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COMPETITIVENESS OF THE TOURIST AIR PASSENGER MARKET IN EUROPE

КОНКУРЕНТОСПРОМОЖНІСТЬ ТУРИСТИЧНИХ АВІАПЕРЕВЕЗЕНЬ У ЄВРОПІ

The article examines the competitiveness of tourist destinations in European countries amid post-crisis recovery of passenger air transport and the reorientation of Ukrainian airlines toward EU markets. The study is relevant due to uneven market recovery, increased safety and regulatory constraints, and insufficient consideration of aviation in existing tourism competitiveness indices. Using data from 29 countries and 11 indicators covering passenger flows, aviation and tourism infrastructure, digital and institutional readiness, safety, sustainability, and cultural resources, descriptive statistics, correlation and multicollinearity analysis, principal component and cluster analysis were applied. Results identify three key competitiveness components and four country clusters, reflecting asymmetric recovery of air passenger flows. Findings can inform benchmarking Ukraine's position, target clusters, and phased strategies for restoring passenger air transport to enhance national tourism competitiveness.

Keywords: *passenger air transport, competitiveness, cluster analysis, principal component analysis (PCA), tourism infrastructure, tourist flows, digital technology, tourism destination.*

У статті досліджено конкурентоспроможність туристичних дестинацій у країнах Європейського регіону в умовах післяковідного відновлення ринку туристичних авіапасажирських перевезень та переорієнтації діяльності українських авіакомпаній на ринки ЄС. Актуальність дослідження зумовлена нерівномірним відновленням європейського ринку авіаперевезень, посиленням безпекових і регуляторних обмежень, а також недостатнім урахуванням авіаційної специфіки в існуючих індексах туристичної конкурентоспроможності. Метою роботи є комплексна оцінка конкурентоспроможності ринку туристичних авіапасажирських перевезень у країнах Європи та визначення факторів, що впливають на туристичну конкурентоспроможність держав. Емпірична база охоплює дані 29 європейських країн за 11 показниками туристичних потоків, авіаційної та туристичної інфраструктури, цифрової та інституційної готовності, безпеки, екологічної сталості та культурних ресурсів. Використано описову статистику, кореляційний аналіз та оцінку мультиколінеарності, аналіз головних компонент і кластерний аналіз із застосуванням Statistica 12 та Microsoft Excel. Кореляційний аналіз засвідчив тісний взаємозв'язок між обсягами авіапасажирських та міжнародних туристичних потоків, кількістю аеропортів і культурними ресурсами, що відображає взаємозалежність транспортної доступності та туристично-культурного потенціалу. Цифрові та інституційні показники також демонстрували високий рівень взаємозв'язків, тоді як окремі змінні мали слабкі або негативні кореляції, що свідчить про

різнорідність факторів конкурентоспроможності. Факторний аналіз виділив три інтегральні компоненти, а кластерний – чотири групи країн із різними умовами розвитку ринку авіаперевезень та структурами конкурентних переваг, що відображає просторову асиметрію відновлення туристичних потоків. Перспективи подальших досліджень полягають у використанні отриманих результатів для бенчмаркінгу України, визначення цільових кластерів та формування поетапної стратегії відновлення ринку туристичних авіаперевезень, що сприятиме підвищенню туристичної конкурентоспроможності країни.

Ключові слова: *пасажирські авіаперевезення, конкурентоспроможність, кластерний аналіз, метод головних компонент, туристична інфраструктура, туристичні потоки, цифрові технології, туристичні дестинації.*

Formulation of the problem. Passenger air transport plays a pivotal role in shaping international tourism mobility, acting simultaneously as a driver of economic growth and a mechanism of interregional integration, particularly in countries with highly open tourism markets. However, the development of air transport–based tourism systems is increasingly influenced by a combination of security-related, transport, and digital factors that jointly determine the spatial accessibility of destinations and their integration into global mobility flows. Despite the strategic importance of these interdependencies, their combined impact on tourism competitiveness remains insufficiently conceptualized in comparative empirical research.

