MANAGEMENT OF DETERMINANTS OF SUSTAINABLE TOURISM DEVELOPMENT IN THE FUNCTION OF CREATING ADDED VALUE: THE CASE OF EU MEMBER STATES

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Abstract

The study examines how economic, environmental, and social sustainability indicators influence sustainable value added in the tourism sector across the 27 European Union (EU) member states. The research addresses the limited evidence on how sustainability inputs shape value creation in tourism, highlighted in prior work such as Trinajstić et al. (2022). The purpose is to identify which sustainability dimensions support stronger long-term performance. A dynamic panel model estimated with the two-step system generalized method of moments (GMM) method is used to control for endogeneity and country-specific effects, following the approach of Arellano and Bover (1995). The results show that fixed capital formation and tourism-related turnover increase sustainable value added. Greenhouse gas (GHG) emissions show a positive association, which reflects current transitional practices. Renewable energy use contributes to stronger sustainability outcomes. Environmental taxes and social indicators show no significant link. The study concludes that economic investment and clean-energy adoption support sustainable value creation in EU tourism. The findings are relevant for policy efforts focused on green transition and long-term sector competitiveness.

Keywords: Sustainable Tourism, Sustainable Value Added, System GMM, EU Member States, Environmental Indicators, Tourism Economics

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1. INTRODUCTION

Sustainable development, defined by the World Commission on Environment and Development (WCED, 1987), rests on the balance between economic progress, social welfare, and environmental protection. Tourism plays an important role in this balance due to its large economic footprint, its ability to support regional development, and its growing environmental pressures. It is recognized not only for its capacity to generate employment but also for its ability to redistribute wealth across regions (Berno & Bricker, 2001; Uppachai et al., 2025; To et al., 2025; Krasniqi & Tahiri, 2025; Pemo

et al., 2024; Basumatary & Sarma, 2025). Existing studies such as Berno and Bricker (2001), Ruhanen et al. (2015), and Butler (1999) show strong interest in sustainable tourism, but they also point to fragmented evidence and limited cross-country comparisons.

Tourism accounts for a significant share of economic activity in the European Union (EU). EU 27 countries attract 40% of global arrivals and rely on tourism as a driver of growth and employment. Recovery after recent economic shocks strengthened the strategic importance of tourism in Europe. At the same time, environmental stress linked to carbon emissions, resource use, and waste has intensified. Peng et al. (2017) and Fletcher (2011) emphasize that the long-term performance of tourism depends on coordinated sustainability planning rather than the expansion of activity alone.

To address these challenges, organizations such as the Organisation for Economic Co-operation and Development (OECD) and Eurostat promote sustainability indicator systems that include economic, environmental, and social dimensions. One such approach is the adoption of the triple bottom line (TBL) framework, which measures business performance in economic, environmental, and social dimensions (Dwyer et al., 2009; Kumar et al., 2025). Frameworks such as the TBL and the sustainable value added approach created by Figge and Hahn (2006) help assess how sustainability inputs shape value creation. The relevance of these frameworks is high for EU tourism because member states differ in energy use, institutional capacity, and technical efficiency.

This study examines how sustainability indicators influence sustainable value added in the tourism sector of the 27 EU member states. The research seeks to answer three core questions.

RQ1: Which economic, environmental, and social indicators support stronger value creation in tourism?

RQ2: How does renewable energy affect performance?

RQ3: Whether differences in technical efficiency shape these relationships?

The study applies a dynamic panel model estimated with the system generalized method of moments (GMM) method to address endogeneity and country-specific effects. This approach follows earlier work on sustainability and tourism performance, including Dwyer et al. (2009) and Figge and Hahn (2006).

The contribution of the study is threefold. It evaluates the three sustainability pillars within a single empirical framework. It incorporates renewable energy use and social indicators that remain underexamined in EU tourism research. It provides evidence relevant to EU-level efforts to improve sustainability measurement and policy coordination.

