public support for the sustainable development of local communities. It contains a review of the literature on aviation relationships with local development and business models of regional carriers. Research includes a case study and a comparative analysis of this type of support in the EU environment. Therefore, the collected data came from own research and information provided by the European Commission. The research question posed in the paper concerns the legitimacy and efficiency of this type of support in the context of the legal framework, case study and statistical European analyses. The results make it possible to draw conclusions with respect to reporting such public services, average costs, as well as differences in interpretations of state aid legislation in this area. The key contribution of the paper to the scholarly literature is efficiency assessment for this type of support and identification of weaknesses in the data published by the European Commission on PSO. The summary presents recommendations for decision-makers and potential directions for further research.

Keywords: aviation; regional; PSO; sustainable development; local.

1. Introduction

Public funds play a key role in working towards sustainable development. Private and social financing also plays a part, but does not cover all the needs in this regard. This is important because public funds are used by the authorities in conjunction with regulatory tools that are assumed to bring benefits to a given area. These principles also apply to the aviation economy which, however, is commonly perceived to be less associated with public support and local development. Nonetheless, in many places around the world, including the European Union, the authorities initiate, support, and organize passenger air transport in order to improve the quality of life of local communities, in particular where economic considerations undermine the sense of conducting such activities only on business terms. Thus, this typically applies to areas with difficult access by alternative means of transport, such as island areas. The tool used in this field in Europe is the Public

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Service Obligation (PSO). Therefore, in planning and financing ordered air connections, the authorities must respect the conditions and requirements set out in Articles 16-18 of the Air Services Regulation No 1008/2008, as well as the Commission Notice from 2017 – Interpretative guidelines on Regulation (EC) No 1008/2008 of the European Parliament and of the Council – Public Service Obligations (PSO). Thanks to them, various local communities can access the global network of transport connections, but also such basic public services as medical care, etc. For smaller communities, it is rarely possible to use supra-regional aviation, as fully-fledged airports are not located in sparsely populated areas. The answer to their needs is, to a greater extent, regional aviation which with well-designed support can significantly strengthen local development. Expenditure is relatively low compared to alternative investments, such as bridge or highway construction for small-scale land traffic purposes only. The capacity of regional aircraft is significantly lower, but completely sufficient in the context of the size of the communities served. This is due to the basic assumptions of the business model of regional air carriers. They often use small turboprop airplanes in their operations that have a significantly less negative impact on the natural environment, which is important in the context of sustainable development assumptions. Thanks to lower engine inertia, turboprop airplanes are also safer than jet planes. Moreover, regional carriers are much more flexible in the planning and execution of air operations, which translates into their potential to meet local transport needs more effectively. This is due to the fact that regional airlines rely on the standard half-year flight schedule planning cycles in supra-regional passenger aviation to a small extent, and operations at smaller airports do not require the use of SLOTs for planned take-offs and landings.

The limitations of the current state of knowledge concern the lack of analysis of the effectiveness of state aid directed to regional air carriers. Thus, the contribution of the article to the current state of knowledge consists in verifying the profitability of this type of aid, from the perspective of local communities and their local authorities.

These circumstances show there is a need for an in-depth analysis of the possibilities of using business models of regional air carriers for local development with the use of public funds in order to achieve high support efficiency and meet full requirements resulting from the management of public funds.

2. Literature review

Research shows that local development activities do not make up regional development, and that even when planning activities at the regional level, one cannot focus on local goals, as this leads to the effectiveness of regional development being low (Amin 1999). The local level is the subject matter of this article, so it should be considered that it may conflict with the assumptions of regional authorities, which usually have greater capacity than local authorities in the targeted spending of public funds. Local development is understood as a comprehensive process of improving the economic, social, and natural environment with the most effective use of endogenous resources, aimed at improving

the well-being and quality of life of the local population (Milán-García et al. 2019). At the same time, efforts to effectively collaborate on a local scale are very difficult, and they usually require long-term investments in social capital (Ioppolo et al. 2016).

