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Covid-19 and tourism impact assessment: cluster analysis for Europe region

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Abstract. For a long time, the tourism industry was considered one of the economy's leading and most progressive sectors, characterized by an advanced scale of development. The situation was changed fundamentally by the COVID-19 pandemic, which caused significant losses at the global level, not only for tourism but also for all sectors of the economy

and society. In this regard, the provision of this article identifies the nature of the impact of the COVID-19 pandemic on tourism in a particular country in the European region using cluster analysis. In the first stage of this work, a detailed literature review on the existence of such a connection was carried out with the help of bibliometric analysis. The authors used the results published in Scopus and Web of Science databases for the keywords «tourism», and «Covid-19» and analyzed the growth dynamics in their number and citations, belonging to the research area and the spread of geography. Building a bibliometric map of keywords based on their joint placement in the VOSviewer software complex deepened findings. It made it possible to form 10 clusters, each of which covers scientific works on various forms of the impact of the COVID-19 pandemic on tourism (for example, behavioral, marketing, economic, environmental, psychological aspects, etc.). In the second stage, an analytical review was conducted, which showed a significant drop in the absolute and apparent contribution of travel and tourism to GDP worldwide in 2020 and 2021 worsened with the pandemic level, and an increase in the dynamics of key indicators of the tourism industry in the world and across all UNWTO regions (especially Asia & Pacific). In the last step, a hierarchical agglomerative cluster analysis (with Ward's method) was carried out for the countries of the European region (45 countries) based on indicators of the number of COVID-19 cases in the country (cumulative and new), vaccination of the population, the presence of restrictions on tourism, international tourist arrivals, and receipts, collection of tourism in exports. All indicators for analyzing the collected state are provided as of July 30, 2022, using the Stata SE 12 software complex. The construction of a dendrogram and the use of Calinski-Harabasz and Duda-Hart stopping rules made it possible to decide on the presence of 3 clusters that meet the conditions of this study and are characterized by different levels of adaptability to post-pandemic functioning and recovery direction.

Keywords: tourism, COVID-19 pandemic, bibliometric analysis, cluster analysis, Europe region, restrictions, international tourist arrivals.

Оцінка впливу Covid-19 на туризм: кластерний аналіз для європейського регіону

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Анотація. Туристична індустрія тривалий час вважалася однією з передових та найбільш прогресивних секторів економіки, що характеризувалася випереджаючими масштабами розвитку. Ситуацію докорінно змінила пандемія COVID-19, що завдала значних збитків на світовому рівні не лише для туризму, а й для всіх секторів економіки та соціуму. У зв'язку із цим, метою даної статті є ідентифікація характеру впливу пандемії COVID-19 на tourism в більшості країн регіону Європи за допомогою кластерного аналізу. Першим етапом даної роботи проведено детальний огляд літератури щодо наявності такого зв'язку за допомогою бібліометричного аналізу. Авторами використано опубліковані роботи в Scopus та Web of Science базах даних за ключовими словами «tourism» та «covid-19» та проаналізовано динаміку зростання їх кількості та цитованості, приналежність за областю досліджень та географією поширення. Отримані результати були поглиблені за допомогою побудови бібліометричної мапи ключових слів за ознакою їх спільного використання в програмному комплексі VOSviewer. Це дозволило сформулювати 10 кластерів, кожен з яких охоплює наукові праці про різні форми впливу пандемії COVID-19 на туризм (наприклад, поведінкові, маркетингові, економічні, екологічні, психологічні аспекти тощо). На другому етапі проведено аналітичний огляд, що засвідчив значне падіння абсолютного та відносного внеску подорожей і туризму у світовий ВВП у 2020 та 2021 роках порівняно з до пандемічним рівнем, та погіршення динаміки ключових індикаторів туристичної індустрії у світі та за всіма UNWTO регіонами (особливо Азіатсько-Тихоокеанський регіон). На останньому кроці проведено ієрархічний агломеративний кластерний аналіз (за допомогою методу Варда) для більшості країн регіону Європи (45 країн) на основі показників про кількість випадків COVID-19 в країні (кумулятивно та нових), вакцинацію населення, наявність обмежень для туризму, міжнародні туристичні прибуття та доходи, частку туризму в експорті. Всі показники для аналізу зібрані станом на 30 липня 2022 року з використанням програмного комплексу Stata SE 12. Побудова дендрограми та використання правилів Калінські-Харабаса і Дуда-Гарта дозволили прийняти рішення про присутність трьох кластерів, що задовольняють умови даного дослідження та характеризуються різним рівнем адаптованості до функціонування після пандемії та напрямом відновлення.