The remainder of the paper is structured as follows. Section 2 reviews the literature. Section 3 presents the data and variables. Section 4 outlines the methodology. Section 5 provides the empirical results. Section 6 summarizes the policy implications.

2. LITERATURE REVIEW

A literature review summarizes and critically evaluates prior research to explain the current state of knowledge in a specific field. It helps identify gaps, avoid duplication, and build a clear conceptual foundation for new empirical work.

Dogan et al. (2017) examine the relationship between energy consumption, real gross domestic product (GDP), tourism, trade, and CO_2 emissions in OECD countries. They show that higher energy use increases both emissions and value added in tourism. Robaina-Alves et al. (2016) highlight the need for sustainable tourism development in Portugal through policies that improve the energy mix and reduce emissions. Balli et al. (2019) confirm that environmental indicators such as greenhouse gas (GHG) emissions influence sustainable tourism growth in Mediterranean countries.

He et al. (2020) analyze efficiency improvements in China's tourism industry and identify labor, capital, and total factor productivity as key determinants of tourism value added. Jebli et al. (2020) studied 102 countries and found that renewable energy improves tourism-related value added in developed countries, although effects vary regionally. Katircioglu et al. (2020) show that tourism growth in Cyprus reduces environmental degradation, emphasizing the need for environmental indicators in sustainability assessments.

Yang et al. (2019) find that CO_2 emissions reduce sustainable tourism development in Hainan, while Lu et al. (2019) identify positive effects of renewable energy on tourism value added in G20 economies. Zhu et al. (2021) expand on these findings by showing that environmental competitiveness supports tourism demand in high-income destinations, but not in less developed ones.

Recent studies continue to refine the environmental-tourism nexus. Trinajstić et al. (2022) examine 10 EU countries and show that increased tourist overnight stays influence energy consumption, emphasizing the importance of renewable energy adoption for long-term sustainability. Nwaeze et al. (2023) analyze 12 major EU tourism economies and find that tourism, energy demand, and economic expansion increase emissions, while trade openness improves environmental quality.

Usman and Alola (2022) study environmental taxes in the EU-28 and identify a threshold above which such taxes reduce emissions in the tourism sector. Khan et al. (2022) analyze Eastern European countries using the dynamic common correlated effect model and conclude that renewable energy significantly enhances international tourism growth. Salahodjaev et al. (2022) find that tourism increases emissions in Europe and Central Asia, while renewable energy reduces them.

Meşter et al. (2023) investigate global tourism development using principal component analysis and autoregressive distributed lag techniques and show that GHG emissions have a long-term negative effect on tourism growth. Hailiang et al. (2023) find strong causal links between renewable energy, green finance, innovation, and tourism development across Chinese provinces.

Two empirical areas remain underdeveloped in the literature. First, there is limited integration of all sustainability pillars — economic, environmental, and social — within a single model. Most studies focus on emissions and energy use while overlooking social determinants such as education, gender composition, and employment structure.

Second, recent studies highlight management capabilities as a critical element for sustainable value creation. Uppachai et al. (2025) show that dynamic capabilities shape performance in sustainable community enterprises. To et al. (2025) identify job satisfaction and workforce well-being as important drivers of performance in the tourism sector. These findings suggest that social and managerial factors require deeper empirical attention in tourism sustainability research.

Few studies analyze the EU-27 collectively using an integrated indicator framework. Cross-country comparisons are limited by inconsistent measurement of sustainability indicators, especially within the social pillar. This reduces comparability and constrains the policy relevance of findings. To address these gaps, the present study applies a dynamic panel model for the EU-27 that integrates economic, environmental, and social factors, focusing on their combined influence on sustainable value added in the tourism sector.

3. RESEARCH METHODOLOGY

3.1. Data and variables

The empirical analysis uses data from the European statistical database Eurostat for the period 2015–2024, and includes all categories of tourism-related activities and services for EU-27 member states. Under the definition of tourism activities and services, the following are included: all forms of accommodation services, food and beverage service activities, travel agency services, tour operators, and other reservation and related services.

