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## **ANALYSIS OF DIGITAL TRANSFORMATION IN EU TOURISM: A COMPARATIVE STUDY**

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### **Abstract**

*This paper examines the level and dynamics of digital transformation in tourism across European Union countries. The aim of the study is to assess changes between 2019 and 2023 and highlight key differences among countries. The analysis is based on secondary data from the Tourism Dashboard, including indicators of e-commerce sales of tourism enterprises, the share of tourism enterprises using social media platforms, and internet speed at tourism destinations. The study applies a combination of descriptive, comparative, and correlation analysis, along with ranking and cluster classification. The results show clear differences in both the level and pace of digital transformation, identifying groups of leaders, stable, fast-growing, and lagging countries, and indicate no significant relationship between changes in internet speed and digital business activities in tourism.*

*Key Words: digital transformation, tourism, European Union, comparative analysis, ranking, clustering*

*JEL classification: E60, O11, O30, Z32*

### **Introduction**

Recently, the rapid development and wider adoption of digital technologies have significantly influenced business operations across the tourism sector. According to Ye and Miao (2025), tourism companies have accelerated their digital transformation efforts to improve operational efficiency, enhance business performance, and increase profitability. Digital transformation is playing an increasingly important

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role in the way tourism destinations improve service quality and reinforce their competitive position, especially in developing economies (Marinac & Pisker, 2026). The European tourism market is keeping pace with the process of digitalization, as reflected in the data available through the innovative EU Tourism Dashboard platform.

The main objective of this paper is to examine changes in the digital transformation of EU countries based on data from the aforementioned platform during the period from 2019 to 2023. The study is guided by several research questions, including whether significant progress has been achieved in digital tourism indicators across EU countries during the observed period, whether differences exist in the level and dynamics of digital transformation among EU countries, and whether there is a relationship between digital infrastructure and digital tourism activities. These questions are explored through a comparative analysis, which is further complemented by correlation analysis, country ranking, and clustering of countries into distinct groups. In this way, the paper contributes to a clearer understanding of the state of digitalization in EU countries in the context of tourism activities.

Through three chapters, the paper explains how digitalization is examined within the innovative tool used by EU institutions, namely the EU Tourism Dashboard, presents the research methodology, and discusses the obtained results together with their interpretation.

### **Digitalization within the EU Tourism Framework**

The relationship between digital technologies and tourism has become an increasingly important area of research within the tourism industry (Wu et al., 2024). Growing attention is being given to the ways in which digitalization influences tourism development, business operations, and the overall tourist experience, highlighting the significant role of technology in the modern tourism sector. Research on the digital economy shows that digitalization contributes to high-quality tourism development through improvements in productivity, environmental performance, and investment efficiency (Cheng, 2025).

Digitalization represents one of the key dimensions of contemporary tourism development within the EU Tourism Dashboard. The dashboard is an interactive web-based platform that presents statistical data and newly developed tourism indicators, structured into four main areas:

environmental impacts, digitalization, socio-economic vulnerability, and basic tourism characteristics (European Commission, n.d.-a). The digital pillar of the platform is designed to monitor the progress of tourism destinations in the field of digital transformation through indicators related to digital infrastructure, the use of digital technologies, and the online presence of tourism enterprises. The platform enables the monitoring and comparison of digital development among EU countries and regions, thereby supporting decision-makers and stakeholders in understanding the level of digital transformation and identifying areas for further improvement (European Commission, n.d.).

All this information is significant for directing investments and enabling the interventions aimed at improving digital skills and infrastructure, thereby contributing to the resilience of EU destinations during periods of crisis and strengthening their competitiveness within the tourism market (González-Rodríguez & Díaz-Fernández, 2025).

### **Methodology**

The analysis in this paper is based on three indicators from the digital pillar of the EU Tourism Dashboard. The e-commerce sales indicator measures the share of tourism ecosystem enterprises that conduct online sales, with higher values indicating a greater level of digital transformation. The indicator of enterprises using social media refers to the share of enterprises that use two or more social media platforms, reflecting a stronger digital presence within the tourism ecosystem. The indicator of internet speed at tourism destinations measures the share of tourist accommodation capacity with internet speeds above 100 Mb/s, where higher values indicate a more developed digital infrastructure and better internet connectivity for tourists (European Commission, n.d.).

The first available data on the platform date back to 2019, making it the starting year of the analysis, while 2023 represents the first year after the tourism crises in which tourism development can be more realistically assessed, as noted by Martínez et al. (2025).

A comparative analysis was conducted to examine the development and transformation between the two observed years. The analysis of progress was based on the absolute changes in the selected indicators. Following this, a composite index of digital transformation, the Digital Tourism

Index (DTI), was created as the arithmetic mean of the observed indicators.

