European Review, Vol. 30, No. 2, 172–193 © 2020 Academia Europaea
doi:10.1017/S106279872000099X

Socio-economic Development and the Level of Tourism Function Development in European Union Countries – a Comparative Approach

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Socio-economic development and the concept of the tourist function of areas are multidimensional socio-economic phenomena, the diagnosis of which is particularly important in various comparative studies regarding EU countries. Measurement based on GDP per capita, widely used in the assessment of the socio-economic level of development of countries, does not include many aspects of this development in its construction. Similarly, the level of development of the tourist function cannot be assessed by means of one universal measure. Both categories should be treated as complex phenomena, which are influenced by many different factors. The aim of this article is to compare and statistically assess two complex phenomena, i.e. level of socio-economic development and level of tourist function development in 28 European Union countries. Linear ordering of EU countries was carried out using the TOPSIS method on the basis of diagnostic variables determining individual complex phenomena in 2016. Values of the overall synthetic measure were also indicated, taking into account all diagnostic variables. Rankings of EU countries were built and four typological groups of countries with high, medium-high, medium-low and low level of development were created. Discriminant analysis indicated variables that have the greatest impact on the classification of EU countries in terms of the level of socio-economic development and level of tourism function development. A linear econometric model with synthetic variables was also constructed, and it was determined which of the synthetic measures is relatively more important in describing the shaping of the overall synthetic measure. The quality of the work is increased by the use of many different statistical and econometric methods, as well as methods from the field of Multidimensional Comparative Analysis. Thanks to this, it is possible not only to deepen the assessment of the studied phenomena, but also to obtain more objective results. Conclusions from the research may be a basis for proper management in the field of socio-economic development as well as for the development of the tourist function of EU countries. They can also be used

for appropriate allocation of financial support for countries within the framework of the EU cohesion policy and in determining the tourist specialization of countries.

1. Introduction

European Union countries are diverse in terms of the level of socio-economic development (Fura and Wang 2017; Stec *et al*. 2014; Timmer *et al*. 2010; Wesseling 1998). In order to reduce economic, social and territorial disparities between the individual Member States, the European Union has a cohesion policy. Financial assistance under the cohesion policy is primarily aimed at supporting areas with lower development level, with a geographical or natural disadvantage, low population density and with mountain areas. Proper distribution of financial resources requires constant monitoring of changes in the level of socio-economic development of Member States.

Tourism is now considered to be a very important element of international relations. Interdisciplinarity and the high dynamics of development of this field result from the fact that individual countries or regions perceive tourism as an instrument to solve many economic and socio-cultural problems. Policymakers should therefore implement relevant economic decisions to sustain efforts to spur growth in the tourism sector (Cannonier and Burke 2017; Ohlan 2017; Shahbaz *et al*. 2017).

As confirmed by research, Europe is the world's number one tourist destination (European Commission 2010; UNWTO 2018; Juul 2015). Europe's main strengths include its infrastructure, its cultural diversity in a comparatively small area, and its borderless travel area within the Schengen zone. In the European Union, tourism is the third largest socio-economic activity and makes an important contribution to the EU's gross national product and to employment (tourism generates 10% of GDP and represents 9% of total employment in the European Union). Maintaining Europe's leading market position has been set as the objective of EU tourism policy. Tourism can become a strong point especially for those EU countries with rich tourist values, but with a lower level of socio-economic development. Therefore, it is extremely important to examine EU countries in terms of the level of tourist function development.

The aim of this article is to compare and statistically assess the level of socio-economic development and level of tourist function development of EU countries. With the use of diagnostic variables defining both these complex phenomena for 2016, EU countries were organized and classified according to the TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method. Moreover, variables having the greatest impact on the classification of EU countries in terms of the level of development of both the studied complex phenomena were indicated with the use of discriminant analysis. The influence of particular complex phenomena on the value of the overall synthetic measure was also assessed.

In order to implement research assumptions, we tried to answer the following questions:

https://doi.org/10.1017/S106279872000099X Published online by Cambridge University Press

- Which EU countries can be considered as leaders in terms of the level of socio-economic development, and which have an average or low level?
- Which countries have a leading tourist function, and in which countries does it play a marginal role?
- Which diagnostic variables have the greatest impact on the classification of EU countries in terms of the level of socio-economic development and level of tourist function development?
- Which of the complex phenomena under study are relatively more important for the overall socio-economic situation?
- What is the practical significance of the obtained results?

2. Socio-economic Development and Tourist Function of an Area – a Literature Review

Socio-economic development is a concept that is difficult to define, it includes many elements at once, and depends on the context of its use. The concept of development is based on the concept of change, which constitutes a transition from one state of affairs to another. Determining socio-economic development as a sequence of changes consists of indicating what characterizes these changes and what determines them. The nature of socio-economic development is determined by development processes and/or development goals. Generally, these processes are internally ordered sequences of changes in states of things or phases in which the determination of some states by subsequent states takes place (Takamori and Yamashita 1973).

Some authors (Bellu 2011; Khan 1991) define socio-economic development more broadly, treating it as a process of positive quantitative–qualitative changes (involving increasing and improvement of existing phenomena and emergence and development of new phenomena) in the sphere of all economic, cultural and social activities as well as social-production and political-constitutional relations. Other authors (Chojnicki 2010; Fritz 2004) even point out that this development process also includes, apart from economic changes, changes of a social nature. Social development determines economic development and vice versa. Without one, the other will not exist, but both components contribute to the mechanism that drives the 'circle of development' in the long run.