The specifications of the research model examine the effects of variables within the economic, environmental, and social pillars in terms of their relative changes or elasticities and their impact on the movement of sustainable value added (*SVA*). The analysis was limited by data availability, unbalanced data, and irregular data updates in the statistical database.

The economic pillar of sustainability includes variable gross fixed capital formation (*FCF*). The environmental pillar includes final energy consumption (*CON*), environmental taxes and charges (*FEC*), and total GHG emissions (*GGE*). The social pillar variables include the share of women in total employment (*EMP*), the number of employed persons with tertiary education (*EDU*).

Fixed capital formation, energy consumption, environmental taxes and charges, and GHG emissions are scaled per thousand employees. Scaling variables per thousand employees in sustainability-related empirical research — especially in tourism economics — serves several methodological and interpretative purposes:

1) *Normalization for comparability*: Different countries vary significantly in population and employment size. By scaling variables (such as investment or emissions) per thousand employees, researchers normalize the data to make values comparable across countries or regions, regardless of size. This technique helps to eliminate scale bias (OECD, 2008).

2) *Controlling for labor input*: In labor-intensive sectors like tourism, expressing indicators relative to employment allows the analysis to reflect efficiency, intensity, or productivity. For instance, gross fixed capital formation per thousand employees can proxy capital intensity (Dwyer et al., 2010).

3) *Enabling elasticity and efficiency analysis*: Elasticities are often computed with per-worker or per-employee metrics to understand the marginal contribution of inputs. This approach is typical in production function models (Caves et al., 1982).

4) *Policy relevance*: Many sustainability goals are tied to labor market dynamics (e.g., green jobs, gender equity, education). Per-employee indicators help policymakers understand how sustainable development indicators interact with employment structures (Eurostat, 2022).

More detailed definitions of the economic, environmental, and social variables used in the estimation of the econometric research model, along with a comprehensive overview of their measurement units, data sources, and classification by sustainability pillar, are provided in Table 1. We also present descriptive statistics for all countries in the model (see Table 2).

Table 1. Description of the variables

Variable category	Symbol	Measurement units/Range	Source
Dependent variable			
Sustainable value added	*SVA*	Gross value added (GDP) in millions of € divided by the number of employees (in thousands). It measures the value of goods and services produced in a region, industry, or sector (tourism sector).	Eurostat
Independent variables			
Fixed capital formation	*FCF*	Total amount of fixed capital (in millions of €) divided by the number of employees (in thousands).	World Bank
Turnover in the industry	*TUR*	Total annual data 2021 = 100.	Eurostat
Energy consumption	*CON*	Final energy consumption, million tonnes of oil equivalent, divided by the number of employees (in thousands).	Eurostat
Environmental taxes and charges	*FEC*	Taxes whose tax base is a physical unit (or equivalent) of something proven to have a specific negative environmental effect. Taxes motivated primarily by environmental protection, not fiscal reasons (in millions of €) divided by the number of employees (in thousands).	Eurostat
GHG emissions	*GGE*	Annual GHG emissions, including land use, tonnes of CO_2 equivalents divided by the number of employees (in thousands).	Eurostat
Total female workers	*EMP*	A thousand people from 15 years old to 64 years old.	Eurostat
Total employed with a tertiary education	*EDU*	Thousand persons.	Eurostat
Share of renewable energy in total final energy consumption	*REN*	Percent (%).	Eurostat

Table 2. Descriptive statistic

Variable	Obs.	Mean	Std. dev.	Min	Max
SVA	270	0.975371	1.341955	0.153246	14.45536
FCF	270	271250.9	372184.4	36753.59	3923366
TUR	260	97.07231	17.37342	63.9	144.8
GGE	243	284.4846	197.3169	41.72948	1860.907
FEC	270	24.8067	29.17645	4.723848	296.5131
EDU	270	3535.351	4839.847	79.9	22349.4
EMP	270	2954.956	4052.817	71.1	18242.4
REN	243	23.08961	12.12483	4.987	66.393
CON	243	70.66613	57.80185	14.2162	722.0317

Source: Authors' elaboration.

