

Entrepreneurship or Resources for a Better Tourism? A K Nearest Neighbors and Decision Tree Dynamic Analysis for Romania

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Abstract: Tourism is one of the growing sectors worldwide in the last decade and one of the most affected industries after COVID-19 pandemic. Tourism is a very complex sector of the economy and depends on a very wide range of factors including tourism attractions, tourism resources but also by the entrepreneurship actions in the destinations. The aim of the paper is to find out, by using a complex statistical methodology, if the level of tourism indicators (turnover, arrivals, overnight stays) has changed after ten years (2020/2010), due to the entrepreneurial actions and/or based on specific touristic resources (natural resources and built heritages/historical monuments). A multi-methods approach was applied: explore outliers' analysis, Kruskal–Wallis test, Student t test, Pearson correlations, machine learning methods (K Nearest neighbors analysis and decision tree). Our results have both theoretical and practical contribution, fill a gap in the scientific literature, offer important outputs for all Romanian stakeholders and worldwide, especially in the actual conditions which marked a total reconsideration and rethinking of tourism after COVID-19 pandemic.

Keywords: natural resources; heritage; machine learning; cluster analysis; decision tree; Romania; county; entrepreneurship

1 Introduction

Tourism is a very complex sector of the economy and depends on a very wide range of factors [1-2] including tourism attractions and tourism resources and a basis of tourism economic development [3]. The factors underpinning tourism include resources [4] and the capitalization of cultural resources continue to be a challenge for communities and organizations [5, 6]. Tourism resources are the basic

conditions for the growth and development of tourism in a region [7-8]. In order to transform the potential benefits of tourist resources into actual economic benefits, it is necessary to analyze the scale, quality, distribution, and isolation of tourist sources, conduct in-depth research and accurate statistics, and then understand its important significance [9].

Pursuant to the economic definition of 'resource', resources in tourism may be defined as all those means that can be beneficially utilized for the purpose of tourism in a given area [10]. The scientific and professional nature of tourism resources is an important foundation for the scientific development and safety of tourism resources and the guarantee for the healthy development of tourism in the region. Its scientificity is mainly reflected in the distribution of tourism resources [11]. Some authors believe that the factor separation through spatial aspect is of great importance because the complexity of resources and their distribution in space largely determine and form the tourist offer, as well as tourist demand. Those conditions that determine the tourism development in space are: attractiveness, infrastructure, hospitality and so on [12].

The evaluation methods of tourism resources include experience evaluation, technology appreciation and comprehensive analysis appreciation [13]. In the early stage of the development of evaluation, people are more accustomed to qualitative appraisal. Because there are many levels of specific contents in the comprehensive evaluation of tourism resources, people have not found a universal method for comprehensive evaluation of tourism [14]. The effectiveness and efficiency of the development of tourism resources is an important area of tourism research, and it is also an important basis for measuring the utilization and development efficiency of regional tourism industry resources [15]. Taking into consideration the fact that tourist movements reach worldwide dimensions, recently more attention is being paid on studying the factors that encourage tourism development and especially in terms of their dimensioning [16-21]. Also, other studies suggest that touristic resources are also critical determinants of tourism performance [22-23] and on local development [24].

Entrepreneurship has received increased attention within tourism research reflecting its important role [25-26] and in the last years a special attention was given to *entrepreneurial aspects of tourism* worldwide, from education to its role on national, regional and local regional development [27-29, 30 and society [31] being rich in practice but poor in theoretical development [32-33]. Starting from the scientific contribution and more integrated approach of Ateljevic and Page [34; 27 on tourism and entrepreneurship from different perspectives -cultural [35], characteristics, motivation for travel, nature-based tourism, innovations, global-local divide, etc. - and frequently from social point of view [36 it is well know the high contribution and role of entrepreneurship in fostering local development [34]. In the last years, statistical reports have shown that tourism development influences the economic growth and represents a real boost for local entrepreneurship [37 a real driver of economic growth, employment, and social development [38-39],

developing new business models and often linked to creativity and innovation [39]. The sustainability of tourism not only involves the responsible use of natural resources, natural and cultural integrity [38] but also to promote entrepreneurship in the tourism industry. Tourism entrepreneurship is different from other types of entrepreneurs, and this needs a specific theoretical [25] and practical insights. There are studies who proved that, on short-run, exist a positive correlation between wages in tourism and entrepreneurship [40] but on long-run tourism sector wages have a negative impact relationship with entrepreneurship [40], respectively the higher wages represent practically a higher cost to entrepreneurship, the residents of tourism destination perceived the benefits of tourism development but not the costs [41]. Entrepreneurship has a major importance for the success of tourism and hospitality and this factor has a powerful contribution to many island economies. Booth et al. [42] made a systemic literature review about tourism and hospitality entrepreneurship on islands, finding 132 related articles between 1989 and 2018 [42]. Cem et al. also made a similar literature review concerning relationship between tourism and entrepreneurship [43]. Bibliometric methods were used in the analysis of 142 articles in the field. The results of their study reveal that the articles compassing tourism and entrepreneurship are grouped under three themes: a) small and medium tourism enterprises; b) types of entrepreneurship and c) the studies about entrepreneurship in tourism industry.