At the same time, researchers are analysing the possibilities of achieving the sustainable development goals in aviation, but most of them focus on the international dimension, which has the largest share in civil aviation (Bonser 2019, De Mestral et al. 2018), or national dimension (Bugayko et al. 2020). In the local dimension, the impact of airports on their immediate surroundings has been mainly analyzed (Trojanek, Huderek-Glapska 2018), but there are few analyses in the context of the positive impact that aviation might have on sustainable local development (Button 2020). Despite this, there are certain studies in the scientific literature which indicate the potential of aviation in the development of small communities, mainly island communities, whose economic development is based on tourism, and therefore requires a rational transport network (Karampela et al. 2017). The first studies on the use of electric aircraft to support sustainable development are also being written, which is important in the view of the high emissivity of this mode of transport (Alvestad et al. 2020, Reichmann 2021). Introducing them on a large scale will significantly influence the environmental impact of aviation.

European legal solutions allow the authorities to influence the development of aviation in peripheral areas under PSOs (Leandro 2021, Ydersbond et al. 2020). Similar solutions include “Essential Air Services” (EAS) observed in the USA (US Department of Transportation 2017), and the “Remote Air Service Subsidy” (RASS) in Australia (Australian Department of Infrastructure, 2020). This framework allows designing the development of small communities using civil aviation transport solutions. Therefore, it is necessary to analyse the scope, purposefulness, and tools for this in terms of ensuring the effectiveness of this type of support for local communities. This will enable decision-makers to rationally direct public funds for the benefit of areas which, for various reasons, are disadvantaged in terms of access to the global transport network. There are certain scientific studies concerning this field in the literature, but they are mostly related to the use of models in optimizing the benefits of airlines or passengers (Leandro 2021). This article aims to verify the effectiveness of support tools in the context of sustainable local development, and therefore the benefits for the community of people living in a given area.

The business model of a regional air carrier is missing from most studies (Lohmann, Koo 2013, Sengur, Sengur 2017), although it still potentially constitutes an attractive and perspective tool for improving the coherence of transport networks (Chabiera 2021). Therefore, its key elements that have an impact on the potential support for the development of local communities should be identified. At the same time, it cannot be ignored that, according to some researchers, current business models in the area of regional air connections do not match the growing demand for this type of services (Knibb 2012).

3. Methods

The research conducted was qualitative, as knowledge in the area of research on public air services analysed at the local level and the diagnosis of current phenomena in real conditions is in its early stages of development. This allowed understanding the phenomena occurring with the use of public funds in regional transport at greater depth, and drawing scientifically valid conclusions (Meredith 1998). Moreover, such an approach enabled formulating hypotheses that go beyond the examined enterprises (Yin 2009).

The narrow knowledge in the subject matter of this article translates into a state of scientific uncertainty, as illustrated by divergent and insufficient research results (Knibb 2012, Lohmann and Koo 2013), and also confirmed in other analyses (Baker et al. 2015, Merkert, Beck 2017). Therefore, this justifies conducting an exploratory study based on qualitative tools in the context of the identified research needs and from the perspective of justifying the specific nature and effectiveness of the adopted solutions.

Considering the above, and due to its purpose, the research conducted was of a descriptive and theoretical nature. In order to broaden the functional context, it included both a case study and a comparative analysis of PSO data, narrowed down to selected criteria. This made it possible to identify and understand the cause-effect relationships that would be difficult to determine based, for example, on a survey with respondents' opinions, as the study concerns phenomena that are taking place now. It also made it possible to analyse the actions taken from the point of view of their effectiveness and efficiency (Patton, Appelbaum 2003).

The own research was preceded by a general diagnosis and analysis of this specific market, which was the basis for determining the selection criteria for the case to be studied. In order to ensure that the entities surveyed were adequate to study assumptions, it was concluded that only regional airlines would be surveyed, i.e. carriers performing the majority of their air operations over a distance of no more than 500 km and/or less than one hour of flight (Graham 1997). In addition, it was decided that the lower limit of the carrier's lifetime would be adopted at 10 years. This assumption was aimed at eliminating start-ups, which are characterized by a specific business model, are more exposed to the risk of business interruption, and shape, to a lesser extent, the trends reflected in the entire sector (March 2019). Moreover, in order to broaden the analytical perspective, a decision was made to choose a company from the group of highly developed countries, as in their case it is possible to use public funds to support the development of local communities through air transport.

The first task in carrying out the research was to select an enterprise meeting the above-mentioned requirements and willing to participate in the study. To this end, a list of potential respondents was defined and inquiries for interviews with management representatives were sent. Most of the 50 inquiries sent went unanswered, but approval was ultimately obtained from two entities meeting the above criteria.

