

Analysis of the Main Components in the Evaluation of Tourism Performance in Romania (2014-2022): Essential Dimensions and Strategic Directions for Sustainable Development

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Abstract

Tourism contributes significantly to economic and social development, but in Romania it faces challenges related to the capitalization of resources and infrastructure development. This study applies the Principal Component Analysis (PCA) to data from 2014-2022, provided by the National Institute of Statistics (INS), to identify the essential dimensions influencing tourism performance. The indicators analysed include the share of tourism in GDP, international arrivals, average length of stay and regional distribution of tourist flows.

The results highlight two main dimensions: the attractiveness of destinations and the economic contribution. The first two components explain 94.77% of the total variation, Component 1 being dominated by variables associated with destinations (e.g., „Mountain”), and Component 2 by economic variables (e.g., „PondTurPIB”). The temporal evolution shows a decline in 2020 caused by the COVID-19 pandemic, followed by a partial recovery in 2021-2022.

The study contributes to understanding the dynamics of Romanian tourism and provides recommendations for public policies focused on diversification of the offer and investments in infrastructure, supporting the competitiveness and sustainability of the sector.

Key words: Tourism, analysis, destinations, economic contribution, development

J.E.L. classification: Z3, C1, B26, F63

1. Introduction

Tourism is recognized as one of the most dynamic sectors of the global economy, contributing significantly to economic development, job creation and regional income consolidation. Internationally, tourism generates about 10% of global GDP and 1 in 10 jobs (WTTC, 2022), being considered an essential pillar of sustainable development. In Romania, tourism has significant potential due to the diversity of natural and cultural resources, including varied landscapes, internationally recognized spa resorts and a valuable cultural heritage. However, Romania's tourism sector faces a number of challenges, such as insufficiently developed infrastructure, lack of effective promotion, and limited capitalization of ecotourism destinations such as the Danube Delta (Gössling & Hall, 2019).

Analysing tourism performance requires a complex approach, given the multidimensional nature of the sector. Economic indicators, such as the contribution of tourism to GDP or the number of international arrivals, must be correlated with factors related to the attractiveness of destinations, infrastructure and tourist satisfaction (Buhalis, 2000). In this context, Principal Component Analysis (PCA) is a useful method that allows identifying the essential dimensions that explain variations in a complex data set. PCA has been widely used in the literature to synthesize and interpret tourism indicators, providing a clear perspective on the key factors contributing to tourism success (Hair et al., 2010).

The dimensions identified in the literature are aligned with the results of the present research, which emphasizes the importance of two major axes: the attractiveness of destinations and the economic contribution. The attractiveness of destinations, determined by factors such as the quality of services, infrastructure and diversity of tourist activities, is a central element for attracting tourists. Previous studies show that mountain and spa destinations play a crucial role in extending the average length of stay (Smith & Puczkó, 2014). At the same time, the economic contribution of tourism, highlighted by variables such as „PondTurGDP” or „ArrivalsInternat”, confirms that tourism can function as an engine for the economic growth of regions, when it is well managed (WTTC, 2022).

The COVID-19 pandemic has highlighted the vulnerability of this sector, causing the most severe decline in tourism activity in history. The year 2020 saw a 74% reduction in international arrivals globally (UNWTO, 2021), and Romania was no exception. Travel restrictions and border closures have significantly affected international tourism, but domestic tourist flows to less crowded destinations, such as mountain and rural resorts, have increased (Sigala, 2020). In this context, analysing the evolution of tourism over the last decade is essential to understand trends and develop strategies to support the resilience of this sector.

The present research is based on data taken from the statistics of the National Institute of Statistics (INS) for the period 2014-2022, including essential indicators for tourism analysis, such as the share of tourism in GDP, the number of international arrivals, the average length of stay and the distribution of tourist flows in the main regions of Romania. By applying the ACP, this research aims to synthesize the complexity of the data in a simplified model, highlighting the relationships between the analyzed variables and identifying the determinants of tourism performance.