Europe represents a particularly relevant context for such analysis due to the presence of shared regulatory frameworks in aviation and tourism, relative institutional homogeneity, and a high intensity of cross-border tourism mobility, a substantial share of which is ensured by air transport. At the same time, recent geopolitical shocks have profoundly altered the operational and spatial configuration of European air transport networks. The military conflict in Ukraine and the subsequent closure of its airspace significantly disrupted international air traffic logistics, increased security-related risks, and adversely affected tourism demand across the region. These disruptions were further amplified by aviation-related sanctions introduced in February 2022, when the European Union closed its airspace to Russian aircraft, followed by reciprocal restrictions imposed by the Russian Federation on EU and selected non-EU carriers.

The closure of Ukraine's airspace alone resulted in the loss of approximately 3.3% of total passenger air traffic in Europe [1], generating long-term structural effects on route networks and the spatial organization of air transport flows. In parallel, according to the European Travel Commission, during 2022–2023 major long-haul source markets, including China, the United States, and Canada, exhibited reduced outbound tourism activity towards Europe, contributing to a contraction in international demand. Although the European passenger air transport market entered a phase of recovery in 2023–2024–reflected in a year-on-year increase of more than 19% in passenger volumes in EU countries in 2023 and the surpassing of pre-pandemic traffic levels in 2024 [2,3]–this recovery was highly uneven across countries, reinforcing structural asymmetries and reshaping the competitive landscape of tourism-related air transport.

Despite these dynamics, existing global and regional tourism competitiveness indices provide only a fragmented representation of the role of air transport in international tourism mobility. Indicators related to air connectivity, tourism infrastructure, digital governance, and institutional quality are typically assessed as separate dimensions, which limits their explanatory capacity with respect to cross-country differences in tourism competitiveness under conditions of post-pandemic recovery and geopolitical instability. This fragmentation highlights a clear research gap and underscores the need for a comprehensive analytical approach that integrates aviation accessibility, tourism infrastructure development, digital transformation, and institutional capacity within a unified framework for assessing the competitiveness of European countries in the field of tourism-oriented air transport.

Analysis of recent research and publications. Air transport is widely examined in academic literature as one of the key drivers of economic growth and tourism development,

while its level of resilience and adaptive capacity under crisis conditions largely determines the efficiency and reliability of passenger air services. A substantial body of scholarly work has been devoted to the functioning of the passenger air transport market and contemporary approaches to its regulation, reflecting the strategic importance of aviation for national economies and international mobility. In particular, Chuzhykov V. I. emphasizes that the world's leading airlines are integrated into three dominant global aviation alliances – SkyTeam, Star Alliance, and Oneworld–which have effectively structured the global aviation space and ensured dominant market positions for selected carriers [4]. Under current conditions, considerable scholarly attention has been focused on the challenges of post-crisis recovery of Ukraine's aviation sector. Oleshko T. I. [5], for instance, highlights the key challenges associated with the restoration of regular air services and the reopening of Ukraine's airspace in the post-war period. Studies by Harazh O. P., Shevchuk D. O., and Kulyk L. S. [6] address the formation and development of human capital in the aviation industry under wartime risks and in the context of post-war recovery. Horbal N. I. and Radchenko Ya. P. [7] analyze the current state and development prospects of Ukraine's air transport sector, assessing the impact of pandemic-related and military factors on the functioning of passenger air transport and on the competitive positions of national airlines. Within the context of tourism-related air transport, significant contributions are made by the studies of Pohuda N., Pohuda O., and Ivchenko L. [8], which examine the impact of air accessibility on the formation of international tourism flows. The authors argue that the restoration of aviation mobility constitutes a necessary precondition for the revitalization of tourism activity. A similar position is expressed by Nguyen [9], who considers air transport to be one of the key channels through which tourism activity influences economic growth, emphasizing the decisive role of the resilience of passenger air transport systems.