An interview questionnaire was prepared, based on the Canvas business model proposed by Osterwalder and Pigneur (2010), extended to include aspects of the impact

of public funds on the functioning of the enterprise and the effects of this support on local communities.

As a result, the study included an in-depth, partially structured interview with the management of a regional airlines which uses public funds to implement a policy of improving the quality of life of residents of peripheral areas. Due to the nature of the interview, it was not necessary to code the answers. The interview referred to facts, but with the awareness that the answers given by the respondent were related to their perception of the phenomena.

Regardless of the interview conducted, an analysis of secondary data from the available materials and organizational documentation of the entity was also carried out. This included press interviews, media information, and reports available on the Internet. This part of the analysis allowed partial verification and objectification of information collected during the interview.

Moreover, the data obtained made it possible to define the criteria for the comparative analysis of the PSO (European Commission 2019), which was the second part of the study. This allowed making the conclusions obtained in the first part of the study objective. The aim of the analysis was to determine the effectiveness and level of use of PSO for small communities in Europe. The criteria included the size of the town served (the number of inhabitants below 10,000), travel time to a larger urban centre (less than 1 hour), the size of the aircraft (up to 50 passenger seats), the number of months the connection is operated per year (min. 12), and the number of operations per week (min. 2). The average actual values from seven days between 12 and 19 March 2021 (flightradar24.com) were used to calculate the flight time, because the timetable data, including the operating reserve, often differs from the actual flight duration. To determine the number of passenger seats, the data of individual carriers and aircraft manufacturers found on their websites was used, taking into account the planes actually making the connections, and not the ones contracted under the PSO (data from flightradar.com). The size of the cities served was determined on the basis of national statistical data.

The adopted selection criteria made it possible to focus on small hubs, i.e. local communities regularly served by regional airlines, and led to obtaining a list of support tools that could be used for the analysis of effectiveness and the support tools used by public entities.

4. Results

4.1 Case studies

4.1.1 Case 1

The analysed airline mainly operates turboprop airplanes on sections of less than one hour of flight. Its registered office is in a highly developed country with public support mechanisms for the ordered air connections. It has a fleet of ten 19-passenger planes and currently employs around 300 people, including on-board, technical, operational, commercial, and administrative personnel. The carrier provides regular connections to a dozen or so small local communities (inhabited by as few as even several hundred people)

which can be reached by alternative means of transport over a period of four hours. This way, it enables their inhabitants to travel to other parts of the region or country, access public services that are unavailable in their locations, and, additionally, transport necessary goods. As a result of the COVID-19 pandemic, the company practically went bankrupt, as it was forced to cease its regular operations due to legal restrictions and a significant drop in demand for calls made, among other reasons. As soon as there was a risk that the market gap would not be filled by competitors, regional authorities stepped in and provided funding for aviation equipment and support for individual connections in line with the needs expressed by local communities.

> "The planes comes from the change [public support engagement – S.C.], so 7 of 10 planes that I have, do not represent any cost to the company" – said president of the company, describing the most important public aid for the carrier.

Thus, it was possible to provide transport services for residents who, for example, were deprived of hospitals or other important public services in their vicinity. However, public support was linked to certain conditions set by the authorities, and concerned changes in the management of the company and downsizing. This reduced the profitability of the airline, but allowed it to survive and also generate profits – an added value for the owners. Thus, the aid obtained from public funds translated into benefits for various stakeholders of the enterprise, despite the fact that some of them (e.g. dismissed employees and managers) did not take advantage of it.

4.1.2 Case 2

This airline use one regional jet and thirteen turboprop airplanes on less than one hour flights. It's based in a developing country without public support mechanisms for the aviation sector. The carrier provides regular connections, mostly on touristic destinations. Before COVID-19 appeared, tourists were 70% of their passengers. The airline served local communities, by deliver them customers, which bring even 80% of all income in this region. As a result of the pandemic's constrains the airline loss almost 40% of travellers and had to close half of the connections. Nevertheless they didn't fired any of employ and they kept all the fleet. They method to survive was obtaining government contract for the promotion of the region. It covers biggest costs as leasing of the planes, labour and a fuel. The company showed a loss, but survived the most difficult period. After first collapse of travel market, they slowly rebuild they connection net and increase number of passengers.