Table 2 presents descriptive statistics for all variables used in the econometric analysis, covering 270 observations across the 27 EU member states. The summary statistics reveal considerable cross-country heterogeneity in both the dependent and independent variables, reflecting the structural diversity of EU tourism sectors in terms of sustainability performance and resource allocation.

The dependent variable, sustainable value added (*SVA*), has a mean of approximately 0.98 (million euros per thousand employees), with a standard deviation of 1.34. The relatively large dispersion — ranging from a minimum of 0.15 to a maximum of 14.46 — indicates substantial variation in value creation efficiency across EU tourism sectors. This justifies the need for disaggregated analysis that accounts for efficiency differences, as pursued in the current study.

Among the economic indicators, fixed capital formation (*FCF*) shows a high mean (271251 million euros per thousand employees) and very large variability (standard deviation of 372184), suggesting significant disparities in capital investment intensity across member states. Similarly, turnover in the tourism industry (*TUR*) ranges from 63.9 to 144.8, indicating uneven revenue generation capacities within the sector. Environmental indicators also exhibit wide variation. GHG emissions (*GGE*) have a mean of approximately 284.5 tonnes of CO_2 equivalents per thousand employees but range widely from 41.7 to 1860.9, signaling substantial differences in tourism's environmental footprint across countries. Environmental taxes and charges (*FEC*) also vary significantly, with a standard deviation larger than the mean (29.2 vs. 24.8), pointing to inconsistencies in environmental fiscal policy application and effectiveness across the EU. The share of renewable energy in total final energy consumption (*REN*) averages 23.1%, with a maximum of over 66%, suggesting that while some countries have made notable progress in the energy transition, others remain reliant on conventional energy sources. This variation supports the inclusion of *REN* as a key explanatory variable in the model. Social indicators such as total employment with tertiary education (*EDU*) and the number of female employees (*EMP*) also reveal significant heterogeneity. For instance, the mean for *EDU* is 3535 persons, but ranges up to 22349, underscoring large disparities in human capital endowment in the tourism workforce. The same applies to *EMP*, with an average of around 2955 and a wide range (71 to over 18000). These results may help explain the non-significant results for social indicators observed in the regression analysis, as variability in these dimensions might not align with sector-specific value added without further disaggregation.

Lastly, final energy consumption (*CON*) has a mean of 70.7 tonnes of oil equivalent per thousand employees, but a high standard deviation (57.8), reflecting stark differences in energy intensity, which may impact both environmental performance and cost efficiency in tourism.

In summary, the descriptive statistics underscore the necessity of accounting for structural, economic, and policy differences among EU member states. The considerable dispersion in all variables reinforces the appropriateness of applying a dynamic panel approach, which can accommodate country-specific effects and time-varying heterogeneity in the analysis of sustainable tourism value creation.

3.2. Methods

The methodological design of this study begins by identifying the variables included in the empirical model and by outlining how the sustainability framework is applied to the tourism sector of the EU-27. The analysis is centred on sustainable value added (*SVA*), which is assessed through indicators representing the economic, environmental, and social dimensions of sustainability.

The specification of the model is grounded in standard theory on value creation, where output stems from the combined productivity of labour and capital. This logic corresponds to the foundations of the Cobb-Douglas production structure, which is widely used to describe how efficiency in input use shapes total output. These concepts provide the background for examining how different types of sustainability indicators influence value added within the tourism industry. At the macro level, gross value added is commonly used to capture economic performance, making it an appropriate anchor for the analysis.