As method, it's worth to note Kallmuenzer et al. [44] article: they employed a fuzzy-set qualitative comparative analysis on quantitative data from a survey of 113 owner-managers of small and medium-sized tourism firms from Austria, searching configurations of factors that lead to high firm performance. They have found six different configurations, which led to successful paths and higher tourism performance.

At the national level, for Romanian tourism, during the last years we see a period with major structural changes and some major turning points [45]. Important studies analyzed the influence and tendencies of tourism resources [46-48] on tourist movement or tourism indicators [49-50], the management of common pool resources [51], which type of tourism resources induces a higher tourist affluence [52], the diversity and harmoniously distributed of natural and cultural resources in the territory that generates to practice of all types of tourism [53]. From entrepreneurship point of view, for Romanian tourism, there are some studies linked to the impact of absorption of structural fund and European funding programme in the tourism sector [37; 39] with specially attention to the rural regions. Also, in emerging economies, like Romania, tourism development needs active entrepreneurship [40; 28]

The *aim* of the paper is to find out, by using a complex statistical methodology, if the level of tourism indicators (turnover from tourism activities, arrivals, and overnight stays) has changed for ten years (2020 compared with 2010), due to the entrepreneurial actions and/or based on specific touristic resources (natural resources and built heritages/historical monuments). The *objectives* of this research

are: (1) to identify the best predictors for Romanian tourism in two different time (2010 and 2020) in terms of entrepreneurship actions and/or tourism resources; (2) to analysis what is the main indicators who split the Romanian counties in homogeneous groups/clusters; (3) to identify the counties that are similar in term of entrepreneurial actions and/or tourism resources to attract tourists. According to the literature review, we find important studies who analyzed the influence of resources on tourist movement or the link between entrepreneurial actions and tourism development but none of the research considering both aspects. Therefore, we consider that the present research results fill a gap in the literature and offer important outputs for all Romanian stakeholders and worldwide, especially in the actual conditions which marked a total reconsideration and rethinking of tourism after COVID-19 pandemic and the new trends in tourism but also another consequence of the COVID-19 pandemic is a reduction in early-stage entrepreneurial activity worldwide [54].

2 Data and Methods

According to the aim and objectives of the paper, the variables used in the research were territorial data collected from INS (National Institute of Statistic) [52; 48] for 2010 and 2020 only for all 41 Romanian counties [48; 55], without the capital, Bucharest. The variables are: (1) the *tourism* indicators: Overnight stays (number), Tourist arrivals in tourist reception facilities (number) [56]; (2) the *tourism entrepreneurship* indicators: Turnover in tourism - hotels & restaurants (current price, millions of lei), Gross investment in tangible goods of active tourism units (millions of lei) Active enterprises (number) - total, Active enterprises in tourism (number), Percent of tourism enterprises in total number of enterprises (%) [56]; (3) the *resources* indicators: Natural resources and the Built heritage/historical monuments. The data for these resources have the same values for 2010 and 2020 due of the lack of yearly statistic data at county level [57; 48]; (4) the *economic development level of counties*: GDP (current price, millions of lei) [56]; (4) the spatial differences between Romanian counties are mainly caused by the investments in tertiary industry [55].

Descriptive statistics (mean $\pm$ standard deviation) was used for all the indicators for each year (Table 1) and *One Sample Kolmogorov-Smirnov test* to verify the normal distribution of data and to apply the adequate statistical methods according to the results, all the data having normal distribution (p-value < 0.05).