Ключові слова: туризм, пандемія COVID-19, бібліометричний аналіз, кластерний аналіз, регіон Європи, обмеження, міжнародні туристичні прибуття.

Introduction

The COVID-19 pandemic caused significant changes in all spheres of the ordinary life of humankind. One of the most vulnerable sectors of the economy turned out to be tourism, the existence of which is simply impossible to imagine without the constant movement of tourists. It is not surprising because in the era of globalization, international population movements have become commonplaces, and the speed of such activities exceeds the possible incubation periods for most infectious diseases, which have become especially dangerous in the current conditions (Suk et al., 2014). At the same time, international integration processes are associated with the welfare of countries (Bazaluk et al., 2022).

Tourism was and remains one of the essential branches of the national economy, which is considered catalyst for regional development (Kuzior et al., 2021) and forms the image of the country (Mikhnevych et al., 2020, Constantoglou, 2020, Shazly, 2022, Tovmasyan & Gevorgyan, 2022). At the same time, recently, there has been a tendency to switch to sustainable tourism (George, 2020, Florek, 2012) to preserve the environment and optimized the use of resources.

Quarantine restrictions caused a partial suspension of activities or, in some countries, the closure of most of the world's tourist destinations. According to UNWTO (2021b), as of February 2021, more than 32% of such tourist destinations have closed their borders due to the pandemic, and 34% have partially closed.

The tourism sector not only lost most of its profits but also caused cascading economic and social effects such as a decrease in its contribution to the country's GDP, economic development, a significant reduction in jobs, and suspension of the development of tourism-related economic sectors, etc. In addition, the COVID-19 pandemic has halted progress in achieving Sustainable Development Goals, among which climate change is one of the most urgent and directly related to tourism (Njegovanović, 2021).

It determines the formulation of this study's goal, which consists of identifying the nature of the impact of the COVID-19 pandemic on tourism in most countries of the European region using cluster analysis. To fulfill the set goal, this research is proposed to be carried out in the following stages: first, to conduct a thorough review of the literature with the help of bibliometric analysis, which will allow forming an idea of the existing scientific landscape of the study of the impact of COVID-19 on tourism, identify the most urgent and researched problems in this topic and group the main vectors of such impact for deeper investigation; secondly, to analyze the main most noticeable trends at the world level regarding the researched issue; thirdly, with the help of cluster analysis, to form groups by countries with different nature of the impact of the COVID-19 pandemic on tourism.

Literature review

It is impossible to assess the consequences of the COVID-19 pandemic with certainty because they

have manifested themselves in direct and side effects in almost all spheres of activity. According to some studies, there are problems with the financial system in terms of macroeconomic stability (Brychko et al., 2021, Kaya et al., 2021), the achievements in the field of sustainable development of the country and the business sector are questioned (Tiutiunyk et al., 2021, Antonyuk, et al., 2021, Trifu, 2020) and in general new forms of financial, economic and educational transformations are being formed (Novikov, 2021).

In such conditions, numerous studies are aimed at various aspects of such an assessment. Worthy of attention is the work of Leonov et al. (2021), within which the country’s health profile is determined based on social, economic, behavioral, and healthcare determinants with the approach of determining the center of mass; at the regional level – in the work of Kuzmenko et al. (2020). At the same time, the obtained results are quite applicable to tourism because in the current post-pandemic conditions, they directly affect the formation of the attractiveness and competitiveness of tourist destinations in countries around the world and can be used as a method of assessing a tourist destination’s safety.

It should not be underestimated that numerous quarantine restrictions cause the rapid development

of digitalization. In such conditions, we observe progress in the fintech sector (Rubanov et al., 2019, Lyeonov et al., 2020, Baltgailis & Simakhova, 2022), which positively affects entrepreneurial activity (Sadigov, 2022) and financial inclusion (Sau-Wai Law, 2021), anticipatory development of cyber security systems and information and knowledge management (Ed. Fernando, 2021, Yarovenko et al., 2021), etc.

The study of the impact of the COVID-19 pandemic on the field of tourism is quite relevant in the current conditions, which is also confirmed by the bibliometric analysis. Since the spread of the coronavirus disease began only in 2019, it is possible to conduct a literature review in such a short-term period that ends with the date of writing this paper – July 30, 2022. Scopus and Web of Science (WoS) were chosen as the information bases, which represent the most significant, cited studies, and are recognized worldwide. Letunovska et al. (2020) conducted similar analyses in the field of health tourism.