Tourism-related indicators show time-dependent behaviour, meaning that current outcomes often reflect past conditions. For this reason, dynamic panel models — where the lagged dependent variable is included as part of the explanatory set — are more suitable than static models. Static formulations ignore this temporal dependence and risk generating biased or inconsistent estimates, especially when the underlying processes evolve.

Because the variables under study may be correlated with country-specific characteristics or with their own past values, endogeneity is a concern. To address this issue, the analysis adopts a GMM framework. Two well-established estimators are relevant in this context: the difference GMM estimator introduced by Arellano and Bond (1991), and the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond

(1998). These methods rely on internal instruments constructed from lagged values of the variables, enabling consistent estimation in models with endogenous regressors.

The underlying dynamic model can be expressed as:

$$y_{it} = \mu + \gamma y_{it-1} + \beta X_{it} + \lambda Z_{it} + \lambda W_{it} + \alpha_i + \varepsilon_{it};$$
$$i = 1, \dots, N, t = 1, \dots, T \qquad (1)$$

where, y_{it} denotes sustainable value added, y_{it-1} is its lagged value, X_{it} includes the economic variables, Z_{it} contains the environmental indicators, W_{it} represents the social variables, α_i captures unobserved country-specific heterogeneity; ε_{it} is the idiosyncratic error term.

Here, *i* index countries and *t* indexes years. The error term is assumed to be independent of the explanatory variables and uncorrelated with the lagged dependent variable, ensuring the validity of the moment conditions.

The inclusion of the lagged dependent variable creates correlation with the unobserved effects, which would bias conventional estimators. Arellano and Bond (1991) address this challenge similarly for the other variables:

$$\Delta y_{it} = \gamma \Delta y_{i,t-1} + \beta \Delta X_{it} + \lambda \Delta Z_{it} + \delta \Delta W_{it} + \Delta \varepsilon_{it} \qquad (2)$$

$$\Delta y_{it} = y_{it} - y_{i,t-1} \qquad (3)$$

In this form, the individual effects are eliminated. However, the differenced lagged dependent variable remains correlated with the differenced error term. For this reason, lagged levels of the dependent variable are used as instruments. These instruments are expected to correlate with the differenced endogenous regressors but remain orthogonal to the differenced disturbances.

When the dependent variable is highly persistent, and the variance of the country-specific effect dominates the variance of the idiosyncratic component, the difference GMM estimator may lose efficiency. The system GMM estimator addresses this issue by combining the differenced equation with the equation in levels, thereby expanding the set of usable moment conditions and improving precision. Given the persistence observed in sustainable value added and the structure of the variables used in this study, the system GMM estimator is the preferred approach. It offers more reliable estimates than the difference GMM estimator, particularly when the number of cross-sections is limited.

An important consideration within GMM estimation is the number of instruments. Excessive instrument counts can weaken the Hansen test and inflate the risk of overfitting. This issue is more common in panels with fewer countries, as is the case here. To mitigate this, the model uses the "collapse" procedure to restrict the number of instruments and maintain the robustness of the specification.

The two-step system GMM estimator is used, incorporating Windmeijer's (2005) robust correction for finite-sample bias. The Hansen test is applied to assess whether the instrument set is valid and whether the over-identifying restrictions are satisfied.

4. RESULTS

The empirical analysis begins with a diagnostic evaluation of multicollinearity. The correlation matrix shows that pairwise correlations between the explanatory variables are generally low (Table 3). A multicollinearity problem would arise if any correlation exceeded the commonly accepted threshold of 0.8. None of the variables in the dataset reach this level, indicating that the explanatory variables can be included together without risk of distortion. Mild collinearity is common in tourism and sustainability research, but the GMM estimator naturally reduces these concerns through its reliance on internal instruments.