The objectives of this study are the following: (1) to identify and interpret the essential dimensions that influence the performance of tourism in Romania, with a focus on the attractiveness of destinations and the economic contribution; (2) analysis of the impact of the COVID-19 pandemic on the evolution of tourism in the period 2014-2022; and (3) substantiating practical recommendations for the sustainable development of tourism, in line with international trends and good practices. This research contributes both to a deeper understanding of the dynamics of the tourism sector in Romania, and to the development of public policies designed to support the increase of competitiveness and sustainability of this vital sector.

2. Literature review

Tourism plays a central role in the economic and social development of many countries, and the literature highlights the complexity of the factors influencing the performance of this sector. One of the most widely used methods for the analysis of these factors is Principal Component Analysis (PCA), which allows the identification of essential dimensions in a complex set of data. According to Hair et al. (2010), ACP is a robust method for reducing data size and eliminating redundancy in situations where variables are strongly correlated, as is the case in the present study. This technique is frequently used in tourism to understand the relationships between economic, social, and geographic variables.

The dimensions identified in this research, namely the attractiveness of the destinations and the economic contribution, are consistent with the theory of the „four A's” (attractiveness, accessibility, amenities, ancillary services), proposed by Buhalis (2000). The attractiveness of destinations is a central factor in tourists' decision to visit a region. Studies indicate that mountainous, spa and seaside areas are preferred for the diversity of recreational activities and health benefits (Smith & Puczkó, 2014). At the same time, quality infrastructure and ancillary services contribute to the average length of stay, which is also highlighted by the high scores of the variables „DurMedSed” and „Mountain” in this research.

The economic contribution of tourism is another key pillar, reflected by variables such as 'PondTurGDP' and 'Arrivals'. According to WTTC (2022), tourism contributes directly and indirectly to economic growth, stimulating other industries and creating jobs. However, Gössling and Hall (2019) warn that tourism development must be managed sustainably in order to avoid negative effects on the local environment and culture. In Romania, this challenge is highlighted by the weaker positioning of regions such as the Danube Delta, which, although it has a high ecotourism potential, requires significant investments in infrastructure and promotion.

A major turning point for global tourism has been the COVID-19 pandemic, which has had a devastating impact on the sector. The UNWTO (2021) reports a 74% drop in international arrivals in 2020, which has led to massive economic losses worldwide. Sigala's studies (2020) point out that the tourism recovery has been different from one region to another, influenced by the strategies adopted to respond to the crisis. In Romania, domestic tourism has seen an increase during the pandemic, especially in mountainous and rural areas, as tourists have sought safer and less crowded destinations. However, this trend was not enough to compensate for the losses in international tourism.

Regarding the post-pandemic evolution, WTTC (2022) points out that the recovery of the sector has been driven by the pent-up demand for travel, but also by the industry's adaptation to the new requirements. Investments in digitalization and the promotion of lesser-known destinations have played a crucial role in attracting tourists, both domestic and international. This observation is relevant for Romania, where areas such as the Danube Delta or other rural regions have the potential to become hotspots, provided they benefit from adequate investment and promotion.

The literature provides a valuable framework for interpreting the results of this research. The dimensions identified by the ACP confirm global trends in tourism, underlining the importance of destination attractiveness and economic contribution. At the same time, the challenges related to sustainability, infrastructure and promotion remain relevant, and the results of the research can contribute to the foundation of public policies aimed at the sustainable growth of the tourism sector in Romania.

3. Research methodology

The data used in this study were taken from the official statistics of the National Institute of Statistics (INS) in Romania. These include important indicators for tourism, such as the share of tourism in GDP (PondTurPIB), the number of employees in the industry (NrSal), tourist arrivals and overnight stays, the average length of stay (DurMedSed), but also detailed information about specific destinations such as the seaside, spa resorts, mountain areas, the Danube Delta, Bucharest and other regions. The dataset covers the period 2018-2022, providing an overview of the performance of tourism over the past five years.