A distinct strand of research focuses on the transformation of airport functions, particularly the concept of aerotainment, which combines transport and recreational functions and contributes to the creation of interactive passenger experiences [10]. The implementation of such approaches is viewed as a factor enhancing service quality and strengthening the competitive positions of tourism destinations under stable development conditions. A substantial body of literature is also devoted to the environmental aspects of passenger air transport development [11–14]. Researchers note that aviation accounts for approximately 2.4% of anthropogenic CO_2 emissions, representing about 12% of emissions from the transport sector and nearly 4% of current human-induced global warming. In this context, increasing attention is paid to studies aimed at the implementation of digital technologies, Industry 4.0 solutions, and environmentally oriented practices in passenger air transport, which contribute to improving the sustainability and efficiency of transport systems within the tourism sector [7, 15]. At the same time, the scientific literature provides limited insight into the comprehensive assessment of the impact of passenger air transport on the competitiveness of tourism destinations in Europe, particularly with regard to innovative factors, the resilience of transport infrastructure, and the specific features of aviation mobility recovery following crisis events. This gap in the literature determines the relevance and timeliness of the present study.

Formulation of the purpose of the article. The objective of this study is to conduct a comprehensive assessment of the impact of passenger air transport on the competitiveness of tourism destinations in European countries.

Presentation of the main research material. According to data from ACI Europe, Eurocontrol, EASA, and the European Commission, the European passenger air transport market in 2023–2024 demonstrated a steady recovery following the crisis shocks caused by the COVID-19 pandemic and geopolitical restrictions. In 2023, passenger traffic in the EU27+EFTA countries reached 774 million passengers, accounting for approximately 96% of the 2019 level, while the number of operated flights amounted to 91% of the pre-pandemic benchmark [2]. In 2024, European airports handled more than 2.5 billion

passengers, exceeding the 2023 figure by 7.4% and the 2019 level by 1.8% [3]. Overall air traffic approached 96% of pre-crisis values, despite an increase in delays associated with constrained airspace capacity. During 2024, a total of 6.7 million commercial flights were operated, of which 8.7% were charter services [2]. The recovery of the European passenger air transport market was uneven. Major aviation hubs in Western and Southern Europe surpassed pre-crisis indicators, while Central and Eastern European countries experienced a slower recovery due to reductions in route networks and limited network connectivity. According to ACI Europe, 47% of small and medium-sized airports remained below their 2019 traffic levels in 2024, indicating a widening asymmetry between major hubs and peripheral aviation markets. The growing share of charter flights reflected increased demand for seasonal leisure destinations and further intensified the spatial unevenness of air mobility, thereby shaping a heterogeneous competitive environment for tourism-related air transport.

As a result of the full-scale war, Ukrainian airlines were forced to undertake an operational reorientation toward European Union markets in order to maintain business continuity. SkyUp, Windrose, and Skyline Express adapted their business models to new geographical and regulatory conditions by operating charter and ACMI services outside Ukraine. SkyUp obtained certification for its Maltese subsidiary (SkyUp MT) and in 2025 expanded its network of scheduled flights in Europe, with operational bases in Moldova [14]. In 2024, the airline transported 2.5 million passengers, representing a 61.6% increase compared to 2023, while simultaneously increasing the number of flights by 60.7% and expanding its route network from 664 to 851 destinations [3]. Windrose resumed operational activities in cooperation with foreign partners, whereas Skyline Express operates flights from Polish bases to European leisure destinations. The integration of Ukrainian air carriers into the European aviation network has created new competitive conditions in the passenger air transport market within the tourism segment. In this context, a comprehensive assessment of the competitiveness of passenger air transport in tourism across European countries becomes particularly relevant, as it enables benchmarking Ukraine's position relative to European markets, identifying target groups of countries with similar development characteristics, and shaping a phased trajectory for the recovery of tourism-related air transport, taking into account security, digital, and institutional factors.