Hence, the attributes of thus defined changes are (Litwiński 2017; Rodriguez *et al.* 2012) irreversibility and the positive assessment of on-going changes from the perspective of a given value system or the principles recognized by interest groups in a regional or local perspective. The processes of change in a socio-economic system, on the other hand, are dictated by human activity and behaviour (controlling and monitoring). They are focused on achieving the particular states of the final processes that serve as the realization of certain objectives of the activity.

Taking into account different approaches to the definition of socio-economic development, the authors of this article understand socio-economic development

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as all qualitative and quantitative changes directed at gaining certain aims. These are irreversible changes in the sphere of any economic, cultural and social activity as well as social and production and political and systemic relations.

It is worth emphasizing that socio-economic development as a complex process is conditioned by many factors, which most often include (Cracolici *et al*. 2010):

- geographical – shaped by nature (natural environment) and human (artificial environment), related to the place of business;
- scientific and technical – related to the level of knowledge, development of work tools and ability to use them;
- demographic – related to the number and structure of population living in the area where the activity is or will be conducted;
- socio-economic – resulting from the nature of economic and social relations and determined by the level of economic development that has been achieved;
- resulting from the external environment.

Similar conditions are pointed out by Szirmai (2015), listing the following factors:

- external (exogenous) and internal (endogenous);
- various factors or barriers for development,
- presented according to the SWOT analysis, i.e. strengths, weaknesses, opportunities and threats;
- specified according to another classification criterion.

According to this author (Szirmai 2015), traditional development factors are: natural, human resources and capital. Natural conditions consist of all components of the geographical environment, related to space occupied by specific nations and local communities. They are natural and at the same time internal conditions for the development of each society. The role of people in the development process is determined by the size of the population and its spatial distribution, population structure, and method of use in production and service processes. Capital, on the other hand, is included in the total value of fixed assets and non-durable items (equipment). In a spatial aspect, this is everything that is called existing spatial planning together with technical equipment (machines and devices). The sum of these resources is the so-called standard of technical and economic equipment of a given country, region, commune, city or village.

Tourism is one of the areas of economic activity that is considered to be a stimulator of social and economic development.

Tourism, as one of the fastest growing economic areas and as a social phenomenon, is a driving force for many national economies, especially those with a lower level of socio-economic development (Flecha *et al*. 2010; Lee and Chang 2008; Marzuki 2009; Sharpley and Telfer 2014). It gives an opportunity to improve the competitiveness of a region (country) by increasing employment, increasing GDP,

increasing revenues from tourism coming from, among other things, tourist expenses and emergence of new tourist infrastructure (Dritsakis 2004; Ekanayake and Long 2012).

Tourism, as a multidimensional and complex phenomenon, in conditions of globalization, has become a distinctive feature of modern lifestyles and a significant element of socio-economic development both on a regional and global scale and a factor of international integration. Together with the growing importance of tourism in the European Union, it has become a priority branch of the economy in many countries. Currently, tourism activity is considered to be one of the indicators of residents' standard of living and one of the indicators of developing societies.

Tourism is currently one of the most dynamically developing fields of economic activity in the world. The essence of tourism lies in the fact that it has multiple aspects (heterogeneity), because on one hand this activity is a result of socio-economic changes, and on the other, it becomes an indispensable element of the development of contemporary societies (Gnanapala and Sandaruwani 2016; Matarrita-Cascante 2010; Nassani *et al*. 2018). This field of the economy benefits the countries or regions that invest in it. An example of such a country is Switzerland. It should be emphasized that 100 years ago Switzerland was a poor agricultural country in which about two-thirds of the territory was considered non-productive, i.e. unfit for agricultural purposes or other industrial activity (in Switzerland over 60% of the territory is covered by the Alps). However, it is elements of Switzerland's natural landscape, i.e. the very interesting shaping of the area, mountain ranges and lakes, that became a basis for the birth of tourism in this country (Klimek 2010).

It should be noted that even the European Commission conducts a so-called guide on tourism development. It contains many guidelines that will shape the development of tourism in an appropriate way. According to this guide, development of a tourist function of a given country or region depends, among other things, on appropriate natural values, features that distinguish this area from the rest of the environment, creating clusters of tourist attractions, creating a brand of tourist destinations, strategic planning or others (see https://ec.europa.eu/regional_policy/pl/policy/themes/tourism/).

'Tourist function' is most often understood as a socio-economic activity carried out by a specific area and its inhabitants, and directed at services related to tourist traffic. Therefore, this activity located in a given area and its environment consists of activities of its permanent and temporary residents, various institutions and organizations, as well as geographical environment resources enabling the performance of such activities. The overriding goal of undertaking such activities is to help arriving tourists their restore normal psychophysical abilities, which may have been lost as a result of fatigue (Stoffelen and Vanneste 2017).

Specialization of tourist function is extremely rare on its own, and usually it is one of many service functions. Large-scale provision of tourist goods and services requires a very strongly developed service sector (Nayomi and Gnanapala 2015). Hence, the occurrence of tourist function is conducive to the creation of many

complementary, e.g. commercial, communication functions, which, as the area develops, may dominate it (Alipour *et al*. 2012). For example, in small towns, the tourist function, due to a poorly diversified functional structure, has a chance to obtain a dominant position, which is not the case in large cities. It is, therefore, necessary to better understand the nature of the tourist function itself, its relation to other functions, and its role in the socio-economic development of a given territory. The relevance of this issue is due to the current recognition that tourist function aspires to be a factor of great importance for the development of individual regions or countries through generating jobs and income, stimulating investments, ecological and cultural knowledge, and taking care of broadly understood social health.