First, let’s analyze the frequency of use of the following keywords and phrases: «tourism» and «Covid-19» to understand general trends, as well as Covid-19 AND tourism», which is the direct object of our research in scientific works, taking into account their dynamics development (Table 1).

Table 1. The study of the distribution and dynamics of scientific works related to the impact of the COVID-19 pandemic on tourism

Keywords	Scopus	WoS	Dynamics
tourism	126339	99783	
«COVID-19» OR «coronavirus 2019» OR «COVID 2019»	346361	300205	
COVID -19 AND tourism	3342	2696	
Times Cited: total	30721	22416	
h-index	75	65	

Source: created by the author based on the Scopus and WoS databases and their built-in tools.

In general, research on tourism in the selected scientometric databases occupies a significant part and a prolonged period (in Scopus, the first article dates back to 1947, in WoS – 1998), while the increase of works with positive dynamics can be traced. Research into the effects of COVID-19 began in 2019, and its scope is much larger than that of tourism. Note that the data for 2022 are half-yearly and therefore do not indicate a downward trend in scientific research in the selected areas.

As for studies on the connection between COVID-19 and the field of tourism, their volume has been increasing rapidly since 2019 and, as of 2022, amounted to 3,342 in Scopus and 2,696 in WoS. At the same time, these works have a high level of citations, making it possible to form the h-index at 75/65 units accordingly.

Most of the analyzed scientific works in regard to the area of research belonged to the following fields: Social Sciences (25.3% in Scopus and 43.4% in WoS), Business, Management and Accounting (22.9% in Scopus and 20.1% in WoS), Environmental Science (11.8% in Scopus and 17.9% in WoS). In terms of geographical distribution, works from China (382/405 respectively), the United States (333/325), and the United Kingdom (269/232) prevailed.

The most cited articles in the Scopus and WoS databases according to the analysis are:

- the article by Gössling, Scott & Hall (2020) summarizes the socio-economic implications of COVID-19 for certain aspects of the global economy, including tourism. They note that the tourism and hospitality industries are among the most affected sectors of the economy. According to their data, trends were observed to send thousands of employees on vacation or even reduce them because there was a temporary suspension of the activities of most objects of the hotel market, closure of tourist destinations, etc.;

- the article of Nicola, Alsafi, Sohrabi, etc. (2020) analyzes the main trends in tourism and the socio-economic implications of the coronavirus pandemic, which have more devastating consequences than other known epidemics or global crises, as well as due to climate change. Based on their research, the authors question the international model of the trajectory of tourism growth and open new potential ways for its development;

- the researcher Sigala (2020) examines the transformative possibilities of COVID-19 for tourism through its main agents (tourism demand, tourism operators, destinations, and political actors) in three phases (representing the response, recovery, and post-pandemic recovery phase).

For a more objective understanding of the vectors of the impact of the COVID-19 pandemic on tourism, we will build a bibliometric map of keywords based on their co-occurrence in the VOSviewer v.1.6.15 software package (Fig. 1). As a result, 10 clusters with 406 items and 9561 connections were obtained:

- cluster 1 (■, 62 items) grouped scientific works investigating certain behavioral and marketing aspects in tourism, in particular: destination and digital marketing, features of customer behavior and their satisfaction, and certain types of tourism such as virtual, wellness, urban, etc.; this cluster complements.

- cluster 2 (■, 59 items) the economic aspects of the functioning of tourism as a business object, its connection with economic market conditions, regional development and state policy, etc. are investigated;

- cluster 3 (■, 55 items) focused on environmental aspects of tourism development, i.e. issues related to climate change, carbon emissions, air quality, and other issues of environmental protection;

- cluster 4 (■, 47 items) considers the issue of infrastructural support of the tourism sector, in particular through various forms of car and air connections, the cruise industry, etc.;

- cluster 5 (■, 36 items), focuses specifically on the psychological patterns of tourists' behavior – factors for choosing a vacation destination, the impact of the fear of contracting COVID-19 on tourist activity, vaccination processes, other security issues, and the relationship to health care policies in countries, etc.;

- cluster 6 (■, 35 items) considers separate management issues, in particular, management crisis and risk perception, managing relations with various stakeholders, etc.;

- cluster 7 (■, 34 items) considers the connection between the education system and the tourism industry, tourism education and online learning, etc.;

- cluster 8 (■, 33 items) and 9 (■, 25 items) grouped studies involving the mathematical detection of regularities in the tourism sector, in particular through forecasting, correlation-regression modeling, risk and needs assessment, scenario analysis, bibliometric analysis and literature review, theoretical studies, etc.;

- cluster 10 (■, 20 items) covers other issues, including specific sectors of tourism: niche tourism, outdoor recreation, domestic tourism, etc.