To assess the competitiveness of passenger air transport in the tourism sector within the European region, a comprehensive approach was applied, combining quantitative indicators of tourism and aviation flows with index-based characteristics reflecting the institutional environment, digital readiness, and infrastructure development. The analysis covered 29 European countries based on 2024 data (table 1):

Table 1

Sample of countries for the analysis of aviation tourism competitiveness

№	Country name		№	Country name		№ з/п	Country name	
1	Austria	C_1	11	Germany	C_11	21	Netherlands	C_21
2	Belgium	C_2	12	Greece	C_12	22	Poland	C_22
3	Bulgaria	C_3	13	Hungary	C_13	23	Portugal	C_23
4	Croatia	C_4	14	Iceland	C_14	24	Romania	C_24
5	Cyprus	C_5	15	Ireland	C_15	25	Slovakia	C_25
6	Czechia	C_6	16	Italy	C_16	26	Slovenia	C_26
7	Denmark	C_7	17	Latvia	C_17	27	Spain	C_27
8	Estonia	C_8	18	Lihuania	C_18	28	Sweden	C_28
9	Finland	C_9	19	Luxembourg	C_19	29	Switzerland	C_29
10	France	C_10	20	Malta	C_20			

Source: compiled by the authors based on data availability [14–19]

The selection of countries was determined by the availability and completeness of statistical data for all selected indicators, ensuring the validity of cross-country comparisons. The use of 2024 data makes it possible to capture the initial stabilization trends in tourism-related air transport following the COVID-19 pandemic and the period of military and geopolitical instability. For the purposes of the study, the following indicators were used (table 2):

The study employed eleven indicators (table 2), of which Var_1–Var_3 represent absolute measures of tourism and aviation flows and the number of airports [14–16]. Variables Var_4–Var_5 correspond to composite indices of digital and e-government readiness [17, 18], while Var_6–Var_11 are sub-indices of the Travel & Tourism Development Index characterizing the state of transport infrastructure, tourism services, business environment, safety and security, environmental sustainability, and cultural attractiveness [19]. All variables were standardized. Statistical computations were performed using the Statistica 12 software package and Microsoft Excel.

To obtain a preliminary understanding of the data structure, a descriptive statistical analysis was conducted. The results of the descriptive statistics (table 3) indicate substantial variability both in the quantitative indicators of tourism and aviation flows and in the index-based characteristics of institutional and infrastructure development. The distribution of data,

Table 2

Indicators for assessing the competitiveness of tourist air passenger in the European region

Показник	
Number of air tourist arrivals	Var_1
Number of airports	Var_2
Number of international tourist arrivals	Var_3
E_gov_index	Var_4
ICT_index	Var_5
Air transport infrastructure	Var_6
Tourism service and infrastructure	Var_7
Business Environment	Var_8
Safety and Security	Var_9
Environment Sustainability	Var_10
Cultural resources	Var_11

Source: compiled by the authors [14–19]

Table 3

Descriptive statistics of the indicators

	Valid	**Median**	**Min**	**Max**	**Std. dev**
Var_1	29	-0,38560	-0,62986	4,34567	1,01770
Var_2	29	-0,31344	-0,81356	3,51223	1,01770
Var_3	29	-0,35661	-0,83466	3,21870	1,01770
Var_4	29	-0,03633	-2,14321	1,71941	1,01770
Var_5	29	-0,19730	-1,41529	1,87045	1,01770
Var_6	29	0,08014	-1,97908	1,75692	1,01770
Var_7	29	0,06464	-1,59048	2,18837	1,01770
Var_8	29	-0,10235	-1,68903	1,74567	1,01770
Var_9	29	0,09476	-2,52843	1,50004	1,01770
Var_10	29	-0,16794	-2,96423	1,83607	1,01770
Var_11	29	-0,43361	-0,98563	2,20450	1,01770

Source: calculated by the author based on data from [14–19]

featuring both positive and negative deviations from mean values, provides a methodological basis for the application of multivariate analytical techniques.

Correlation analysis revealed strong positive relationships between tourism flow indicators (Var_1 and Var_3, r = 0.810), as well as between the number of airports and cultural resources (Var_2 and Var_11, r = 0.831). Moderate correlations between infrastructure-related and digital-institutional indicators confirm the interdependence between aviation infrastructure development, tourism mobility, and the quality of the regulatory environment. Multicollinearity testing using the variance inflation factor (VIF), with Var_1 specified as the dependent variable, indicated the absence of critical values, allowing all variables to be retained for further modeling.