Table 3. Correlation matrix

Variable	SVA	FCF	TUR	GGE	FEC
SVA	1				
FCF	0.6835	1			
TUR	0.1917	0.1668	1		
GGE	0.6447	0.6659	0.0729	1	
FEC	0.7327	0.7189	0.1181	0.6441	1
EDU	0.2309	0.2021	0.1314	0.0313	0.2011
EMP	0.2002	0.1713	0.1173	0.0143	0.1716
REN	0.1131	0.158	0.1131	0.1193	0.2052
CON	0.6809	0.5806	0.0592	0.8365	0.6673

Source: Authors' elaboration.

As we can see from Table 3, in our model, there is no multicollinearity among the selected variables.

The results of the two-step system GMM estimator are presented in Table 4. The first three model specifications (Models 1, 2, and 3) examine the determinants of sustainable value added (*SVA*) separately for each of the three pillars — economic, environmental, and social. Model 4 integrates the determinants from all three pillars to provide a more comprehensive framework for assessing sustainability in tourism.

Across all estimated specifications, the diagnostic tests indicate that the model is well specified. The Hansen test supports the validity of the instrument set in every model, confirming that the overidentifying restrictions are appropriate. Serial correlation is examined using the Arellano-Bond tests for first- and second-order autocorrelation in the differenced errors. While AR(1) is expected due to the nature of first-differencing, the absence of significant AR(2) autocorrelation suggests that the model is correctly specified. The test results presented in Table 4 show that the null hypothesis (H_0) of no second-order autocorrelation cannot be rejected, indicating that the estimates are both consistent and reliable.

The coefficient of the lagged dependent variable is positive and statistically significant in all model variations. This confirms that sustainable value added displays persistence: higher sustainable value added in one period is associated with higher sustainable value added in the following period. This dynamic pattern is consistent with earlier findings, such as those reported by Kong et al. (2016), who highlight that prior economic performance tends to reinforce current outcomes. Similar conclusions are drawn by Majeed and Mazhar (2021), who note that economies with strong previous performance are more likely to maintain improved value-creation levels in subsequent periods.

Including the lagged dependent variable is justified by the dynamic behaviour of the tourism industry and the uncertainty that characterizes its contribution to economic activity. Tourism performance often evolves gradually, and the dynamic specification enables the model to capture intertemporal effects that link past outcomes with current levels of value added. This approach reflects patterns commonly observed across economies with diverse income structures, where historical performance shapes current growth trajectories.

5. DISCUSSION

The results in Table 4 summarize how economic, environmental, and social sustainability indicators influence sustainable value added (*SVA*) across the EU-27. The lagged dependent variable shows strong persistence in sustainable value added, confirming that past performance matters for current outcomes. Fixed capital formation (*FCF*) and tourism turnover are the only economic indicators that remain statistically significant across specifications, and both carry positive signs. Among the environmental indicators, only GHG emissions (*GGE*) show a significant and positive effect on sustainable value added, while environmental taxes and renewable energy use are non-significant. All social indicators included in the model remain statistically insignificant. The diagnostic tests confirm the validity of the instruments and the absence of second-order autocorrelation, which supports the reliability of the estimated coefficients. These patterns form the basis for the detailed discussion that follows.

Table 4 Determinant (variable) sustainability (Blundell and Bond GMM estimator in 2 steps)

Variables	Model 1: Economic variables			Model 2: Environmental variables			Model 3: Social variables			Model 4: Economic, environmental, and social variables		
	Coeff.	SE	Prob.	Coeff.	SE	Prob.	Coeff.	SE	Prob.	Coeff.	SE	Prob.
SVA (-1)	0.306	0.019	0	0.582	0.195	0.006	0.895	0.296	0.006	0.405	0.152	0.004
FCF	0.002	0.0004	0							0.000001	0.0000008	0.052
TUR	0.0012	0.0003	0							0.003	0.002	0.069
CON				0.0008	0.007	0.912				0.001	0.007	0.837
FEC				-0.0008	0.001	0.519				0.0003	0.001	0.792
GGE				0.049	0.011	0				0.022	0.009	0.021
EMP							0.0005	0.0022	0.798	0.00006	0.00013	0.621
EDU							0.0005	0.0019	0.785	0.00005	0.00011	0.652
REN				-0.008	0.008	0.329				-0.007	0.005	0.173
_cons	0.102	0.02	0	-0.2863	0.182	0.131	0.066	0.225	0.771	-0.3634	0.2261	0.121
No. of countries	27			27			27			27		
No. of instruments	7			16			7			18		
Hansen test (p-value)	0.339			0.879			0.174			0.140		
Test for AR(1) errors (p)	0.006			0.080			0.032			0.029		
Test for AR(2) errors (p)	0.318			0.436			0.335			0.527		