Before applying the analysis method, the data was processed to ensure a correct interpretation. Since the variables are measured in different units, they have been standardized using the z-score method. Standardization was necessary to eliminate the influences of scale on the analysis and to allow direct comparison between variables. Also, some transformations were applied to convert values such as „DurMedSed” from text format (where the comma was used as a decimal separator) to numeric format.

The data analysis was performed using the SPSS program, which is well known for its advanced statistical processing tools. Principal Component Analysis (PCA) was applied to identify latent data structures and reduce their size. ACP is an ideal method for analyzing complex data sets, as it synthesizes information into principal components, each explaining a significant part of the total variation. In the analysis, the correlation matrix was used, so that the relationships between the variables were not influenced by the differences in scale.

The selection of the main components was made based on several criteria. First, components that had eigenvalues greater than 1 were kept. The cumulative variance explained by the selected components was also intended to be at least 80% to ensure that the analysis captures the most important dimensions of the data. Each main component has been interpreted according to the loads of the associated variables (loadings), providing clear clues about the main relationships and factors influencing tourism.

Table no. 1 Analyzed indicators

Anii	PondTurPIB	NrSal	SosirInternat	InoptărilInternat	SosirIntern	InoptărilIntern	DurMedSed	Litoral	Balneare	Montan	Delta	Buc	Alte
2022	2,392	5209493	1,674,000	3,667,000	10,914,000	23,377,000	2,1	1,366,000	890,000	3,515,000	495,000	1,981,000	3,954,000
2021	1,741	5,094,288	1,581,065	3,458,858	9,718,046	20,860,755	2,2	1,244,000	813,000	3,358,000	597,000	1,983,000	3,741,000
2020	1,596	5,031,767	454,000	997,000	5,945,000	13,582,000	2,3	772,000	620,000	2,370,000	272,000	1,582,000	2,994,000
2019	2,981	5,164,471	2,684,000	5,291,000	10,691,000	24,795,000	2,2	848,000	597,000	2,342,000	254,000	1,535,000	2,826,000
2018	2,909	5,068,063	2,797,000	5,330,000	10,108,000	23,315,000	2,2	766,000	594,000	2,374,000	286,000	1,545,000	2,888,000
2017	2,787	4,945,868	2,760,000	5,291,000	9,383,000	21,802,000	2,2	776,000	577,000	2,270,000	125,000	1,472,000	2,685,000
2016	2,765	4,759,419	2,481,000	4,832,000	8,522,000	20,609,000	2,3	701,000	486,000	1,878,000	136,000	1,433,000	2,312,000
2015	2,399	4,611,395	2,240,000	4,472,000	7,682,000	19,047,000	2,4	686,000	479,000	1,822,000	138,000	1,450,000	2,246,000
2014	1,961	4,507,729	1,915,000	3,768,000	6,551,000	16,512,000	2,4	690,000	451,000	1,609,000	138,000	1,318,000	1,924,000

Source: Own processing according to INS data

The results were presented in the form of suggestive visualizations. The Scree plot allowed the optimal number of components to be clearly identified, and the Biplot plot provided a picture of the relationships between variables and principal components. These visual representations are useful for understanding how individual indicators contribute to the main components.

While the analysis is robust, there are also limitations. The dataset includes only nine years of observations, which may influence the generalizability of the results. However, the application of the PCA has made it possible to reduce redundancies in the data and highlight key relationships. The high multicollinearity observed between the variables was effectively addressed by this method, facilitating a clear interpretation of the determinants of tourism.

This methodological approach provides a solid framework to analyze and understand the main dimensions that contribute to the development of tourism in Romania.