By ranking countries according to the values of the composite index in 2023, it was possible to identify the leaders in digitalization. This also resulted in the classification of countries into four groups, as the progress of digital transformation was not uniform across the observed countries.

Pearson’s correlation analysis was applied to determine whether a relationship exists between digital infrastructure (internet speed) and digital activity in tourism (e-commerce and social media). A detailed presentation of the results is provided in the following sections of the paper.

### Results with discussion

A tabular overview of the basic data, including the average values recorded in the two observed years for all three indicators, as well as the minimum and maximum values and standard deviation, is presented below.

Table 1: *Descriptive statistic*

| EU 27    | E-commerce sales % |      | Enterprise using social media % |      | Internet speed at tourism destinations % |      |
|----------|--------------------|------|---------------------------------|------|------------------------------------------|------|
|          | 2019               | 2023 | 2019                            | 2023 | 2019                                     | 2023 |
| Average  | 31.4               | 39.2 | 34.9                            | 46.2 | 10.0                                     | 62.7 |
| Min      | 10.5               | 23.7 | 13.3                            | 19.0 | 1.3                                      | 38.2 |
| Max      | 50.7               | 64.4 | 71.0                            | 79.3 | 27.2                                     | 83.5 |
| St. Dev. | 9.3                | 10.7 | 15.6                            | 14.5 | 6.9                                      | 13.1 |

Source: *Author*

Based on Table 1, it can be concluded that positive growth was achieved across all observed indicators in 2023 compared to 2019, with particularly significant progress recorded in the area of internet speed at tourism destinations.

The primary analysis conducted in this study was an analysis of change, expressed through absolute change (percentage points) and, additionally, relative growth (%). Absolute change represents the actual increase in percentage values, while relative growth indicates the extent of growth in relation to the initial level.

Table 2: *Change analysis ( $\Delta$ )*

| EU 27 | $\Delta$ ECS** |        | $\Delta$ EUSM |        | $\Delta$ ISTD |         |
|-------|----------------|--------|---------------|--------|---------------|---------|
|       | p.p.           | %      | p.p.          | %      | p.p.          | %       |
| AT*   | 13.9           | 46.2%  | 9.9           | 21.4%  | 35.83         | 1499.2% |
| BE    | 1.1            | 2.9%   | 9.3           | 13.3%  | 50.71         | 548.8%  |
| BG    | 14.7           | 74.6%  | 5.7           | 42.9%  | 65.33         | 2803.9% |
| HR    | 7.0            | 21.7%  | -0.1          | -0.3%  | 40.88         | 356.7%  |
| CY    | 19.4           | 59.3%  | 4.7           | 9.8%   | 52.50         | 4038.5% |
| CZ    | -0.1           | -0.3%  | 19.0          | 61.9%  | 31.58         | 378.2%  |
| DK    | 19.2           | 44.5%  | 17.7          | 37.2%  | 57.64         | 331.6%  |
| EE    | 0.4            | 1.2%   | 21.7          | 136.5% | 49.67         | 774.9%  |
| FI    | 19.5           | 67.2%  | 4.4           | 6.2%   | 70.29         | 1224.6% |
| FR    | -1.6           | -5.4%  | 13.5          | 45.8%  | 51.82         | 316.4%  |
| DE    | 5.8            | 19.9%  | 19.5          | 60.6%  | 50.79         | 824.5%  |
| EL    | 13.3           | 126.7% | 20.4          | 129.9% | 38.30         | 592.0%  |
| HU    | 24.4           | 119.0% | 11.6          | 80.6%  | 50.70         | 212.8%  |
| IE    | 2.5            | 5.7%   | -14.0         | -25.9% | 52.88         | 831.4%  |
| IT    | 5.6            | 21.8%  | 19.3          | 55.6%  | 40.44         | 703.3%  |
| LV    | 8.5            | 31.8%  | 13.4          | 36.8%  | 58.20         | 3383.7% |
| LT    | -10.1          | -22.7% | -12.6         | -29.9% | 64.57         | 462.5%  |
| LU    | 7.5            | 46.3%  | 25.2          | 112.0% | 61.47         | 482.1%  |
| MT    | 15.6           | 42.5%  | 15.2          | 29.7%  | 75.21         | 943.7%  |
| NL    | 7.9            | 29.8%  | 22.4          | 77.5%  | 58.28         | 331.7%  |
| PL    | 14.4           | 49.5%  | 9.4           | 37.5%  | 45.05         | 565.2%  |
| PO    | -2.6           | -8.6%  | 23.9          | 141.4% | 78.01         | 1426.1% |
| RO    | -5.7           | -17.1% | 11.1          | 65.3%  | 53.87         | 296.8%  |
| SK    | 9.84           | 57.3%  | 7.2           | 28.7%  | 39.26         | 831.8%  |
| SI    | -3.1           | -8.0%  | 10.8          | 32.0%  | 54.28         | 1649.8% |
| ES    | 22.0           | 51.9%  | 17.7          | 43.2%  | 52.13         | 252.3%  |
| SE    | 1.8            | 3.6%   | -0.7          | -1.5%  | 41.18         | 151.6%  |