A tourist function is universal in its endogenous dimension. It occurs without exception, although to a different extent, because we organize our leisure everywhere, including in the place of our permanent residence. However, in its exogenous dimension, it is a highly specialized function. Geographical location, which determines the size and nature of tourism resources, largely determines this. The presence of the appropriate size and quality of tourism resources and demand for tourism goods and services have an impact on meeting the needs in the sphere of tourism, and this has an impact on the level of development of a given area. Both demand and tourism resources are internally quite strongly diversified, which, in turn, causes specialization within the tourist function itself, and thus specialization within the scope of tourist goods and services provided by a specific territorial unit.

Full satisfaction of demand reported by tourists requires the coexistence and cooperation of many individual goods and services produced by different producers. Tourists visiting a given region report demand for specific goods and services, they import and spend money. These funds are the revenues of entities operating in a given region, but they are also allocated, among others, to employees' remuneration and purchases of the goods and services necessary for conducting further operations. At the same time, this results in an increase in budget revenues of local government units in the form of tax revenues (Lacher *et al*. 2010).[26]

Some authors even emphasize that the tourist function does not develop spontaneously, it is part of local and regional development processes and is an important impulse that makes socio-economic development of the whole country more dynamic (Lee 2013). Development of tourism leads to investment revival (including the development of technical infrastructure), a consequence of which is an inflow of capital from outside the region, in many cases from abroad. This is clearly visible in the example of the development of business tourism and the presence of global hotel chains in a region (Kulendran and Wilson 2000; Sugiyarto *et al*. 2003).

It should also be emphasized that development of tourist function in a region has an impact on the region's overall image (Gierczak-Korzeniowska 2019), which refers to all aspects of its functioning, and thus the tourist function is addressed to a wider range of people than just tourists and vacationers (Haralambopoulos and Pizam 1996).

The significance of tourist function manifests itself in a greater ability to generate new jobs, improve the quality of life of the local communities (Andereck and Vogt

2000), or increase the competitiveness of individual regions, which has a huge impact on raising the level of socio-economic development.

Development of the tourist function is associated with economic and social development. Less developed countries gain importance and, thanks to the development of the tourist function, they have a chance of economic development, thus raising the standard of living for their residents.

3. Methods Applied

The level of socio-economic development and the level of tourist function development of EU countries are complex phenomena that are difficult to assess with a single indicator.

Therefore, in this article, we have used one of the so-called Multidimensional Comparative Analyses – the TOPSIS method to analyse these multi-dimensional phenomena. This method makes it possible to determine the value of synthetic measure (aggregate measure), thus replacing the description of objects using a set of diagnostic features with one aggregate. Thanks to such a procedure, the obtained results are considered to be more objective and easier to interpret compared to results obtained on the basis of individual indicators.

The TOPSIS method belongs to the so-called pattern methods; it consists of determining Euclidean distance from both the pattern and development anti-pattern (Hwang and Yoon 1981).

In pursuing the goals of their work, we have identified the following stages in the research procedure.

(1) Proposing a preliminary set of variables defining the complex phenomenon under study and the presentation of values of variables X_j ($j = 1, 2, \ldots, m$) describing the examined objects O_i ($i = 1, 2, \ldots, n$) in the form of an observation matrix:

$$\mathbf{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

(2) Conducting the selection of diagnostic variables.

A condition for correct implementation of the linear arrangement of objects is to check the pre-proposed variables defining a complex phenomenon due to the discriminating ability and duplication of information. Diagnostic variables should be characterized by an appropriate level of variability, therefore variables for which coefficients of variation are calculated from the below formula are subject to

https://doi.org/10.1017/S106279872000099X Published online by Cambridge University Press

elimination (their value does not exceed the threshold of 10%):

$$v_j = \frac{s_j}{\overline{x}_j} \times 100 \tag{2}$$

where:
$\overline{x}_j$ = arithmetic mean for feature X_j,
s_j= standard deviation for feature X_j.

Diagnostic variables should also not be excessively correlated, which may cause them to be carriers of similar information. An interesting procedure for evaluating the level of correlation of variables is the method of the inverse matrix of Pearson linear correlation coefficients (Malina and Zeliaś 1997). It means that in the case of strong correlation between variables, diagonal elements of a matrix inverse to the correlation matrix (R^{-1}) significantly exceed the value of 10, which is a symptom of poor numerical conditioning of the Pearson linear correlation coefficient matrix (R).

(3) Bringing variables to comparability by normalizing values of variables by means of zero unitarization, according to the following formulas (Kukuła 2000).

For stimulants:

$$z_{ij} = \frac{x_{ij} - \min\limits_i\{x_{ij}\}}{R_j} \tag{3}$$

For destimulants:

$$z_{ij} = \frac{\max\limits_i\{x_{ij}\} - x_{ij}}{R_j} \tag{4}$$

It should also be added that the method of zero unitarization used for normalization is a recommended way of bringing variables to comparability, widely accepted, among others, within the methodology of counting the Human Development Index.