The airline was not supported directly from public funds, but through the purchase of its services. This has significantly contributed to helping local communities as it has led to hold of local tourist infrastructure and many jobs. Contrary to Case 1, the aid granted was not subject to the requirements of the authorities, but nevertheless was aimed at the local tourism industry, which, without the key element enabling customers to come to the region, would be doomed to a deepened crisis.

4.1.3 Case studies – summary

The key element of business model of regional airlines, significant in the context of survive and develop is flexibility. On the other hand, in crisis circumstances, without public investment, it could be insufficient to hold helpful service for local communities.

The obtained research results confirm that this type of public aid is effective and necessary, regardless of the state's development level. This means that regional air connections are an important element of the transport infrastructure, important for some residents living in smaller towns or remote territories. Public support may take various forms, direct - providing financing for airplanes or personnel, but also indirect - in the form of purchasing services from carriers.

4.2. PSO Analysis

The criteria used narrowed the base of connections under European PSO to 33 (out of 176 communicated by the European Commission), including: two in Estonia, one in France, ten in Greece, one in Ireland, three in Sweden and 16 sixteen Great Britain. For the sake of clear data presentation, the following abbreviations have been adopted:

ES – Estonia
FR – France
GR – Greece
IR – Ireland
SW – Sweden
UK - Great Britain
J32 - Jetstream 32
BN2 - Britten-Normann 2B-26
C208 - Cessna 208
ATR - ATR 42-500
F50 - Foker 50
B200 - Beech B200 King Air
DHC - DHC-6 Twin Otter
ERJ - Embraer ERJ-145EP
CO – Country
AFT - Average flight time
NOS - Number of seats in aircraft
PCPP - Public cost per one passenger in EUR
TCOS - Total cost of support per year in EUR
SO - Seating offering
ANOP - Actual number of passengers
LF - Load Factor (%)
ND - No data.

The data has been rounded to the full value (Table 1).

Table 1: Selected PSO data for locations below 10,000 inhabitants, for 2018.

CO	Location	Destination	AFT	Air-craft	NOS	PCP P (€)	TCOS (€)	SO	ANOP	LF (%)
ES	Kardla	Talin	36’	J32	19	102	979538	ND	9604	85
ES	Ruhnu	Kuressaare	15’	BN2	9	289	381087	ND	1320	109
FR	Ouessant	Brest	18’	C208	9	234	735611	ND	3141	37
GR	Sitia	Athens	52’	ATR	48	45	ND	ND	21241	121
GR	Astypalea	Athens	53’	ATR	48	118	395000	ND	13005	99
GR	Kythira	Athens	41’	ATR	48	43	ND	ND	33054	250
GR	Leros	Athens	46’	ATR	48	112	ND	ND	23533	178
GR	Milos	Athens	24’	ATR	48	41	ND	ND	75426	571
GR	Naxos	Athens	29’	ATR	48	14	ND	ND	86413	655
GR	Skiathos	Athens	25’	ATR	48	17	ND	ND	46069	358
GR	Skyros	Athens	24’	ATR	48	67	473678	ND	12159	92
GR	Kasos	Rhodes	45’	ATR	48	1003	795000	ND	4069	31
GR	Astypalaia/ Leros	Rhodes	55’	ATR	48	2566	1089000	ND	668	11
IR	Aran Islands	Connemara	15’	BN2	9	38	1162769	63467	30458	48
SW	Hemavan	Stockholm	45’	F50	50	311	3442821	21000	11059	53
SW	Sveg	Stockholm	50’	B200	11	283	1823764	23000	6439	81
SW	Pajala	Lulea	36’	B200	11	440	1004932	6700	2285	38
UK	Barra	Glasgow	46’	DHC	19	123	1773007	ND	14437	77
UK	Campbeltown	Glasgow	27’	DHC	19	149	1304789	ND	8763	51
UK	Tiree	Glasgow	55’	DHC	19	161	1806161	ND	11190	55
UK	North Ronaldsay	Kirkwall	17’	BN2	10	59	195116	ND	6106	ND
UK	Papa Westray	Kirkwall	17’	BN2	10	59	178585	ND	5461	ND
UK	Sanday	Kirkwall	14’	BN2	10	59	178585	ND	3074	ND
UK	Stronsay	Kirkwall	15’	BN2	10	59	178585	ND	2361	ND
UK	Coll	Oban	30’	BN2	9	989	563980	ND	726	44
UK	Colonsay	Oban	25’	BN2	9	989	563980	ND	672	40
UK	Tiree	Oban	35’	BN2	9	989	563980	ND	800	48
UK	Coll	Tiree	15’	BN2	9	989	563980	ND	82	5
UK	Benbecula	Stornoway	22’	ERJ	50	46	395283	ND	8542	39
UK	Fair Isle	Tingwall	20’	BN2	10	1057	1031945	ND	2752	31
UK	Foula	Tingwall	16’	BN2	10	1057	1031945	ND	1120	20
UK	Out Skerries	Tingwall	12’	BN2	10	1057	1031945	ND	0	0
UK	Papa Stour	Tingwall	10’	BN2	10	1057	1031945	ND	35	2