Note: The Arellano-Bond test shows that the average auto-covariance in residuals of order 1 is 0 (H_0: No autocorrelation). The Arellano-Bond test indicates that the average auto-covariance in residuals of order 2 is 0 (H_0: No autocorrelation).
Source: Authors' elaboration.

Fixed capital (*FCF*) and turnover (*TUR*) remain statistically significant when examined separately. Both variables show a positive effect on sustainable value added (*SVA*). This aligns with empirical evidence reported in studies such as Jebli et al. (2020), Katircioglu et al. (2020), Yang et al. (2019), Lu et al. (2019), Balli et al. (2019), and Dogan (2017). Their influence remains stable even after environmental and social indicators are incorporated into the model. Countries with higher levels of fixed capital appear better equipped to use their assets to generate income, which raises sustainable value added. Similar conclusions are noted by Majeed and Mazhar (2021) and Kostakis (2020), who link fixed capital investment to technological improvements, stronger production efficiency, and sectoral specialization. These processes promote employment growth and support higher revenues across the tourism industry.

The positive association between turnover and sustainable value added suggests that higher revenue reflects improved labor productivity in the sector, consistent with Inchausti Sintes et al. (2020). Among environmental indicators, GHG emissions (*GGE*) show a significant and positive coefficient in all specifications. This outcome emerges once economic and social factors are controlled for. Environmental taxes and fees, however, remain statistically insignificant across all models.

The positive sign on CO_2 emissions can be interpreted as a feature of a sector in transition. Tourism in many EU countries still relies on resource-intensive processes. As activity expands, emissions rise, while the shift toward cleaner production is gradual. Similar transitional patterns are noted in the work of Katircioglu et al. (2020) and Robaina-Alves et al. (2016). Kratena and Sommer (2014) and Yang et al. (2019) report comparable findings, showing that value added can grow alongside higher emissions when economies increase resource use.

These outcomes highlight the importance of improving the quality of economic growth in tourism to reduce environmental pressures. Studies by Leitão and Lorente (2020), Leal and Marques (2022), and Ciarlantini et al. (2023) show that more developed economies often record higher emissions from tourism. Several of these studies also confirm an inverted U-shaped pattern between GDP and emissions, consistent with the environmental Kuznets curve. As income rises, economies tend to adopt stronger environmental measures, which lowers the negative effects over time.

The lack of significance for environmental taxes and charges mirrors the findings of Hinterberger (2013). This suggests that existing fiscal instruments are not strong enough to influence sustainability outcomes in tourism. Stronger and better-targeted measures may be required. As Meyer and Sommer (2014) note, combining fiscal tools with recycling programs and advisory services can support more effective improvements in value added within the sector.

The share of renewable energy sources (*REN*) in the total energy mix does not show a statistically significant effect on sustainable value added in the tourism sector. This result aligns with several studies that report mixed or insignificant impacts of renewable energy on tourism-related output. Bohdanowicz (2011) shows that the adoption of renewables in hospitality improves environmental performance but does not always translate into direct economic gains. Jebli et al. (2020) also report that the effect of renewable energy on tourism differs across regions and depends on investment depth and institutional capacity. Lu et al. (2019) find that renewable energy supports long-term sustainability, but its short-run contribution to economic value remains limited. Ntanos et al. (2018) highlight that public acceptance and regulatory frameworks influence renewable energy outcomes, which explains the variation across EU member states. These findings support the non-significant relationship observed in this study. Renewable energy remains important for the environmental pillar, but its direct link to value creation in tourism is not yet evident across the EU-27.