\* Codes of 27 member states of the European Union according to official EU sources

\*\* Abbreviated indicator names

Source: *Author*

Denmark, Finland, Malta, the Netherlands, and Spain stand out as countries with a high level of digital transformation and continuous progress across all observed indicators, while France, Lithuania, and Romania show slight negative trends, without significant deviations in overall digital performance.

In addition to the presented results, the Digital Tourism Index (DTI) was developed as the average value of the observed digital indicators. The

DTI enables a comparative evaluation of the level of digital transformation among countries, while the change in DTI ( $\Delta$ ) reflects the intensity of progress achieved between 2019 and 2023.

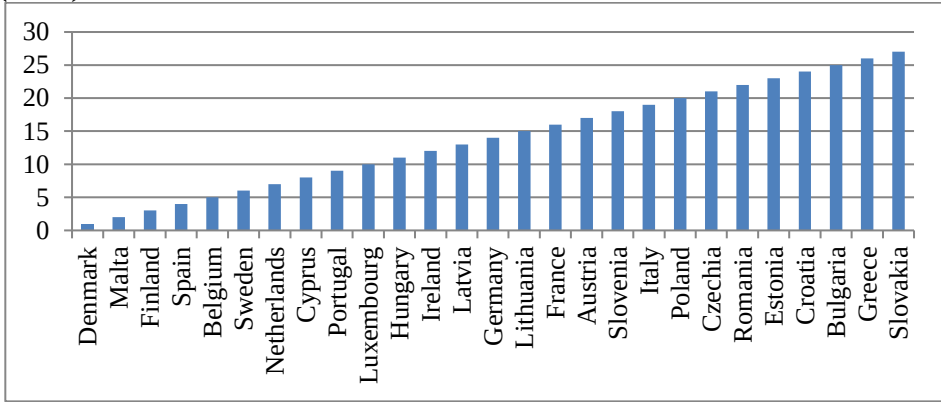
Table 3: *Digital Tourism Index*

| EU 27 | DTI 2019 | DTI 2023 | $\Delta$ DTI p.p. | $\Delta$ DTI % |
|-------|----------|----------|-------------------|----------------|
| AT    | 26.23    | 46.11    | 19.88             | 75.8%          |
| BE    | 39.01    | 59.38    | 20.37             | 52.2%          |
| BG    | 11.78    | 40.35    | 28.58             | 242.7%         |
| HR    | 25.25    | 41.18    | 15.93             | 63.1%          |
| CY    | 27.30    | 52.83    | 25.53             | 93.5%          |
| CZ    | 25.88    | 42.71    | 16.83             | 65.0%          |
| DK    | 36.03    | 67.54    | 31.51             | 87.5%          |
| EE    | 18.37    | 42.29    | 23.92             | 130.2%         |
| FI    | 35.25    | 66.64    | 31.40             | 89.1%          |
| FR    | 25.26    | 46.50    | 21.24             | 84.1%          |
| DE    | 22.52    | 47.88    | 25.36             | 112.6%         |
| EL    | 10.89    | 34.89    | 24.00             | 220.4%         |
| HU    | 19.57    | 48.47    | 28.90             | 147.6%         |
| IE    | 34.65    | 48.45    | 13.79             | 39.8%          |
| IT    | 22.05    | 43.83    | 21.78             | 98.8%          |
| LV    | 21.61    | 48.31    | 26.70             | 123.6%         |
| LT    | 33.52    | 47.48    | 13.96             | 41.6%          |
| LU    | 17.15    | 48.54    | 31.39             | 183.0%         |
| MT    | 31.92    | 67.26    | 35.34             | 110.7%         |
| NL    | 24.32    | 53.85    | 29.53             | 121.4%         |
| PL    | 20.72    | 43.67    | 22.95             | 110.7%         |
| PO    | 17.59    | 50.69    | 33.10             | 188.2%         |
| RO    | 22.85    | 42.61    | 19.76             | 86.5%          |
| SK    | 15.66    | 34.43    | 18.77             | 119.8%         |
| SI    | 25.30    | 45.96    | 20.66             | 81.7%          |
| ES    | 34.69    | 65.30    | 30.61             | 88.2%          |
| SE    | 41.75    | 55.85    | 14.09             | 33.8%          |

Source: *Author*

Based on the 2023 composite index values, disparities in digital transformation levels among EU countries were identified. The highest-ranked countries are characterized by a high level of digital integration across all observed dimensions. The analysis of progress indicates uneven development, with certain countries experiencing accelerated digital transformation despite a lower initial level of development.