To reduce data dimensionality and synthesize the information, principal component analysis (PCA) was applied (table 4):

As a result of the principal component analysis, three integrated components were identified, explaining 73.5% of the total variance of the variables. The first component characterizes the scale of tourism flows and the level of development of aviation and tourism infrastructure. The second component reflects the digital and institutional capacity of countries, while the third component is associated with the quality of tourism services and selected infrastructure characteristics, exhibiting limited predictive relevance. The cumulative R^2X and Q^2 values indicate a high explanatory power and moderate predictive performance of the model, confirming its suitability for subsequent cluster analysis of countries based on the level of aviation tourism competitiveness.

In order to identify the main groups of variables and to generalize the interrelationships among the indicators of aviation tourism competitiveness, a factor loading analysis was conducted (table 5):

The results of the principal component analysis and the factor loadings of variables (table 4) made it possible to identify three generalized components that reflect the key dimensions of the competitiveness of passenger air transport in the context of tourism mobility. The first component integrates indicators related to the scale of tourism flows and the level of development of aviation and tourism infrastructure, including the number of air passengers, international tourist arrivals, airports, the state of transport infrastructure, and cultural resources. The high factor loadings of these variables indicate that this component captures the degree of concentration of tourism movements in which air transport plays a leading role. The second component characterizes

Table 4

Key parameters of the principal component model

Component	R^2X	R^2X (Cumul)	Eigenvalues	Q^2	Limit	Q^2 (Cumul)
1	0,356191	0,356191	3,918102	0,132429	0,123377	0,132429
2	0,243481	0,599672	2,678290	0,179599	0,133333	0,288244
3	0,135171	0,734843	1,486878	0,033312	0,145299	0,311954

Source: calculated by the author based on data from [14–19]

Table 5

Factor loadings of variables

	Comp. 1	Comp.2	Comp. 3		Comp. 1	Comp.2	Comp. 3
Var_1	0,8222	0,1331	0,2499	Var_7	0,2827	0,2836	0,7375
Var_2	0,7429	0,1376	-0,4369	Var_8	-0,2350	0,7965	-0,2643
Var_3	0,8932	0,2486	-0,0330	Var_9	-0,5009	0,5281	-0,0434
Var_4	-0,1786	0,8391	0,1979	Var_10	-0,0480	0,4444	-0,6343
Var_5	-0,5166	0,6470	0,1190	Var_11	0,8845	0,1355	-0,2909
Var_6	0,6502	0,4975	0,2767				

Source: calculated by the author based on data from [14–19]

the digital and institutional conditions of the passenger air transport market, as reflected by significant loadings of the E-Government Index, ICT Index, as well as indicators of the regulatory environment and safety. It represents countries' capacity to ensure effective governance, digital service provision, and a favorable environment for the development of international mobility. The third component is associated with the quality of tourism services and selected infrastructure characteristics; however, its contribution to explaining the overall variance is relatively limited. This suggests that these characteristics play a supplementary role in shaping cross-country differences in the scale of tourism-related air transport.

The identified components formed the basis for subsequent cluster analysis, as they allow the multidimensional set of indicators to be synthesized and countries to be grouped according to similar structural characteristics of passenger air transport development in the tourism segment. Based on the clustering results using the principal component scores, four groups of European countries were identified.

Cluster I: France, Germany, Italy, Spain, Greece, Slovenia

Countries in the first cluster are characterized by the highest values of the first and second principal components, reflecting a combination of large-scale tourism flows, well-developed aviation and tourism infrastructure, and a high level of digital and institutional capacity. This group includes the most competitive European countries in the field of passenger air transport serving international tourism mobility.