The obtained clusters testify to a sufficiently diverse range of research devoted to the impact of the COVID-19 pandemic on tourism. It fully confirms the above division by research area – there are social, economic, and ecological directions, each of which

is important and relevant enough. In the context of this study, the emphasis is on the economic and social dimensions of the impact, which will be developed below. Despite this, the issue of identifying the nature

of the impact, which can be differentiated depending on the country or geographical region, requires deeper research and development, which is what this work will be devoted to.

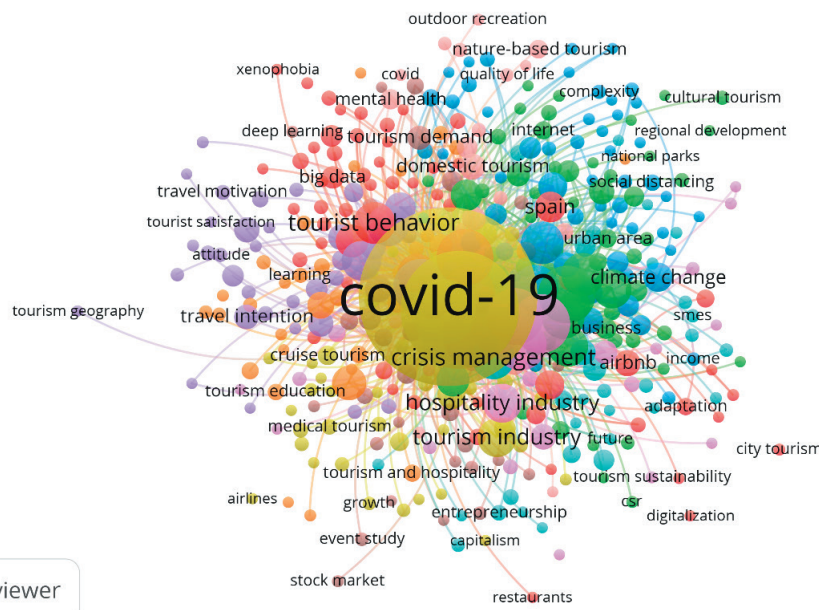


Fig. 1. Bibliometric map of clusters by keywords co-occurrence in Scopus database on the impact of the COVID-19 pandemic on tourism. Source: created by the author based on the Scopus database in the Vosviewer software.

Materials and methods

To study the impact of the COVID-19 pandemic on tourism, we used the following analytical databases: WHO and UNWTO. A list of variables for the research was formed (Table 2). The selected indi-

cators characterize both the situation with the spread of the COVID-19 pandemic in countries and the fight against it (as of July 30, 2022), as well as the resulting changes in the tourism sector (for 2019-2020 as the most typical indicators of the consequences of the pandemic).

Table 2. Characteristics of the array of input data

Indicator	Unit	Variable	Database
Disease cases, cumulative total per 100 thousand population	unit	x1	WHO Coronavirus (COVID-19) Dashboard
Disease cases, newly reported in last 7 days	unit	x2	WHO Coronavirus (COVID-19) Dashboard
Persons fully vaccinated per 100	persons	x3	WHO Coronavirus (COVID-19) Dashboard
Person booster add dose per 100	persons	x4	WHO Coronavirus (COVID-19) Dashboard
International tourist arrivals (ITA) change 20/19	%	x5	UNWTO TOURISM DATA DASHBOARD
International tourist receipts (ITR) change 20/19	%	x6	UNWTO TOURISM DATA DASHBOARD
Tourism as % of Export	%	x7	UNWTO TOURISM DATA DASHBOARD
Restrictions in the country caused by COVID-19	(1 – no, 0 – yes)	x8	UNWTO TOURISM DATA DASHBOARD

Europe as one of the UNWTO regions and the global leader in international tourism by international tourist arrivals was chosen as the object of the study. At the same time, after analyzing the availability of the necessary data, the list of sample countries was reduced to 45, which include EU countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany,

Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden) and other countries of the region (Albania, Armenia, Azerbaijan, Belarus, Georgia, Iceland, Moldova, Montenegro, Norway, Switzerland, UK, Ukraine).