(4) Determination of coordinates for model units – pattern (A^+) and development anti-pattern (A^-) (see Hwang and Yoon 1981):

$$A^+ = (\max_i\ (z_{i1}),\ \max_i\ (z_{i2}),\ \cdots, \max_i\ (z_{im}) = (z_1^+, z_2^+, ...,\ z_m^+) \tag{5}$$

$$A^- = (\min_i\ (z_{i1}), \min_i\ (z_{i2}),\ \cdots\ ,\ \min_i\ (z_{im}) = (z_1^-, z_2^-, ...,\ z_m^-) \tag{6}$$

(5) Calculation of Euclidean distance of each object from the pattern z^+ and anti-pattern z^- with the use of formulas:

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$$d_i^+ = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_m^+\right)^2},\ d_i^- = \sqrt{\sum_{j=1}^{m} \left(z_{ij} - z_m^-\right)^2} \tag{7}$$

(6) Determination of synthetic measure value:

$$S_i = \frac{d_i^-}{d_i^+ + d_i^-} \tag{8}$$

where the S_i measure takes values from the range [0;1]. The smaller the distance of a given object from the development pattern, and thus greater than the development anti-pattern, the closer to unity is the value of the synthetic measure. This means that an object (country) is more developed when it comes to a studied complex phenomenon when it acquires a synthetic measure value that is closer to unity.

(7) Classification of objects into groups which are similar in terms of the studied complex phenomenon. According to the scheme (Nowak 1990):

group I: $S_i \geq \overline{S}_i + S_{S_i}$	high level
group II: $\overline{S}_i + S_{S_i} > S_i \geq \overline{S}_i$	medium-high level (9)
group III: $\overline{S}_i > S_i \geq \overline{S}_i - S_{S_i}$	medium-low level
group IV: $S_i < \overline{S}_i - S_{S_i}$	low level

where:
$\overline{S}_i$ = mean value of synthetic measure,
S_{S_i} = standard deviation of synthetic measure.

(8) Application of discriminant analysis in order to identify variables that have the greatest impact on the classification of EU countries in terms of the level of development of complex phenomena under study.

Discriminant analysis is a statistical technique that makes it possible to study differences between groups by analysing several variables simultaneously. It decides if groups differ due to an average of the highlighted variable, and then uses it to predict belonging to a group. This method also allows us to check which variables are the best to discriminate against groups. Assumptions of the discriminant method can be found, among others, in the works of Fisher (1936), Huberty and Olejnik (2006) and Klecka (1981).

(9) Construction of a linear econometric model, in which the role of explanatory variable would be the value of general synthetic S_{iO} measure, determined by the TOPSIS method including all 17 diagnostic variables (11 variables defining the level of socio-economic development of EU countries and six variables characterizing the level of tourist function development),

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while explanatory variables are values of synthetic measures determined separately for both complex phenomena (S_{iD}, S_{iT}). Thanks to such proceedings, it is possible to assess whether explanatory variables exert a significant influence on the explained variable.

$$\hat{S}_{iO} = a_0 + a_1 S_{iD} + a_2 S_{iT} \tag{10}$$

where:
a_0, a_1, a_2 = structural parameters of a model,
S_{iO}, S_{iD}, S_{iT} = synthetic measures.

In order to determine the relative importance of explanatory variables in explaining changes in the explained variable, the so-called 'validity' coefficients can be determined according to the formulas:

$$b_1 = \frac{\overline{S}_{iD}}{\overline{S}_{iO}} a_1 \tag{11}$$

$$b_2 = \frac{\overline{S}_{iT}}{\overline{S}_{iO}} a_2 \tag{12}$$

where:
$\overline{S}_{iO}$, $\overline{S}_{iD}$, $\overline{S}_{iT}$ = mean value of synthetic measures.

Greater absolute values of the b_i coefficient indicate a relatively greater impact of a given explanatory variable on the explained variable of a model.

4. Variables Defining the Studied Complex Phenomena and their Statistical Verification

In order to assess the level of socio-economic development of EU countries, we initially proposed the following variables:

$X1_D$ – GDP per capita in euro (current prices) in thousands (S).
$X2_D$ – Gross value added by kinds of activity-services in % (S).
$X3_D$ – Gross domestic expenditure on research and development activity (R&D) in % of GDP (S).
$X4_D$ – Investment rate in % (S).
$X5_D$ – Share of high-tech exports in total exports in % (S).
$X6_D$ – Infant deaths rate per 1000 population (D).
$X7_D$ – Activity rate in % (S).
$X8_D$ – Employment rate in % (D).
$X9_D$ – At-risk-of-poverty rate in % (D).
$X10_D$ – Students of higher education institutions per 10 thousand of population (S).
$X11_D$ – Mobile telephone subscribers per 1000 population (S).

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Table 1. Descriptive statistics of variables based on socio-economic development in countries in 2016.