Source: own study based on European Commission’s figures (2019).

The first conclusion drawn from the analysis of the above data is that the data is of low quality. The European Commission publishes the LIST OF PUBLIC SERVICE OBLIGATIONS for information purposes, based on the statements received from individual Member States, which translates into their inconsistency and divergent interpretations. For example, Load Factor is defined by the European Commission as a percentage ratio of the number of passengers to the seats actually made available on a given route. It is commonly used in the airline industry to measure airline passenger capacity, or as a performance measure to reflect airline performance (Jenatabadi, Ismail 2007). The equation describing this coefficient is as follows:

$$Load\ Factor = \sum_{i=1}^{r} \left(\frac{Number\ of\ carried\ passenger * distance}{Avaiable\ seat * distance} \right) * 100\%$$

Taking into account that this coefficient concerns the percentage of passengers filling the plane, it should not exceed the value of 100%. However, in many cases, the presented PSO statement shows this value to be above 100%, which contradicts the above definition. In the most extreme case (Naxos, Greece), the Load Factor reaches 655%. Attempts can be made to explain this by changing the originally assumed aircraft or the frequency of operations. Nevertheless, taking the above doubts into account, the Load Factor analysis based on the data provided by the European Commission is groundless.

Another question concerning data reliability involves the same total costs of a call per year for different numbers of passengers with the same unit costs. For example, flights from Tingwall (UK) to four different destinations have the same unit cost per passenger and total per year, but different values for passengers carried. It can be assumed that the PSO order included the execution of a certain number of connections, regardless of the number of passengers, but a more detailed analysis of the orders shows that what also varied was the expected minimum value of seats offered on a given route. In the case of Out Skerries the contract required 3,392 seats per year and four weekly operations, and not a single passenger took advantage of this offer. It seems more credible that the order concerned these four destinations in total and the indicated values constitute the sum for the entire order, and not for the individual routes, the more so as the comparison of flight time shows that some connections are twice as long as others. However, this means that the amounts indicated are not reliable. For unknown reasons, perhaps related to the difficulties in the analysis of reports concerning the implementation of the PSO on individual routes, or differences in the scope of national requirements, most locations do not have the data on the number of seats offered for a given connection.

The second observation concerns the differences in interpretations of EU regulations by different Member States. The list shows that some countries use PSOs to operate from very small airports and even landing sites (Ruhnu, Estonia), which are sometimes even organized ad hoc on a beach that is flooded during high tide (Barra, UK). In other countries, the official translation of Regulation (EC) No 1008/2008 of the European Parliament and of the Council indicates that this is not possible, as operations between airports only are allowed (Polish "lotnisko", as opposed to "port lotniczy", which both translated into English mean an “airport”). For these, national regulations specify numerous requirements in the field of security, fire and medical services, fencing, navigation equipment, and other fields (Aviation Law Act of 17 September 2020, Journal of Laws of 2020, item 1970 and ULC 2011). Thus, under the same regulation, the organization of the PSO differs from country to country.

The third phenomenon relates to the costs of support for individual communities. They are very diverse and partially correlate with the flight time on a given connection. Subject to the above data quality reservations, the minimum value of support per passenger was EUR 14 (Naxos, Greece) and the maximum, EUR 2,566 (Astypalaia / Leros, Greece), with an arithmetic mean of EUR 443 and a median of EUR 149. The minimum total

amount of support annually is EUR 381,087 (Ruhnu, Estonia), and the maximum is EUR 3,442,821 (Hemavan, Sweden), with the arithmetic mean value of EUR 913,963 and a median of EUR 795,000.