Table 3 shows the obtained descriptive statistics (average, standard deviation, minimum and maximum

values) for the selected data set and sample countries. The data indicate a significant differentiation of indicators between countries. Therefore, for example, the cumulative cases of the disease differ from 7 thousand to 62 thousand cases and the appearance of new cases from 0 to 552 thousand cases. The change in the main indicators of the active tourism sector is also noticeable: compared to 2019, the indicators (ITA, ITR) changed by a range from 19% to 95%.

Table 3. Descriptive statistics of the array of input data

Variable	Mean	Std. Dev.	Min	Max
x1	33407.28	15037.05	7855.41	62617.66
x2	51121.90	134554.00	0.00	552883.00
x3	63.80	17.51	26.44	86.39
x4	40.33	21.66	1.37	68.93
x5	-0.69	0.12	-0.95	-0.33
x6	-0.60	0.16	-0.87	-0.19
x7	0.05	0.05	0.01	0.24
x8	0.77	0.43	0.00	1.00

Cluster analysis was chosen as a research method as one of the techniques of an empirical grouping of data based on similarity or difference, which is determined by the distance between objects (Murtagh and Legendre, 2004). In the framework of this work, a hierarchical agglomerative method was chosen, which allows to visually trace the construction of clusters with the help of a dendrogram. As a measure of distance (a measure of closeness), the Euclidean one was chosen, which represents the geometric distance in a multidimensional space for *n* variables:

$$d_{xy} = \sqrt{\left(\sum_{j=1}^m (x_j - y_j)^2\right)}$$

Ward’s method was chosen for determining the distance between clusters, as the most common method of cluster analysis is based on the use of variance analysis to optimize intercluster spaces. To identify the optimal number of clusters, stop rules of Calinski-Harabasz (1974) and Duda-Hart (2000) were used, which complement each other. They are based on comparing sums of squares in different pairs of clusters.

All empirical calculations were carried out using the Stata SE 12 software package, construction of individual graphs for analysis was carried out using MS Excel 2010.

Results and Discussion

Part 1. Analytical review. The field of tourism was considered one of the most profitable sectors of the economy, which developed dynamically during the last two decades before the COVID-19 pandemic. The tourism industry generated an average of 10% of the total gross domestic product (GDP) from 2000 to 2019, after which a significant decline was recorded in absolute and relative terms (Fig. 2).

As of 2020, tourism’s contribution to worldwide GDP decreased by 49% to 5.3% of GDP in relative terms and by 41% to the level of 4775 billion U.S. dollars. In 2021, we were witnessing a gradual recovery of the industry: in percentage terms, the indicator increased by 22%, and in relative terms – by 15%, although it was not possible to reach the reference level.

As a result of quarantine restrictions around the world, such indicators as ITA and ITR have also changed significantly. We will analyze the dynamics of their changes for 2019-2021 in the world and by UNWTO regions in Table 4.