Indicator	Maximum value		Minimum value		Mean	Coefficient of variation in %	Coefficient of asymmetry
$X1_D$	Luxembourg	92.80	Bulgaria	7.10	29.06	63.9	1.59
$X2_D$	Luxembourg	87.40	Ireland	57.60	72.21	10.7	0.13
$X3_D$	Sweden	3.25	Latvia	0.44	1.53	55.6	0.67
$X4_D$	Czech Republic	25.20	Greece	12.60	20.45	13.9	–0.62
$X5_D$	Malta	24.20	Portugal	3.80	12.26	49.5	0.46
$X6_D$	Malta	7.40	Finland	1.90	3.73	36.5	1.35
$X7_D$	Sweden	87.10	Italy	70.10	78.21	5.10	–0.16
$X8_D$	Greece	21.50	Czech Republic	2.90	7.60	52.40	2.00
$X9_D$	Romania	25.30	Czech Republic	9.70	17.07	22.90	0.22
$X10_D$	Greece	619.97	Luxembourg	115.94	406.55	24.1	–0.50
$X11_D$	Austria	1661.39	France	1034.53	1247.23	12.40	0.66
$X12_D$	Malta	5484.59	Sweden	82.87	1094.06	116.80	2.10

Source: Own elaborations based on Eurostat data (http://ec.europa.eu/eurostat/data/database).

$X12_D$ – CO_2 emissions from fuel combustion in tonnes per square kilometre of area (D).

Symbols (S) and (D) indicate the character of a variable, respectively treating it as a stimulant or destimulant.[1] Variables proposed to assess the level of socio-economic development of EU countries represent the most important aspects of socio-economic development of individual countries (Rao 1976). Basic descriptive parameters of these variables for EU countries are presented in Table 1.

When analysing the statistical data presented in Table 1, it can be seen that EU countries are the most diversified in terms of variable $X12_D$ – CO_2 from fuel combustion in tonnes per square kilometre of area. The coefficient of variation amounted to 116.80%.

The lowest value of the coefficient of variation (5.10%) was obtained for variable $X7_D$ – Activity rate in %. This variable, in accordance with criteria for selection of diagnostic variables, is eliminated from the initial set of variables defining the level of socio-economic development of EU countries. The remaining variables have been checked in terms of the level of correlation. Pearson linear correlation coefficients between variables did not take high values and the correlation test procedure with

1. Stimulants are features whose high values are, from a given point of view, desirable phenomena (e.g. level of socio-economic development), while low values are undesirable. Destimulants are features whose low values are, from a given perspective, desirable occurrences, while high values are undesirable.

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the use of inverse correlation matrix method did not eliminate any of the variables. All diagonal elements of the matrix inverse to the R^{-1} correlation matrix did not exceed 10 (Table 2).

Ultimately, in subsequent studies, the following diagnostic variables remained to assess the level of socio-economic development of EU countries: $X1_D$, $X2_D$, $X3_D$, $X4_D$, $X5_D$, $X6_D$, $X8_D$, $X9_D$, $X10_D$, $X11_D$, $X12_D$.

The next step in the research was the selection of diagnostic variables for the assessment of the second complex phenomenon under study, i.e. the level of tourist function development of EU countries. Here, the following variables have been pre-proposed:

$X1_T$ – Number of bed places per 1000 population (Beretje and Defert index) (S).

$X2_T$ – Number of accommodated tourists per square kilometre of area (Defert index) (S).

$X3_T$ – Number of accommodated tourists per 1000 population (Schneider index) (S).

$X4_T$ – Number of nights spent per 100 population (Charvat index) (S).

$X5_T$ – Density of accommodation (number of tourist bed places per square kilometre of area) (S).

$X6_T$ – The accommodation capacity index (number of provided bed places in group accommodation facilities) (S).

$X7_T$ – The relation between the income and expenses regarding foreign tourism (S).

$X8_T$ – The percentage of employees in tourism development and gastronomy in the general number of employees (S).

All of the proposed variables for assessment of the tourist function development level are stimulants. Descriptive statistics for these variables are included in Table 3.

Based on the data contained in Table 3, it can be seen that all variables ($X1_T$ – $X8_T$) meet the criterion of the appropriate level of variation (coefficients of variation for all variables are greater than 10%). A study of the correlation level between individual variables showed, in some cases, a strong correlation relationship. Therefore, from the initial set of variables determining the level of tourist function development, the following variables were eliminated: $X2_T$ and $X4_T$. the definitive matrix inverse to the correlation matrix is presented in Table 4.

Diagnostic variables that were used to assess the level of tourist function development of EU countries were: $X1_T$, $X3_T$, $X5_T$, $X6_T$, $X7_T$, $X8_T$.

5. Empirical Results

After selecting diagnostic variables to assess the level of socio-economic development and level of tourist function development of EU countries, in the subsequent stages of the research procedure (separately for each complex phenomenon) normalization of variables according to equations (3) and (4) was carried out, and values of synthetic measures S_{iD} and S_{iT} were determined using the TOPSIS method. In a similar

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Table 2. Matrix inverse to correlation matrix (level of socio-economic development).

	$X1_D$	$X2_D$	$X3_D$	$X4_D$	$X5_D$	$X6_D$	$X8_D$	$X9_D$	$X10_D$	$X11_D$	$X12_D$
$X1_D$	2.756	0.325	–1.771	0.690	–1.556	0.458	–0.716	–0.282	0.866	–0.378	–0.410
$X2_D$	0.325	2.755	–1.020	0.844	–1.222	0.111	–1.637	–0.427	0.525	–0.633	–1.205
$X3_D$	–1.771	–1.020	3.685	–1.137	1.914	0.697	1.427	0.946	–1.186	0.512	0.033
$X4_D$	0.690	0.844	–1.137	2.172	–1.496	0.030	0.068	–0.263	0.177	–0.068	0.258
$X5_D$	–1.556	–1.222	1.914	–1.496	3.430	0.090	1.136	0.868	–0.501	0.398	–0.391
$X6_D$	0.458	0.111	0.697	0.030	0.090	2.189	0.595	–0.642	0.017	0.302	–0.942
$X8_D$	–0.716	–1.637	1.427	0.068	1.136	0.595	3.302	–0.344	–1.255	0.975	0.745
$X9_D$	–0.282	–0.427	0.946	–0.263	0.868	–0.642	–0.344	2.273	0.250	–0.141	0.558
$X10_D$	0.866	0.525	–1.186	0.177	–0.501	0.017	–1.255	0.250	1.948	–0.422	0.046
$X11_D$	–0.378	–0.633	0.512	–0.068	0.398	0.302	0.975	–0.141	–0.422	1.350	0.171
$X12_D$	–0.410	–1.205	0.033	0.258	–0.391	–0.942	0.745	0.558	0.046	0.171	2.624