For analysis the data a set of statistical methods was used, as follows: (1) *Explore Outliers* to find the extreme values for variables and to find the counties with the highest and lowest values. The main objective of this analysis is to explain a link between the most touristic Romanian counties, the entrepreneurship impact and/or tourism resources; (2) *The Independent Sample Kruskal – Wallis test* to test if there

are statistically significant differences between Romanian counties regarding all the studied indicators; (3) *The Independent Student t test* to compare if there are statistically differences between 2010 and 2020 for tourism indicators (turnover in tourism, overnight stays and tourist arrivals) to decide which of the indicators will be used for cluster analysis [58]; (4) *Pearson correlation coefficients* for analysis the direction, power, and statistical significance of the association between variables; (5) *K Nearest Neighbors (KNN)* for predictive classifications of territorial tourism data for 2010 and 2020, according to entrepreneurship and resource indicators (as features) and for analyzing the changing time clusters of Romanian counties; the tourism indicators were used as target (overnight stays (number), tourist arrivals in tourist reception facilities and turnover in tourism - hotels & restaurants). The principle of this method is based on the minimum distance between two elements of groups (in our case, counties), the elements are from different classes:

$$d(\pi_1, \pi_2) = \min_{x \in \pi_1, y \in \pi_2} d(x, y) \quad (1)$$

(5) a *machine learning* analysis based on the *Decision tree* with CRT (Correlation and Regression Tree) and CHAID (Chi-Square Automatic Interaction Detector) “growing methods” to find the best predictor for 2010 and 2020 for grouping of counties with all the tourism indicators as dependent variables (overnight stays - number -, tourist arrivals in tourist reception facilities and turnover in tourism - hotels & restaurants) and all the entrepreneurship and resources data as independent variables. This method was applied in two conditions: with data as continuous variables and with data as category variables (under/above the median value of each year).

For statistical analyses, SPSS 23.0 (licensed) [59-60] and Microsoft Excel for graphical representation of heat maps were used. All the results are presented in the next section of the paper.

3 Results and Discussions

To analyze if there are significant changes in the studied indicators, first we start with the *descriptive statistics* for each analyzed year, with particular mention for all type of resources with the same values for both 2010 and 2020 (Table 1). The descriptive statistic for resources is for natural resources a mean value of 525.72 ± 196.38 (155 – 976.5) and for heritage 574.0 ± 347.71 (172 - 1791).

According to the results from Table 1, all the mean values increase except for overnight stays and tourist arrivals due to the COVID-19 pandemic in 2020 with all the travel restrictions in Romania and worldwide. Also, even the number of active enterprises in tourism increases in 2020 compared with 2010, the percent of tourism enterprises in total enterprises remain approximately equal.

Table 1
Descriptive statistics for 2010 and 2020

	Turnover in tourism - hotels & restaurants (current price, mil.lei)		Tourist arrivals in tourist reception facilities		Overnight stays (number)	
	2010	2020	2010	2020	2010	2020
Mean	179.90	343.43	122598.00	142410.73	346379.09	331916.82
Median	136.00	238.00	68414.00	80727.00	199574.00	159750.00
Std. Dev.	150.42	334.18	147368.66	188446.58	521544.85	575727.44
Minimum	35.00	68.00	10600.00	5759.00	22453.00	10441.00
Maximum	767.00	1807.00	803096.00	1004521.0	3166706.0	3497428.0
	Active enterprises (number) - total		Active enterprises in tourism (number)		Percent of tourism enterprises in total number of enterprises (%)	
	2010	2020	2010	2020	2010	2020
Mean	9441.70	12302.63	524.43	629.56	5.54	5.24
Median	7572.00	9694.00	466.00	547.00	5.36	4.63
Std. Dev.	5266.58	7719.47	330.56	422.10	1.32	1.53
Minimum	3639.00	3841.00	154.00	175.00	2.72	2.78
Maximum	24258.00	36580.00	1683.00	2217.00	8.03	9.21
	Gross investment in tangible goods of active tourism units (mil. lei)		GDP (mil lei)			
	2010	2020	2010	2020		
Mean	42.80	64.65	10155.26	19525.13		
Median	24.00	38.00	9075.70	16401.90		
Std. Dev.	51.90	79.50	5562.06	11561.62		
Minimum	4.00	5.00	4151.20	7697.30		
Maximum	260.00	450.00	26940.90	55771.90		

To analyze if there are hierarchical changes between counties in 2020 compare with 2010, we applied the *explore outliers*, the results being presented in Table 2 only for the first five places and the last three for each indicator and each year.

It can be observed that there are only a few changes for all the indicators, the first places are dominated by the most developed Romanian counties, respectively: Constanța, Brașov, Cluj, Prahova, Timișoara, Sibiu, Vâlcea, Bihor.