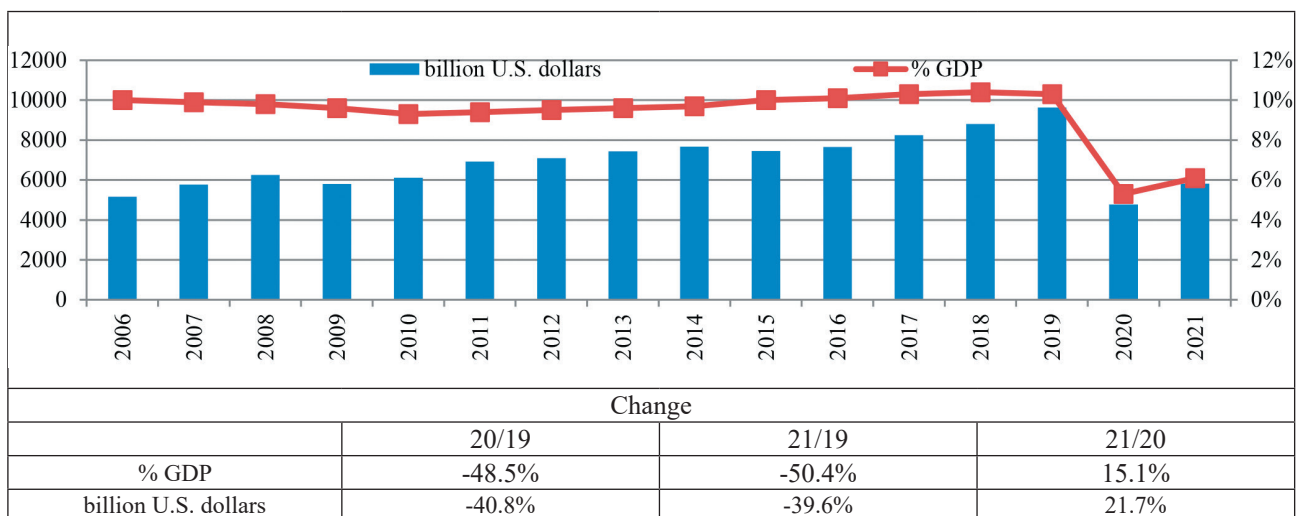


Fig. 2. Absolute and relative contribution of travel and tourism to GDP worldwide, 2006-2021. Source: built by the author on the basis of the Statista data (2022).

Table 4. Dynamics of key indicators of the tourism industry in the world and by UNWTO regions for 2019-2021.

UNWTO regions	(million)			Change (%)		
	2019	2020	2021	20/19	21/19	21/20
ITA						
World	1466.0	405.0	427.0	-72.4%	-70.9%	5.4%
Europe	745.0	238.5	286.8	-68.0%	-61.5%	20.3%
Asia & Pacific	360.1	59.1	20.7	-83.6%	-94.3%	-65.0%
Americas	219.3	69.8	82.4	-68.2%	-62.4%	18.1%
Africa	68.4	18.0	18.4	-73.7%	-73.1%	2.2%
Middle East	73.0	19.8	18.5	-72.9%	-74.7%	-6.6%
ITR						
World	1483.0	546.0	602.0	-63.2%	-59.4%	10.3%
Europe	572.0	236.0	305.0	-58.7%	-46.7%	29.2%
Asia & Pacific	441.0	126.0	97.0	-71.4%	-78.0%	-23.0%
Americas	331.0	126.0	135.0	-61.9%	-59.2%	7.1%
Africa	39.0	15.0	16.0	-61.5%	-59.0%	6.7%
Middle East	99.0	43.0	48.0	-56.6%	-51.5%	11.6%

Source: UNWTO.

The analyzed data indicate a catastrophic decline in the world tourist flow in the post-pandemic years by 72% in 2020 and by 71% in 2021. At the same time, such a recession is the largest in the last twenty years, significantly exceeding the consequences of the Global Economic Crisis of 2008-2009 and the SARS epidemic in 2003. The Asia & Pacific region was the most affected, where the decline in ITA reached 83.6% in 2020 compared to 2019 and 94.3% in 2021, respectively. Despite this, according to the UNWTO, there are positive recovery trends in the world: in 2021, compared to 2020, an ITA growth of 5% was recorded. By region, Europe and America led, where similar indicators increased by 20% and 18%.

Quantitative indicators of tourist arrivals were also reflected in the financial dimension. According to the indicator of income from international tourism, there is a decrease in volumes by 63% and 59% in 2020 and 2021, respectively. Despite this, a gradual recovery of financial flows is observed in 2021, although the level of 2019 is still far away. By region, Asia & Pacific and the Americas were the most affected, with ITR declines by 71% and 62% in 2020 compared to 2019, and 78% and 59% in 2021 similarly.

Workers involved in the tourism industry also suffered significantly. According to The World Travel & Tourism Council (2021), their number decreased by almost 62 million: from 334 million (10.6% of all jobs in the world) in 2019 to 272 million in 2020 (8.2% of all jobs). Thus, quarantine restrictions significantly affected the level of employment and unemployment in the world's countries and the international arena as a whole.

Part 2. Cluster analysis

The analytical review shows the significant impact of the COVID-19 pandemic on the tourism sector, which is manifested in various directions. For its empirical justification, a hierarchical agglomerative cluster analysis was conducted in this work, the results of which are presented below.

As a result of applying the hierarchical Ward method with Euclidean distance in the Stata software complex, a dendrogram was built for the selected input data array (Table 2), which visually displays the possible number of clusters (Fig. 3).