These data should be compared with information on the number of people who directly benefited from PSO support, i.e. passengers, who totaled 446,064 during the year for these 33 locations. On average (arithmetically), there were 13,517 people per connection, but one needs to note that in one case (Out Skerries, UK) not a single passenger showed up. The largest number of passengers for the connection was in Naxos (Greece) – 86,413 people. The median was 6,106 people per call. Therefore, averaging all connections, the cost of support per one passenger was approximately EUR 68, which is significantly less than the average cost per passenger resulting from the European Commission's LIST OF PUBLIC SERVICE OBLIGATIONS (i.e. EUR 443 – see above).

Taking indexation into account, EUR 68/pax. should be taken by decision-makers as a reference figure when planning the use of regional aviation to support connections to small local communities under PSOs.

5. Conclusions

The specific nature of the regional aviation business model, including the equipment used, high flexibility, and readiness to diversify sources of income, gives great potential for using this type of companies to support sustainable local development, in particular by improving the quality of life of members of small communities. The legal framework of developed economies makes it possible, albeit with certain limitations, to implement this type of support, as in the case of the European Union, such a role is played by the PSO. Therefore, decision-makers should each time calculate the various benefits and added values resulting from the use of this tool, and for the needs of such calculations, they can use the above-mentioned analysis results. However, the fact that input data was of poor quality cannot be ignored. This means that special attention should be paid to ensuring the effectiveness of support given, also in financial terms, which requires the use of indicators and measures that correspond to local conditions. For example, the hierarchy of needs in a given community may rank ecological issues much higher than transport accessibility, which will significantly reduce the potential of air transport in this area.

The European Commission should improve the quality of the data presented, standardize their format and harmonize the interpretation of its legal regulations so that they are understood the same way throughout the European Union. Otherwise, it leads to misinterpretation and discrimination against the inhabitants of some Member States.

Further research on the subject matter of this article should develop the analysis of support effectiveness, broaden the methodology to define new indicators and measures for sustainable development, including those covering the negative factors of aviation's impact on the natural environment or the well-being of the inhabitants of the towns served – e.g. due to noise. Further studies should also take into account the added value and

quality of life of members of local communities, their access to public services, and the global transport network.

Summing up, regional passenger aviation is a good tool to effectively support the sustainable development of local communities, although each time it should be individually assessed in the context of the needs and differences for individual locations.

References

Alvestad, K., Haug, S. O., & Jikiun, S. P. (2020) A study of the potential for sustainable aviation in Norway. (master dissertation). Høgskulen på Vestlandet, Norway.

Amin, A. (1999) An institutionalist perspective on regional economic development. *International journal of urban and regional research*, 23(2), 365-378. doi: 10.1002/9780470755716.ch3.

Australian Department of Infrastructure, Transport, cities and regional development. (2020) Remote Air Services Subsidy Scheme. Retrieved March 30, 2021 from https://www.infrastructure.gov.au/aviation/regional/rass.aspx.

Baker, D., Merkert, R., Kamruzzaman, M. (2015) Regional aviation and economic growth: cointegration and causality analysis in Australia. *Journal of Transport Geography*, 43, 140-150. doi: 10.1016/j.jtrangeo.2015.02.001.

Bonser, M. P. (2019) Global aviation system: Towards sustainable development. *International Journal of Aviation, Aeronautics, and Aerospace*, 6(3), 8. doi: 10.15394/ijaaa.2019.1356.

Bugayko, D., Hryhorak, M., Kharazishvili, Y., & Zamiar, Z. (2020) Economic Risk Management of Civil Aviation in the Context of Ensuring Sustainable Development of the National Economy. *Logistics and Transport*, 45.

Button, K. (2020) Boulding, Brundtland, Economics, and Efforts to Integrate Air Transportation Policies into Sustainable Development in Sustainable Aviation, (29-54), Palgrave Macmillan, Cham. doi: 10.1007/978-3-030-28661-3_3.

Chabiera, S. (2021) Perspectives for Development of Regional Passenger Aviation in Poland. *Journal of Aircraft and Spacecraft Technology*, 1-4. doi: 10.3844/jastsp.2021.1.4.

De Mestral, A. L., Fitzgerald, P. P., & Ahmad, M. T. (eds). (2018) Sustainable Development, *International Aviation, and Treaty Implementation*. Cambridge University Press. doi: 10.1017/9781316594216.001.