Source: Own calculations.

Table 3. Descriptive statistics of variables based on tourist function in countries in 2016.

Indicator	Maximum value		Minimum value		Mean	Coefficient of variation in %	Coefficient of asymmetry
$X1_T$	Croatia	0.24	Romania	0.02	0.07	63.3	2.15
$X2_T$	Malta	4893.81	Finland	7.14	295.63	301.60	5.17
$X3_T$	Croatia	3.28	Romania	0.13	1.12	78.40	1.38
$X4_T$	Malta	2062.34	Romania	127.95	648.58	72.00	1.74
$X5_T$	Malta	139.58	Latvia	0.61	13.10	194.40	4.62
$X6_T$	Malta	206.81	Luxembourg	46.28	97.55	35.80	1.67
$X7_T$	Croatia	11.39	Germany	0.41	2.01	106.90	3.20
$X8_T$	Greece	8.41	Romania	2.10	4.67	37.00	0.76

Source: Own calculations based on Eurostat data (http://ec.europa.eu/eurostat/data/database).

Table 4. Matrix inverse to correlation matrix (level of tourist function).

	$X1_T$	$X3_T$	$X5_T$	$X6_T$	$X7_T$	$X8_T$
$X1_T$	6.164	–4.420	–0.059	2.541	–1.886	–0.611
$X3_D$	–4.420	6.090	–0.769	–2.496	–0.023	–0.027
$X5_D$	–0.059	–0.769	1.645	–0.504	0.278	0.004
$X6_D$	2.541	–2.496	–0.504	2.969	0.006	–1.040
$X7_D$	–1.886	–0.023	0.278	0.006	2.769	–0.623
$X8_D$	–0.611	–0.027	0.004	–1.040	–0.623	2.196

Source: Own calculations.

way, only taking into account all diagnostic variables (17 variables), values of the synthetic S_{iO} measure were also calculated. The received rankings of EU countries are presented in Table 5.

In 2016, the leaders of EU countries in terms of socio-economic development level are (Table 5, Figure 1): Austria, Sweden, Denmark, Finland and the Netherlands included in a group with high level of development. These countries have achieved the most favourable average values of eight output variables, i.e. $X1_D$ – GDP per capita in euros (current prices) in thousands; $X3_D$ – Gross domestic expenditure on research and development activity (R&D) in % of GDP; $X4_D$ – Investment rate in %; $X6_D$ – Infant deaths rate per 1000 population; $X8_D$ – Employment rate in %; $X9_D$ – At-risk-of poverty rate in %; $X10_D$ – Students of higher education institutions per 10,000 population; $X11_D$ – Mobile telephone subscribers per 1000 population.

Nine EU countries (France, Cyprus, Estonia, Luxembourg, Germany, Czech Republic, Ireland, Belgium and the United Kingdom) qualified to group II, with a medium-high level of socio-economic development. These countries dominate in terms of two variables: $X2_D$ – Gross value added by kinds of activity-services in %, and $X5_D$ – Share of high-tech exports in total exports in %.

https://doi.org/10.1017/S106279872000099X Published online by Cambridge University Press

Table 5. Rating of EU countries based on value of synthetic measure of level of socio-economic development (S_{iD}), tourist function (S_{iT}) and general synthetic variable (S_{iO}) in 2016.

No	Countries	S_{iD}	Group	No	Countries	S_{iT}	Group	No	Countries	S_{iO}	Group
1	AT	0.704	I	1	MT	0.678	I	1	AT	0.599	I
2	SE	0.662		2	HR	0.598		2	CY	0.557	
3	DK	0.649		3	CY	0.520		3	MT	0.543	
4	FI	0.641		4	EL	0.451		4	SE	0.503	II
5	NL	0.621		5	AT	0.440		5	DK	0.495	
6	FR	0.594	II	6	ES	0.429		6	HR	0.491	
7	CY	0.580		7	PT	0.341	II	7	NL	0.491	
8	EE	0.573		8	IT	0.285		8	FI	0.489	
9	LU	0.572		9	IE	0.285		9	LU	0.478	
10	DE	0.565		10	SI	0.276		10	EE	0.476	
11	CZ	0.564		11	LU	0.274		11	IE	0.475	
12	IE	0.563		12	EE	0.262	III	12	FR	0.471	
13	BE	0.563		13	UK	0.233		13	CZ	0.463	
14	UK	0.555		14	BG	0.232		14	UK	0.448	III
15	SI	0.519	III	15	NL	0.229		15	DE	0.448	
16	HU	0.513		16	DE	0.206		16	SI	0.448	
17	PL	0.481		17	SK	0.196		17	BE	0.442	
18	LV	0.478		18	CZ	0.190		18	ES	0.438	
19	MT	0.475		19	FR	0.182		19	EL	0.425	
20	IT	0.469		20	HU	0.180		20	HU	0.418	
21	LT	0.468		21	DK	0.176		21	IT	0.409	
22	SK	0.466		22	BE	0.174		22	PT	0.406	
23	ES	0.443	IV	23	SE	0.167		23	LV	0.391	
24	PT	0.437		24	LV	0.165		24	SK	0.385	IV
25	HR	0.419		25	PL	0.144		25	PL	0.381	
26	EL	0.413		26	FI	0.141		26	LT	0.376	
27	BG	0.402		27	LT	0.127	IV	27	BG	0.353	
28	RO	0.383		28	RO	0.078		28	RO	0.315	