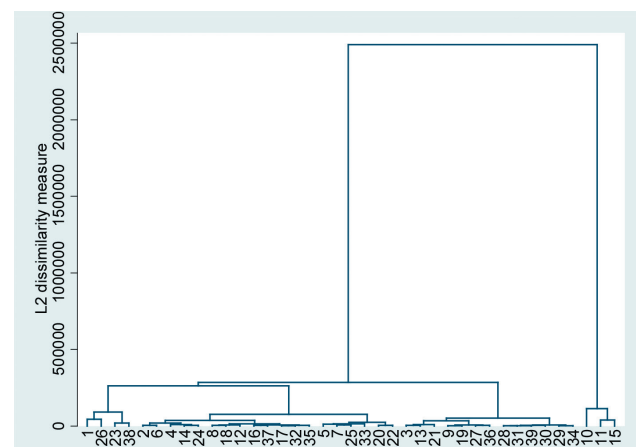


Fig. 3. Dendrogram of hierarchical cluster analysis by the Ward method for European countries

As it can be seen from the dendrogram above, the issue of highlighting the number of clusters is controversial because you can visually see from two to an infinite number of clusters. In this case, applying the stop rules Calinski-Harabasz and Duda-Hart is ad-

visible. They make it possible to determine the optimal number of clusters for a given data set based on the generated pseudo-F, pseudo-T-squared, and Je(2)/Je(1) indicators and the results are shown in Table 5 (highlighted in bold).

Table 5. Results of the application of Calinski-Harabasz and Duda-Hart stop rules within cluster analysis

Number of clusters	Calinski/ Harabasz pseudo-F	Duda/Hart	
		Je(2)/Je(1)	pseudo T-squared
2	724.34	0.73	12.70
3	456.10	0.34	41.40
4	576.62	0.11	5.84
5	736.82	0.25	7.83
6	974.62	0.49	17.83
7	1014.09	0.47	12.63
8	952.51	0.00	-
9	1139.90	0.00	-
10	1459.56	0.47	12.33
11	1571.33	0.19	21.17
12	1766.79	0.44	5.09
13	2083.71	0.00	-
14	2442.03	0.26	8.41

The results obtained also show controversial results. The optimal number of clusters, which is determined by the minimum value of pseudo-F and pseudo-T-squared; the maximum is Je(2)/Je(1), can range from 2 to 4. In the context of this study, we decided to single out precisely 3 clusters, which will be described below. We present a frequency table (Table 6) that characterizes how countries are found in the obtained clusters.

Table 6. One-way table of frequency counts for the obtained clusters

Cluster	Freq.	Percent	Cum.
1	23	58.97	58.97
2	13	33.33	92.31
3	3	7.69	100.00
Total	39	100	X

The first cluster contains 23 countries of the sample, which make up 59%; the second – 13 countries (33%); and the third – 3 countries (8%). To understand the nature of the obtained clusters, we present their descriptive statistics in Table 7. In addition, this table immediately shows how the sample countries are distributed among the three obtained clusters.

The first cluster is the largest in terms of member countries, covering both the EU and other countries. They are characterized by sufficiently high rates of cumulative cases of COVID-19 and the emergence of new topics; the rates of complete vaccination for most countries are adequately high (Georgia is an exception), and the rates of additional vaccination differ. Despite this, in most countries, there are no specific restrictions for tourists, which indicates their quick adaptation. ITA and ITR for most countries were significantly affected – by 60-70% in average. The share of tourism in exports also varies depending on the country (the largest in Croatia and Montenegro).

The second cluster united most of the countries that were former members of the Soviet Union or partners of the Eastern Bloc, as well as some Nordic countries. This cluster is characterized by low rates of the incidence of COVID-19 both cumulatively and in terms of new cases; the rates of vaccination also differ. Key indicators of the tourism sector were significantly affected (ITA decreased mostly in Belarus

Table 7. Descriptive statistics by clusters

Cluster		x1	x2	x3	x4	x5	x6	x7	x8	
Cluster 1	Austria, Spain, UK, Romania, Slovakia, Slovenia, Belgium, Ireland, Switzerland, Portugal, Luxembourg, Lithuania, Iceland, Georgia, Greece, Denmark, Montenegro, Latvia, Netherlands, Estonia, Croatia, Cyprus, Czech Republic									
	mean	42030.50	19115.78	66.72	43.63	-0.68	-0.60	0.06	0.87	
	max	62617.66	114387.00	86.38	68.93	-0.33	-0.19	0.21	1.00	
	min	15555.80	0.00	29.35	6.06	-0.86	-0.87	0.01	0.00	
Cluster 2	Azerbaijan, Belarus, Albania, Armenia, Moldova, Finland, Bulgaria, Hungary, Ukraine, Norway, Sweden, Malta, Poland									
	mean	16546.34	3552.31	55.19	29.18	-0.72	-0.62	0.05	0.69	
	max	27088.19	16846.00	86.39	68.20	-0.56	-0.20	0.24	1.00	
	min	7855.41	0.00	26.44	1.37	-0.95	-0.83	0.01	0.00	
Cluster 3	France, Italy, Germany									
	mean	40359.90	502637.00	78.71	63.40	-0.61	-0.53	0.03	0.33	
	max	49969.00	552883.00	79.62	68.62	-0.56	-0.48	0.05	1.00	
	min	34640.43	440822.00	77.88	59.88	-0.65	-0.61	0.01	0.00	