European Commission. (2019) List of public service obligations, Retrieved March 30, 2021 from https://ec.europa.eu/transport/sites/transport/files/pso_inventory_table.pdf.

Graham, B. (1997). Regional airline services in the liberalized European Union single aviation market. *Journal of Air Transport Management*, 3(4), 227-238. doi: 10.1016/s0969-6997(97)00032-x.

Ioppolo, G., Cucurachi, S., Salomone, R., Saija, G., & Shi, L. (2016) Sustainable local development and environmental governance: A strategic planning experience. *Sustainability*, 8(2), 180. doi: 10.3390/su8020180.

Jenatabadi, H. S., & Ismail, N. A. (2007) The determination of load factors in the airline industry. *International Review of Business Research Papers*, 3(4), 125-133.

Karampela, S., Papazoglou, C., Kizos, T., & Spilanis, I. (2017). Sustainable local development on Aegean Islands: a meta-analysis of the literature. *Island Studies Journal*, 12(1). doi: 10.24043/isj.6

Knibb, D. (2012) Model Muddle. Airline Business, 28(10), 28-31.

Leandro, F., Andrade, A. R., & Kalakou, S. (2021) Designing aviation networks under Public Service Obligations (PSO): A case study in Greece. *Journal of Air Transport Management*, 93, 102042. doi: 10.1016/j.jairtraman.2021.102042.

Lohmann, G., & Koo, T. T. (2013) The airline business model spectrum. *Journal of Air Transport Management*, 31, 7-9. doi: 10.1016/j.jairtraman.2012.10.005.

Marzec, P. (2019). Modele biznesowe organizacji innowacyjnych typu start-up. *Education of Economists and Managers. Problems. Innovations. Projects*, 52(2), 161-173.

Meredith, J. (1998) Building operations management theory through case and field research. *Journal of Operations Management*, Vol. 16, No. 4, 441–454. doi: 10.1016/s0272-6963(98)00023-0.

Merkert, R., Beck, M., (2017) Value of travel time savings and willingness to pay for regional aviation. *Transportation Research Part A: Policy and Practice*, 96, 29-42. doi: 10.1016/j.tra.2016.11.022.

Milán-García, J., Uribe-Toril, J., Ruiz-Real, J. L., & de Pablo Valenciano, J. (2019) Sustainable local development: An overview of the state of knowledge. *Resources*, 8(1), 31. doi: 10.3390/resources8010031.

Osterwalder, A., Pigneur, Y. (2010) *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons, Hoboken.

Patton, E., Appelbaum, S. (2003) The Case Studies in Management Research. *Management Research News*, vol. 26, no. 5, 60-71. doi: 10.1108/01409170310783484.

Reichmann, K. (2021) Widerøe Joins Rolls-Royce and Tecnam Partnership to Launch All-Electric Aircraft Service, *Aviation today*. Retrieved March 30, 2021 from https://www.aviationtoday.com/2021/03/12/wideroe-joins-rolls-royce-tecnam-partnership-launch-electric-aircraft-service/.

Sengur ,Y., Sengur, F.K. (2017) Airlines define their business models: a content analysis. *World Review of Intermodal Transportation Research*, Vol. 6, No. 2, 141–154. doi: 10.1504/writr.2017.082732.

Trojanek, R., & Huderek-Glapska, S. (2018) Measuring the noise cost of aviation–The association between the Limited Use Area around Warsaw Chopin Airport and property values. *Journal of Air Transport Management*, 67, 103-114. doi: 10.1016/j.jairtraman.2017.12.002.

ULC – Polish Civil Aviation Authority: Urząd Lotnictwa Cywilnego. (2011) *Podręcznik Służb Portu Lotniczego*, Retrieved March 30, 2021 from https://www.ulc.gov.pl/_download/lotniska/Doc_9137_8_S%C5%82u%C5%BCby_operacyjne_pl.pdf.

US Department of Transportation, (2021) *Essential air service*. Retrieved March 30, 2021 from https://www.transportation.gov/policy/aviation-policy/small-community-rural-air-service/essential-air-service.

Ydersbond, I. M., Buus Kristensen, N., & Thune-Larsen, H. (2020) *Nordic Sustainable Aviation*. https://doi.org/10.6027/temanord2020-536.

Yin, R. K. (2009) *Case study research: Design and methods (applied social research methods)*. London and Singapore, Sage.

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