The dominance of the first cluster is driven by high factor loadings of variables forming the first component (volumes of air passenger and international tourism flows, number of airports, and infrastructure development), as well as the second component, which captures digital and institutional characteristics of the operating environment. France, Spain, Italy, and Germany consistently lead within the European Union in terms of international tourist arrivals and overnight stays in accommodation establishments; in 2024, Spain hosted more than 93.8 million international tourists, while countries of this cluster collectively accounted for over 50% of total tourist nights in the EU [2,3]. Major airports within this cluster demonstrate high passenger volumes and positive traffic dynamics, confirming the leading role of air transport in servicing tourism mobility. The inclusion of Slovenia in the first cluster is explained not by absolute transport volumes, but by relatively high values of integrated infrastructural and institutional indicators, adjusted for the country's size.

*Cluster II: Croatia, Cyprus, Latvia, Lithuania, Malta, Slovaki*a.

Countries in the second cluster are characterized by medium values of the first principal component and moderate values of the second component, reflecting a combination of limited scales of tourism-related air transport with a sufficient, yet unevenly realized, level of digital and institutional capacity. This cluster comprises countries with a pronounced tourism specialization, in which air transport plays an important but predominantly seasonal role in the structure of tourism mobility.

Cluster III: Belgium, Bulgaria, Czechia, Finland, Hungary, Poland, Portugal, Romania.

The third cluster consists of countries with moderate volumes of passenger air transport and a lower dependence of international tourism mobility on air transport. Despite the overall growth of air passenger traffic across Europe, the role of aviation in tourism movements within these countries remains limited, largely due to the significant share of land-based modes of transport.

Cluster IV: Austria, Denmark, Estonia, Iceland, Ireland, Luxembourg, the Netherlands, Switzerland.

The fourth cluster brings together countries with high levels of digital readiness, institutional effectiveness, and safety. In this group, the competitiveness of passenger air transport in the tourism segment is primarily determined by qualitative characteristics of the operating environment, while absolute passenger traffic volumes play a secondary role.

Conclusions. This study provides a comprehensive assessment of the competitiveness of tourism-related air transport across 29 European countries in 2024. The findings indicate

that, at the aggregate level, the European aviation market has largely recovered to pre-war performance indicators; however, the pace and depth of recovery varied substantially across countries. This asymmetry has contributed to the persistence of structural disparities and the emergence of a heterogeneous competitive environment in the sphere of international tourism mobility.

The application of principal component analysis made it possible to identify three integral factors of competitiveness. The first factor reflects the scale of tourism flows and the level of transport accessibility, largely determined by the development of aviation infrastructure and the cultural attractiveness of countries. The second factor captures the level of digital and institutional readiness, associated with the quality of public governance, the regulatory environment, and the availability of digital services. The third factor characterizes the quality of tourism services and supporting infrastructure; however, its influence on the formation of international air passenger flows appears to be relatively limited. Based on the extracted principal components, a cluster analysis was conducted, allowing for the identification of four types of European countries according to the level of competitiveness of tourism-related air transport. The first cluster comprises leading European countries characterized by a high concentration of international aviation hubs, substantial passenger traffic volumes, and strong digital and institutional capacity. The second cluster includes countries with pronounced seasonal and resort-oriented specialization, where demand for air transport exhibits a clearly defined cyclical pattern. The third cluster consists of countries with a moderate level of development of tourism-related air transport, in which aviation does not constitute a dominant element of international tourism mobility. The fourth cluster is represented by countries with a high quality of institutional and digital environments, where competitive positions are shaped primarily by the effectiveness of governance and regulatory mechanisms rather than by the scale of passenger flows. The experience of Ukrainian airlines (SkyUp, Windrose, and Skyline Express) demonstrates their capacity for adaptation under conditions of transformed route geographies and regulatory environments. This adaptive capacity creates prerequisites for the future integration of Ukraine's tourism-related air transport market into relevant European clusters following the reopening of the country's airspace.

Future research directions include continuous monitoring of the competitiveness of tourism-related air transport in the post-crisis period; comparative analysis of the impact of digital and institutional readiness on the development of aviation mobility across different clusters; evaluation of the effectiveness of development strategies for small and medium-sized airports under conditions of interregional inequality; and examination of the role of seasonal and charter air services in shaping competitive advantages for countries with limited transport accessibility.

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