and Moldova, ITR – in Azerbaijan and Armenia). For most countries, tourism occupies a small share of exports (Albania is an exception); most countries have no restrictions.

The third cluster includes only three countries: France, Germany and Italy, among the most popular tourist destinations in Europe. At the same time, the share of tourism in their exports is 5/1/3%, respectively. They are characterized by average incidence rates cumulatively, new cases, and sufficiently high levels of total and additional vaccination of the population. Thanks to this, the average indicators of changes in the leading tourist indicators (ITA, ITR) are observed in this cluster by an average of – 50/60%; certain restrictions for tourists are still observed (except in Italy).

Conclusions

The impact of the COVID-19 pandemic on the tourism industry is quite multifaceted and complex, which led to the conduct of this study. We will present the main results. Bibliometric analysis based on Scopus and Web of Science databases revealed a substantial increase in scientific output, particularly in the social, economic, and environmental fields of research, both quantitatively and qualitatively on the selected topic, although their development began in 2019. Geographically, studies of China, the United States, and the United Kingdom currently dominate. These conclusions are confirmed by constructing bibliometric maps of the co-occurrence of keywords in the VOSviewer software complex. It made it possible to form 10 clusters, each dedicated to different aspects of the study of the impact of the COVID-19 pandemic on tourism (marketing, economic, environmental, psychological, educational, etc.).

An analytical review of the main trends in the tourism industry caused by the COVID-19 pandemic made it possible to identify the following patterns. In the post-pandemic period (2020 and subsequent years), a significant decrease in travel and tourism's total and relative contribution to GDP worldwide was observed (in 2020/2019, by 49% in relative terms and by 41% in absolute terms). In general, the number of tourist arrivals worldwide fell by 72% (2020/2019) and by 71% (2021/2019), and tourist receipts – by 63% and 59%, respectively. By geographic region, Asia & Pacific was the most affected, with an 83% drop in 2020/2019 in arrivals and a 71% drop in receipts. Other regions also suffered significant losses, including the Europe region: a 68% drop in arrivals for 2020/2019 and a 47% drop in receipts. All this had numerous cascading consequences, such as a de-

crease in the number of people employed in the tourism sector and, therefore, the population's level and quality of life, etc.

All this formed the basis for conducting a cluster analysis for the countries of the European region using the hierarchical Ward method with the Euclidean distance in the Stata software complex. Indicators characterizing the situation in the country with the spread of the COVID-19 pandemic (new and cumulative cases for the entire period), the state of basic and additional vaccination were selected as input parameters; as well as key indicators of the tourism industry: ITA, ITR and the share of tourism in exports, as well as the presence of restrictions for tourists in the country. The construction of a dendrogram for the obtained clusters and the application of the Calinski-Harabasz and Duda-Hart stop rules led to the decision to select three clusters as a result of the analysis. The first cluster covers most of the European countries, which, despite high morbidity rates, quickly adapted and lifted most of the restrictions for tourists.

The second cluster unites countries with low tourism potential, in connection with this, relatively low rates of the incidence of COVID-19 are observed, and key indicators of the tourism sector have been significantly affected. The third cluster united sufficiently developed tourist countries (France, Germany, Italy) with average morbidity rates and enough high vaccination rates. Despite the existing tourist restrictions, these countries are gradually recovering and have intermediate rates of change in the leading tourism indicators.

Despite the achievement of the set goal, this work has its limitations. Thus, the cluster analysis is based on eight indicators selected based on countries' openness of access and proportionality. Expansion or modification of individual indicators may have different results and other research prospects. Also, the period is limited because data on the spread of the coronavirus disease and its impact is only available from 2019; a longer time horizon can open more detailed results for analysis. Despite this, the obtained results show quite exciting trends, which allow a further thorough examination of the similarity of the countries in the clusters and their adaptation to the tourism sector in post-pandemic times.

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