Table 2
Extreme values for variables for Romanian counties for 2010 and 2020

	Turnover in tourism - hotels & restaurants		Tourist arrivals in tourist reception facilities		Overnight stays (number)	
	2010	2020	2010	2020	2010	2020
Highest	Constanța	Constanța	Constanța	Constanța	Constanța	Constanța
	Brașov	Brașov	Brașov	Brașov	Brașov	Brașov
	Cluj	Cluj	Prahova	Prahova	Vâlcea	Bihor
	Prahova	Timiș	Cluj	Bihor	Bihor	Vâlcea
	Timiș	Ilfov	Sibiu	Sibiu	Prahova	Prahova
Lowest	Mehedinți	Ialomița	Olt	Călărași	Teleorman	Călărași
	Călărași	Sălaj	Tulcea	Teleorman	Călărași	Teleorman
	Giurgiu	Călărași	Călărași	Giurgiu	Olt	Giurgiu
	Active enterprises (number) - total		Active enterprises in tourism (number)		Percent of tourism enterprises in total number of enterprises (%)	
	2010	2020	2010	2020	2010	2020
Highest	Cluj	Cluj	Constanța	Constanța	Constanța	Caraș Severin
	Timiș	Ilfov	Cluj	Cluj	Caraș Severin	Constanța
	Constanța	Timiș	Timiș	Brașov	Tulcea	Tulcea
	Brașov	Constanța	Brașov	Timiș	Hunedoara	Hunedoara
	Bihor	Brașov	Bihor	Mureș	Harghita	Harghita
Lowest	Botoșani	Ialomița	Călărași	Teleorman	Giurgiu	Giurgiu
	Ialomița	Covasna	Ialomița	Călărași	Ilfov	Buzău
	Mehedinți	Mehedinți	Giurgiu	Ialomița	Buzău	Ialomița
	GDP (mil lei)		Gross investment in tangible goods of active tourism units (mil. lei)		Natural resouces	Built heritage/ historical monuments
	2010	2020	2010	2020	2010/2020	2010/2020
Highest	Timiș	Cluj	Constanța	Constanța	Suceava	Cluj
	Cluj	Timiș	Ilfov	Brașov	Arge	Iași
	Constanța	Constanța	Cluj	Cluj	Bihor	Dâmbovița
	Prahova	Prahova	Bihor	Ilfov	Caraș Severin	Prahova
	Brașov	Iași	Brașov	Timiș	Maramureș	Sibiu
Lowest	Mehedinți	Tulcea	Călărași	Sălaj	Ilfov	Galați
	Giurgiu	Covasna	Olt	Tulcea	Brăila	Ialomița
	Covasna	Călărași	Giurgiu	Ialomița	Călărași	Brăila

The last places are occupied by the counties with the low level of economic development but also with the low number of touristic resources, as follows: Călărași, Giurgiu, Ialomița, Brăila, Teleorman, Olt, Covasna, Sălaj, Buzău, most of them from the south part of the country.

To verify if these polarized distributions are statistically significant, we applied the *Independent Sample Kruskal – Wallis test* due of the fact that the comparing variable are nominal (county). The results indicate for all the indicators included in the research, for $p\text{-value} < 0.05$, statistically significant differences.

According to the results from Table 3 for the Independent Samples Student t test, only for the *turnover in tourism* there are statistically significant ($p\text{-value} = 0.005$) differences between 2010 and 2020. This result practically represents the main motivation for the present approach of our research from two important perspectives for tourism in general and for Romanian tourism especial, respectively: from the entrepreneurship perspectives and from tourism resources perspectives. We will use this information in the KNN cluster analysis.

Table 3
The results for Independent Samples Student t Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Turnov	EVA	8.179	.005	-2.85	80	.005	-163.53	57.23	-277.43	-49.63
	EVNA			-2.85	55.57	.006	-163.53	57.23	-278.20	-48.86
Overnight	EVA	.010	.920	.119	80	.905	14462.26	121321.09	-226974.4	255898.94
	EVNA			.119	79.23	.905	14462.26	121321.09	-227010.38	255934.92
Arrivals	EVA	.339	.562	-.530	80	.597	-19812.73	37361.00	-94163.50	54538.04
	EVNA			-.530	75.60	.597	-19812.73	37361.00	-94229.87	54604.41

EVA = Equal variances assumed; EVNA = Equal variances not assumed

Therefore, based on the results from the descriptive statistics and extreme outliers' analysis, and to verify if there are a statistically significant correlation between the economic development, entrepreneurial actions in tourism, tourism resources and tourism indicators, we applied the Pearson correlation coefficients, for 2010 (Figure 1) and 2020 (Figure 2), the results being presented as heat maps.