4. Findings

In the context of rapid digital transformations, the tourism industry has extensively integrated emerging technologies such as artificial intelligence, blockchain, big data and the Internet of Things to optimize operations and improve the customer experience. Digitalization and digital transformation have become essential elements for the competitiveness of the tourism sector, contributing to the innovation of business models and adaptation in a business environment characterized by volatility, uncertainty, complexity and ambiguity (VUCA). However, the literature on the impact of digitalization in tourism remains fragmented, and a systematic understanding of the evolution and research trends in this field is needed. The present study aims to explore the mapping of the academic literature on digitalization in tourism, through a bibliometric analysis, in order to identify the main research clusters and suggest future directions relevant to this field.

Figure no. 1 Correlation matrix

		Correlation Matrix ^{a,b}												
		PondTurPIB	NrSal	SosirInternat	InoptărilInternat	SosirIntern	InoptărilIntern	DurMedSed	Litoral	Balneare	Montan	Delta	Buc	Alte
Correlation		B	NrSal	SosirInternat	InoptărilInternat	SosirIntern	InoptărilIntern	DurMedSed	Litoral	Balneare	Montan	Delta	Buc	Alte
	PondTurPIB	1.000	.139	.900	.889	.615	.776	-.296	-.244	-.238	-.205	-.378	-.301	-.202
	NrSal	.139	1.000	-.105	-.064	.684	.519	.722	.659	.793	.808	.687	.719	.856
	SosirInternat	.900	-.105	1.000	.994	.543	.730	-.366	-.292	-.349	-.301	-.394	-.369	-.342
	InoptărilInternat	.889	-.064	.994	1.000	.608	.782	-.279	-.196	-.268	-.220	-.312	-.281	-.268
	SosirIntern	.615	.684	.543	.608	1.000	.966	.535	.581	.573	.609	.476	.532	.583
	InoptărilIntern	.776	.519	.730	.782	.966	1.000	.311	.373	.345	.385	.255	.308	.355
	DurMedSed	-.296	.722	-.366	-.279	.535	.311	1.000	.964	.977	.983	.962	1.000	.969
	Litoral	-.244	.659	-.292	-.196	.581	.373	.964	1.000	.968	.960	.921	.966	.924
	Balneare	-.238	.793	-.349	-.268	.573	.345	.977	.968	1.000	.995	.928	.977	.987
	Montan	-.205	.808	-.301	-.220	.609	.385	.983	.960	.995	1.000	.937	.982	.992
	Delta	-.378	.687	-.394	-.312	.476	.255	.962	.921	.928	.937	1.000	.963	.922
	Buc	-.301	.719	-.369	-.281	.532	.308	1.000	.966	.977	.982	.963	1.000	.968
	Alte	-.202	.856	-.342	-.268	.583	.355	.969	.924	.987	.992	.922	.968	1.000

a. Determinant = .000

b. This matrix is not positive definite.

Source: Own processing

The correlation matrix (Figure no. 1.) indicates the relationships between the variables included in the analysis, highlighting both strong positive correlations and significant negative correlations.

High positive correlations, such as that between „Arrivals” and „Arrivals” (0.994), underline the fact that the number of international arrivals is closely linked to the length of stay of these tourists. This result is supported by the literature, which indicates that international tourists are more likely to stay for longer periods in destinations that offer diverse amenities and a quality experience (Dwyer et al., 2008).

In contrast, negative correlations, such as between „PondTurGDP” and „Delta” (-0.378), suggest that certain natural regions, although ecologically valuable, do not contribute significantly to the national GDP through tourism. This observation is confirmed by studies showing that eco-tourism in areas such as the Danube Delta requires more investment to reach its economic potential (Weaver, 2006).

The high multicollinearity observed in the matrix (e.g., the zero determinant) is commonly encountered in studies looking at interrelated variables. The literature recommends the use of PCA to reduce information redundancy (Hair et al., 2010).