BE – Belgium, BG – Bulgaria, CZ – Czech Republic, DK – Denmark, DE – Germany, EE – Estonia, IE – Ireland, EL – Greece, ES – Spain, FR – France, HR – Croatia, IT – Italy, CY – Cyprus, LV – Latvia, LT – Lithuania, LU – Luxembourg, HU – Hungary, MT – Malta, NL – the Netherlands, AT – Austria, PL – Poland, PT – Portugal, RO – Romania, SI – Slovenia, SK – Slovakia, FI – Finland, SE – Sweden, UK – United Kingdom.Source: Own calculations based on Eurostat data (http://ec.europa.eu/eurostat/data/database).

Group III, with a medium-low development level, comprising eight countries (Slovenia, Hungary, Poland, Latvia, Malta, Italy, Lithuania and Slovakia), is not distinguished in terms of any output variable defining the level of socio-economic development.

The last countries in the ranking in terms of socio-economic development level were: Romania, Bulgaria, Greece, Croatia, Portugal and Spain. This group is characterized by the most favourable variable value $X12_D$ – CO_2 emissions from fuel combustion in tonnes per square kilometre of area.

In order to decide which variables distinguish (discriminate) the created groups of EU countries due to the level of development of studied complex phenomena,

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Figure 1. Classification of EU countries in terms of level of socio-economic development in 2016.

discriminant analysis was used. The calculated value of the Wilks lambda test (0.0097), as well as value of the F statistic (4.85) and corresponding test probability value $p < 0.001$ indicate that discrimination of EU countries in terms of the level of socio-economic development, determined with the use of the analysed variables, is statistically significant. Variables that discriminate against this division into groups the most are: $X1_D$ – GDP per capita in euro (current prices) in thousands ($p = 0.024$); $X8_D$ – Employment rate in % ($p = 0.044$); $X10_D$ – Students of higher education institutions per 10,000 population ($p = 0.0037$); $X11_D$ – Mobile telephone subscribers per 1000 population ($p = 0.018$).

However, when analysing the ranking of EU countries in terms of the level of tourist function development, it can be noted that Malta, Croatia, Cyprus, Greece, Austria and Spain are countries with a high level of tourist function development. This group has achieved the most favourable average values of all output variables defining the level of tourist function development. It can therefore be concluded that in these countries tourism has a dominant meaning and may constitute their smart specialization. Portugal, Italy, Ireland, Slovenia and Luxembourg also

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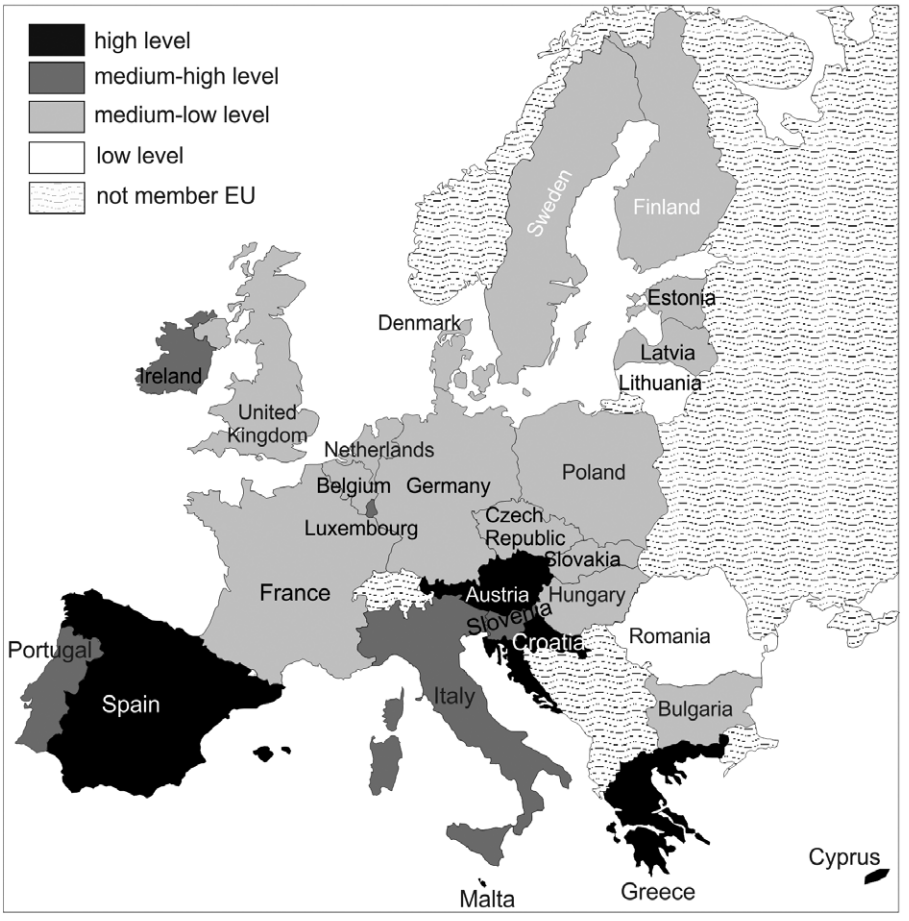