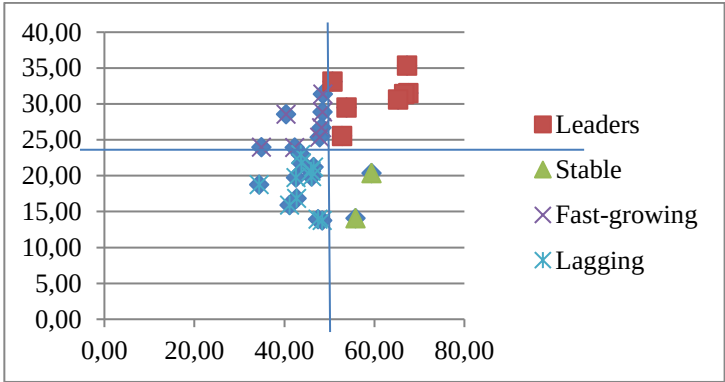
Figure 1: *Ranking of EU countries according to the Digital Tourism Index (2023)*



Source: *Author*

The top five ranked countries are Denmark, Malta, Finland, Spain, and Belgium, while Slovakia, Greece, and Bulgaria are ranked at the bottom of the list. Based on the combination of the level of digital transformation and the dynamics of development, four groups of countries were identified: leaders, stable economies, accelerated economies, and lagging economies. These findings confirm the heterogeneity of digital transformation in tourism across EU countries. Figure 2 illustrates the classification of countries into groups, while Table 4 provides a more detailed explanation of this categorization.

Figure 2: *Relationship between the level and progress of digital transformation in EU tourism*



Source: *Author*

The scatter diagram, including the average value reference lines, enables the visual identification of four groups of countries according to the level and dynamics of digital transformation.

Table 4: *Country clusters*

| Type         | Descriptions             | Countries                                                                                         |
|--------------|--------------------------|---------------------------------------------------------------------------------------------------|
| Leaders      | high level + high growth | Cyprus, Denmark, Finland, Malta, Netherlands, Portugal, Spain                                     |
| Stable       | high level + low growth  | Belgium, Sweden                                                                                   |
| Fast-growing | low level + high growth  | Bulgaria, Estonia, Germany, Greece, Hungary, Latvia, Luxembourg                                   |
| Lagging      | low level + low growth   | Austria, Croatia, Czechia, France, Ireland, Italy, Lithuania, Poland, Romania, Slovakia, Slovenia |

Source: *Author*

The dominant share of lagging countries (40.74%) indicates a significant gap in the digital transformation of tourism within the EU, despite the presence of both leading and accelerated economies (25.93% each), while the small number of stable countries (7.41%) suggests a limited intermediate stage of development.

The results of the correlation analysis indicate a very weak, almost negligible relationship between changes in internet speed and e-commerce activities ( $r=0.01$ ), as well as between internet speed and the use of social media ( $r=0.03$ ).

## Conclusion

Digital transformation is imperative for the advancement of the tourism sector (Wu et al., 2024). Studies indicate that digitalization has significant potential in the tourism industry, enabling the transformation of business processes. In the context of crises, market changes, and evolving environmental conditions, digital transformation is becoming increasingly important for the adaptation and development of the tourism sector (Filipiak et al., 2023).

The findings indicate that significant progress was achieved in digital tourism indicators across EU countries during the period from 2019 to 2023. Based on the combination of the level of digital transformation and the pace of its progress, countries were classified into four categories:

leaders, stable economies, accelerated economies, and lagging economies, highlighting considerable differences in the dynamics of digital transformation in tourism among EU countries. The obtained results suggest that improvements in digital infrastructure alone do not necessarily lead to more intensive digital activity within the tourism sector.

Overall, the study provides important insight into the growing significance of digital transformation within tourism economies. Guided by the examples of Denmark, Malta, and Finland, countries with lower levels of digitalization could achieve faster and more efficient progress in digital transformation and strengthen their position within the evolving EU tourism market. As noted by Lučić (2022), digital transformation in the tourism industry represents an important pillar for enhancing the attractiveness and competitiveness of the sector.

The main limitation of the research is the relatively short observation period. Therefore, future research should include a longer time horizon and incorporate additional indicators from the digital pillar of the EU Tourism Dashboard.

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