Figure no. 2 Variation explained

Component	Total Variance Explained					
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.111	62.392	62.392	8.111	62.392	62.392
2	4.209	32.378	94.770	4.209	32.378	94.770
3	.480	3.696	98.466			
4	.108	.828	99.293			
5	.044	.337	99.631			
6	.038	.292	99.922			
7	.009	.066	99.989			
8	.001	.011	100.000			
9	8.573E-16	6.595E-15	100.000			
10	1.699E-16	1.307E-15	100.000			
11	3.335E-17	2.566E-16	100.000			
12	-5.591E-17	-4.301E-16	100.000			
13	-3.240E-16	-2.492E-15	100.000			

Extraction Method: Principal Component Analysis.

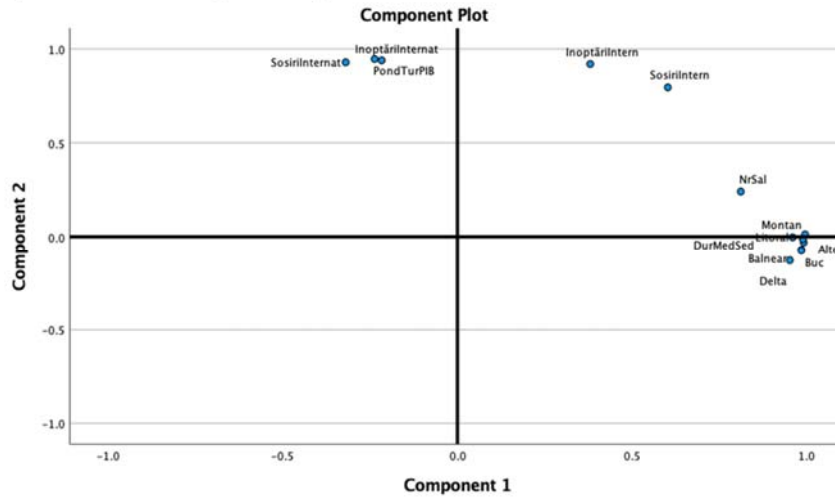
Source: Own processing

Figure no. 2 on the explained variance indicates that the first two main components retain 94.77% of the total variation, which suggests that these two components synthesize most of the information in the dataset.

Component 1 accounts for 62.39% of the variation and is dominated by destination-related variables such as „Mountainous,” „Spa,” and „Seaside.” This can be interpreted as the dimension of „attractiveness of destinations”. Component 2 explains 32.38% of the variation and is strongly correlated with economic variables, such as „PondTurGDP” and „ArrivalsInternat”, representing the „economic” dimension. The literature emphasizes the importance of these two dimensions. The destination attractiveness component (Component 1) is supported by regional development theory, which shows that diversification of tourist attractiveness (e.g. mountain and spa areas) increases tourist flows (Dwyer et al., 2008). The economic component (Component 2) is frequently mentioned as a key factor in the literature, with studies showing that tourism contributes directly to GDP growth through tourism expenditure and indirectly through the development of associated industries (WTTC, 2022).

International studies emphasize that the attractiveness of destinations and the economic contribution are two fundamental pillars of tourism development (Buhalis, 2000; WTTC, 2022). The identification of these two dimensions confirms that Romania aligns with global trends, but requires differentiated strategies to develop each dimension in a sustainable way.

Figura no. 3 Plot component (Biplot)