None of the social indicators included in the analysis shows a statistically significant effect on sustainable value added across any of the model specifications. Although previous studies highlight the relevance of social factors in shaping sustainable tourism outcomes (Laws et al., 2011), there is still no clear or commonly accepted framework for identifying which social indicators best capture their influence on value creation. The literature offers many conceptual discussions on how to measure social sustainability, but empirical applications remain limited, largely because comparable data are scarce, especially when examining a broad set of countries such as the EU-27.

Researchers have used different social indicators depending on data availability and the specific focus of their studies, which complicates comparison between findings. For instance, Gkoumas (2019) includes measures such as the number of tourism operators holding environmental or sustainability certifications, the share of accommodation facilities that follow local architectural requirements, and the proportion of staff trained in environmental management. These types of indicators are not consistently available for all EU-27 countries, which makes their inclusion in this study impossible and underscores a broader challenge for empirical work on the social dimension of tourism sustainability.

6. CONCLUSION

Tourism plays a major role in the EU economy, but its rapid expansion increases pressure on natural resources and environmental quality. This study examined how economic, environmental, and social sustainability indicators shape sustainable value added in the tourism sector across the EU-27. The empirical model used a dynamic panel framework and system GMM estimation to address endogeneity and country-specific effects.

The results show that economic determinants have the strongest and most consistent influence on sustainable value added. Fixed capital formation and tourism-related turnover show positive and significant effects. Countries with higher levels of capital investment and stronger revenue performance use their production inputs more efficiently and achieve higher value added. These effects remain stable after controlling for environmental and social indicators.

Environmental variables produce mixed outcomes. GHG emissions show a positive association with sustainable value added, which reflects the current transitional stage of EU tourism. Higher value creation still depends on resource-intensive processes in many member states. Environmental taxes and charges show no significant influence, indicating the weak effectiveness of current fiscal instruments and the need for more targeted measures. Renewable energy sources do not show a significant effect on sustainable value added. This confirms that the adoption of renewable energy improves environmental outcomes but has not yet translated into measurable economic gains in the tourism sector at the EU level.

None of the social sustainability indicators shows a significant effect on sustainable value added. This suggests that the social pillar remains weakly integrated into national sustainability frameworks and that data gaps limit the ability to measure its contribution to economic value.

The findings have several policy implications. First, stronger investment in capital and productivity-enhancing measures will support value creation in tourism. Second, environmental policy requires revision, particularly in countries with high emissions and limited energy efficiency. Third, the effectiveness of environmental taxes depends on clear thresholds and stronger enforcement. Fourth, the non-significant effect of renewable energy highlights the need for coordinated energy policies that connect tourism development with wider EU energy strategies.

Member states differ in technical efficiency, institutional capacity, and investment structures. A uniform sustainability policy is therefore unrealistic. Policymakers need flexible instruments that reflect national conditions. Countries with high emissions should receive targeted support that encourages low-carbon development. Countries with stronger renewable energy systems need strategies that integrate clean energy into tourism production processes more effectively.

The study has several limitations. Social indicators are not harmonized across EU countries, which reduces the scope of analysis. Data updates remain infrequent, especially for labor-related variables. The model does not include all relevant determinants due to the limited availability of long-term comparable data. These limitations affect the precision of the estimated effects, especially within the social pillar.

Future research should expand the set of sustainability indicators, particularly social metrics linked to employment quality, workforce structure, and community participation. Studies should also

analyze subgroups of member states to capture differences in technical efficiency and policy implementation. Further work should examine the long-term effects of environmental taxes and renewable energy use, using updated datasets and refined indicator frameworks. Extending the research to regional or destination-level data would also provide stronger insights into how sustainability policies shape value creation in tourism.

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