Figure 2. Classification of EU countries in terms of level of development of tourist function in 2016.

have a fairly good situation in the studied area. The majority of EU countries (15 countries) are included in group III, with the average-low level of tourist function development. Only two countries (Lithuania and Romania) have achieved a low level of tourist function development (Figure 2).

When verifying the division of EU countries into groups due to the level of tourist function development, discriminant analysis was also used. The calculated Wilks lambda value (0.075), as well as F statistic (18.5) and corresponding test probability $p < 0.0001$ indicates statistically significant discrimination of groups of countries created with the TOPSIS method. The most discriminating variable turned out to be S_{iO} – The percentage of employees in tourism development and gastronomy in the general number of employees ($p = 0.0015$).

In the last stage of the research procedure, a linear econometric model with synthetic variables was constructed in accordance with equation (10).

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Table 6. Estimation results of a linear econometric model with synthetic variables.

Estimates of parameters	Standard errors	*t-Statistic*	*p*-value	Coefficient of determination R^2	Validity coefficients b_i
$a_0 = 0.048$	$S(a_0) = 0.009$	$t_0 = 5.285$	0.0000	0.989	–
$a_1 = 0.612$	$S(a_1) = 0.016$	$t_1 = 38.984$	0.0000		$b_1 = 0.716$
$a_2 = 0.290$	$S(a_2) = 0.009$	$t_2 = 31.988$	0.0000		$b_2 = 0.176$

Source: Own calculations.

The results of model estimation with the use of Least Squares Method are presented in Table 6.

Based on the data contained in Table 6, it can be seen that synthetic variables S_{iD} and S_{iT} have a significant impact on general synthetic variable S_{iO} (in all cases, p test probability is 0). In contrast, the obtained significance coefficient values indicate that relatively greater importance in the description of the formation of the general synthetic measure is played by the aggregate measure defining the level of socio-economic development ($b_1 = 0.716$). This conclusion is also confirmed by values of the Pearson linear correlation coefficient:

$$r_{S_{iO}\,S_{iD}} = 0,726,\ r_{S_{iO}\,S_{iT}} = 0,551$$

The relationship between the general synthetic measure and a synthetic measure of socio-economic development of EU countries can be considered quite strong in a positive direction. On the other hand, there is a moderate positive correlation dependence between the general synthetic measure and a synthetic measure of the development of the tourist function of EU countries.

6. Conclusion

Socio-economic development and level of tourist function development are complex phenomena of a multidimensional nature. The complexity of these phenomena makes it necessary to apply both statistical and econometric methods, as well as multidimensional comparative analysis in comparative studies of objects (e.g. EU countries).

Statistical evaluation of two complex phenomena, i.e. level of socio-economic development and level of tourist function development in 28 European Union countries, included nine subsequent stages of proceedings. In the initial stage, initial variables describing both phenomena submitted in 2016 and selection of diagnostic variables were proposed. Then, the ordering of EU countries was carried out with the use of the TOPSIS method. Values of the general synthetic measure were also determined to take into account all diagnostic variables. Rankings of EU countries

https://doi.org/10.1017/S106279872000099X Published online by Cambridge University Press

were built and four typological groups of countries with high, medium-high, medium-low and low level of development were created.

Obtained results confirm the fact of diversifying EU countries in terms of the level of socio-economic development and level of tourist function development.

Austria, Sweden, Denmark, Finland and the Netherlands are leaders in the ranking in terms of the level of socio-economic development. Most EU countries (17 countries) have an average level and six countries (Spain, Portugal, Croatia, Greece, Bulgaria and Romania) low level.

However, Malta, Croatia, Cyprus, Greece, Austria and Spain have a high level of tourist function development. It can therefore be concluded that tourism has a dominant meaning in these countries and may constitute their smart specialization. The largest number of EU countries (20 countries) were included in the group with an average level of development of the studied phenomenon. Ranking of EU countries in terms of the level of development of tourist function is closed by Lithuania and Romania.

Econometric analysis has confirmed a significant impact of synthetic measures on a level of socio-economic development and level of development of tourist function on a general synthetic measure, at the same time allocating a relatively larger impact to the first studied phenomenon. Correlation analysis has also confirmed the positive direction of the dependence of both complex phenomena on the overall synthetic measure.

The obtained results may be helpful in conducting an appropriate regional policy, which should lead to increased territorial efficiency, that is, to the use of resources held by a given area. At present, it is assumed that there will be a departure from the current support of all sectors or industries in order to support strategic sectors (including the development of tourist function) that may become engines of the economy of a given country. Supporting the development of smart specializations, including tourism, using unique potentials of a given area may contribute to building its competitive advantage. In addition, the obtained results may also apply to the creation of joint development strategies with the use of the strengths of each territory to best contribute to the integrated and sustainable development of the EU as a whole.

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