Source: Own processing

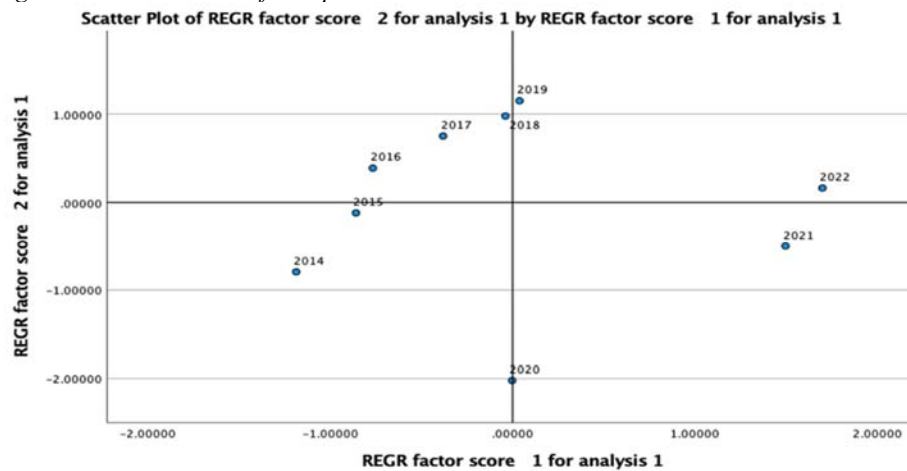
Figure no. 3 Biplot illustrates the positioning of the variables in relation to the two main components, providing a clear picture of the relationships between them.

Economic variables, such as 'PondTurGDP' and 'Arrivals', are positioned along Component 2, suggesting that they contribute significantly to the economic dimension. On the other hand, the variables „DurMedSed”, „Mountain” and „Spa” are strongly correlated with Component 1, emphasizing their connection with the attractiveness of destinations.

Variables such as „Delta” and „Buc” have less central positions, indicating less influence on the two main components. This may reflect the limitations of these regions in attracting a large number of tourists or in their overall economic contribution.

The identified dimensions are aligned with the model of the four A's (attractiveness, accessibility, amenities, and ancillary services) proposed by Buhalis (2000). Destinations that support the average length of stay (such as Montan and Balnear) reflect the attractiveness and facilities offered, while economic variables (e.g., „PondTurPIB”) demonstrate the contribution of tourism to the national economy. In addition, the placement of variables such as the Delta at the bottom suggests challenges in the sustainable use of natural heritage, an aspect extensively analyzed in the literature on ecological tourism (Weaver, 2006).

Figure no. 4 Scatter Plot of Component Scores



Source: Own processing

Figure no. 4 Scatter Plot offers a clear perspective on the evolution of tourism in Romania during the analyzed period, highlighting the variations in its performance based on the two main components: the attractiveness of the destinations and the economic contribution. The comparative analysis of the periods 2014-2016, 2020 and 2021-2022 highlights the dynamics of the tourism sector under the influence of economic, social and global factors.

The years 2014-2016 are characterized by negative positioning on both main components, suggesting a poor overall performance of Romanian tourism. On the economic dimension, this period indicates a low contribution of tourism to GDP, a low number of international arrivals and an underdeveloped infrastructure. In terms of the attractiveness of destinations, the negative scores reflect an insufficient use of the potential of key tourist regions, such as mountain and spa areas.

These observations are supported by the literature, which identifies the lack of a coherent promotion strategy and limited investments as determinants of the low performance during this period. Gössling and Hall (2019) point out that poor infrastructure and poor quality services limit the competitiveness of tourism, especially in rural and natural regions. In addition, the post-global crisis economic period of 2008-2009 continued to affect tourism in Eastern Europe, leaving visible traces in its dynamics.

The year 2020 represents a severe inflection point in the evolution of tourism, being strongly affected by the COVID-19 pandemic. The very low positioning on the economic dimension reflects the massive reduction in international arrivals, border closures and travel restrictions imposed globally. In contrast, the attractiveness of destinations has remained relatively stable, due to the increase in domestic tourism in less crowded regions, such as mountain resorts and spas.

The literature confirms the extent of the pandemic's impact on the tourism sector. The UNWTO (2021) indicates that 2020 was the most difficult year in the history of global tourism, with a 74% drop in international arrivals. In Romania, this global trend has been accentuated by a high dependence on international tourism in certain regions, such as Bucharest and the seaside. However, mountain and spa resorts have seen a slight increase in the flow of domestic tourists, due to the preference for safer destinations closer to home (Sigala, 2020).

The years 2021 and 2022 mark the beginning of a recovery for the tourism sector, but with distinct dynamics. In 2021, the negative positioning on the economic dimension suggests a still low economic contribution, caused by the reluctance of international tourists and the uncertain conditions related to the pandemic. However, the size of the attractiveness of destinations shows a slight increase, driven by the resumption of tourist activities and the partial relaxation of restrictions.

In 2022, a significant recovery on the economic dimension is observed, indicating an increase in tourism's contribution to GDP and an intensification of international arrivals. This development is supported by the easing of travel restrictions, the reopening of borders and the increase in pent-up demand for travel. The attractiveness of destinations remains positive, but without a significant improvement compared to the previous year.

According to WTTC (2022), the recovery of global tourism in 2022 was driven by strong demand for travel, especially to safe and affordable destinations. However, studies highlight that this recovery has not been uniform, being influenced by the infrastructure and adaptation strategies of each region.

Comparing these periods, it becomes apparent that the years 2014-2016 were characterised by structural constraints and poor overall performance. The year 2020 represents an unprecedented crisis point, underlining the vulnerability of the tourism sector to global shocks. On the other hand, the years 2021 and 2022 indicate a gradual recovery, with a more pronounced improvement in the economic dimension than in that of the attractiveness of destinations. This evolution suggests the need for public policies that support the diversification of the tourism offer, investments in infrastructure and the promotion of less valued destinations, such as the Danube Delta. The results are in line with the literature, which emphasizes the importance of integrated strategies and adaptation to new market requirements for sustainable tourism growth.

5. Conclusions

The present research highlights the main dimensions influencing the performance of tourism in Romania between 2014-2022, using the Principal Component Analysis (PCA) to synthesize and interpret a complex set of data. The results indicate that Romanian tourism is structured on two fundamental axes: the attractiveness of destinations and the economic contribution.

The first dimension, the attractiveness of destinations, is strongly influenced by variables such as „DurMedSed” (average length of stay), „Mountainous” (mountainous areas) and „Spa” (spa resorts). These results underline the importance of key tourist regions in attracting tourists and extending the length of stays. In particular, mountain and spa resorts have demonstrated greater resilience in times of crisis, such as the COVID-19 pandemic, becoming preferred destinations for domestic tourists. This highlights the need for a strategy to diversify tourism products and improve infrastructure in order to increase the competitiveness of these regions.

The second dimension, the economic contribution, is reflected by variables such as 'PondTurGDP' (share of tourism in GDP) and 'ArrivalsInternat' (international arrivals). This confirms that tourism plays an important role in the country's economic development, especially by attracting international tourists. However, the analysis highlights an uneven contribution of different regions to the national economy, with a worse performance in areas such as the Danube Delta, which, although it has a high ecotourism potential, requires greater investment in infrastructure and promotion.

The impact of the COVID-19 pandemic on tourism is clearly highlighted in the research results, with 2020 marked by a drastic decrease in international tourism flows and economic contribution. However, this crisis has also highlighted opportunities, especially in promoting domestic tourism and lesser-known destinations. The years 2021 and 2022 show a gradual recovery, with an increase in the economic contribution and a stabilization of the attractiveness of destinations.

Based on these results, some important strategic conclusions can be drawn. First of all, Romanian tourism needs an integrated approach that combines effective promotion with investments in infrastructure and digitalization. Secondly, ecotourism destinations, such as the Danube Delta, require a dedicated strategy to become competitive attractions both nationally and internationally. Third, the pandemic has demonstrated the importance of adaptability and resilience in the face of global challenges, highlighting the need to develop flexible public policies to support tourism in times of crisis. The contribution of this research consists in providing a detailed perspective on the factors influencing the performance of tourism in Romania and in highlighting strategic directions for its development. The results are relevant for both policymakers and industry actors, providing a starting point for developing sustainable public policies and strategies that support the competitiveness and growth of this vital sector.

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