	Turnover in tourism - hotels & restaurants (current price, millions lei)	Overnight stays (number)	Tourist arrivals in tourist reception facilities	Gross investment in tangible goods of active local units (mil. lei)	Active enterprises (number) - total	Active enterprises in tourism (number)	Percent of tourism enterprises in total number of enterprises (%)	GDP (mil lei)	Natural resources	Built heritage / historical monuments
Turnover in tourism - hotels & restaurants (current price, millions lei)	1	0.804	0.898	0.884	0.886	0.893	.141	0.775	.209	0.439
Overnight stays (number)		1	0.932	0.756	0.558	0.748	0.377	0.463	.227	.176
Tourist arrivals in tourist reception facilities			1	0.786	0.707	0.855	0.359	0.632	.246	0.32
Gross investment in tangible goods of active local units (mil. lei)				1	0.751	0.776	.141	0.626	.097	.269
Active enterprises (number) - total					1	0.905	.011	0.873	.268	0.468
Active enterprises in tourism (number)						1	0.385	0.796	0.363	0.346
Percent of tourism enterprises in total number of enterprises (%)							1	.050	0.456	-.058
GDP (mil lei)								1	.195	0.462
Natural resources									1	0.34
Built heritage / historical monuments										1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Figure 1

Correlation matrix for 2010

From the both correlation matrices it's evident the direct (positive) correlations of a strong intensity (from the 0.707 to 0.973), a statistically significant (p -value < 0.01) between tourism indicators (*turnover in tourism, arrivals, and overnight stays*) and entrepreneurial actions (*investments, number of total numbers of active enterprises and number of active enterprises in tourism*). There is one exception, a moderate correlation between *overnight stays* and *total number of active enterprises* for both years (0.425 for 2010 and 0.558 for 2020) and between *arrivals* and *total number of active enterprises* only for 2010 (0.526). There is direct (positive) correlation but low to moderate intensity between *arrivals/overnight stays* and the *percent of tourism enterprises in the total number of enterprises* (0.359 to 0.513) but the last one has no statistically significant correlation with turnover in tourism. Another important aspect is revealed by the direct correlation of strong intensity between *gross investment in tangible goods of active tourism units* and *active enterprises in tourism*. The *turnover in tourism* correlates directly with strong intensity (0.782 in 2010 and 0.775 in 2020) with *GDP*. Also, the *arrivals and overnight stays* are a direct correlate of moderate intensity with *GDP* for both years. The *entrepreneurial actions* are also direct correlate of moderate to strong intensity with *GDP*. Regarding the correlation between tourism indicators and the specific tourism resources (natural and heritages): (1) there is no statistically significant correlation with *natural resources*; (2) there is direct correlation of low intensity, statistically significant, between turnover and built heritage for both years and between arrivals and built heritage only for 2010 (0.320). The correlation matrices reveal an important aspect according to the main objectives of the research: (1) the built heritage is a direct correlate of moderate intensity for both years with *GDP*; (2) the total number of active enterprises is direct correlate of moderate intensity with built heritage/historical monuments; (3) the active enterprises in tourism are a direct correlate of medium intensity with all types of resources for both studied years.

	Turnover in tourism - hotels & restaurants (current price, millions lei)	Overnight stays (number)	Tourist arrivals in tourist reception facilities	Gross investment in tangible goods of active local units (mil. lei)	Active enterprises (number) - total	Active enterprises in tourism (number)	Percent of tourism enterprises in total number of enterprises (%)	GDP (mil lei)	Natural resources	Built heritage / historical monuments
Turnover in tourism - hotels & restaurants (current price, millions lei)	1	0.854	0.884	0.969	0.816	0.963	0.273	0.782	.182	0.4
Overnight stays (number)		1	0.959	0.885	0.425	0.791	0.513	0.421	.218	.179
Tourist arrivals in tourist reception facilities			1	0.88	0.526	0.855	0.497	0.527	.284	.293
Gross investment in tangible goods of active local units (mil. lei)				1	0.716	0.908	0.324	0.668	.126	.305
Active enterprises (number) - total					1	0.837	-.131	0.893	.181	0.509
Active enterprises in tourism (number)						1	0.339	0.805	0.338	0.411
Percent of tourism enterprises in total number of enterprises (%)							1	-.016	0.476	.001
GDP (mil lei)								1	.172	0.573
Natural resources									1	0.34
Built heritage / historical monuments										1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Figure 2

Correlation matrix for 2020

The explore outliers' analysis emphasis the highest and the lowest counties according to the individual values of each indicator for 2010 and 2020. The Student t test shows that only for turnover in tourism is statistically significant differences between all the 42 Romanian counties by comparing 2010 with 2020 and the Kruskal-Wallis test shows differences between counties for all the eleven variables from the study. In line with these results, we applied the *K Nearest Neighbors* (KNN) *cluster analysis* for predictive classifications of territorial tourism for 2010 and 2020 with turnover in tourism as target variable to identify the similar profiles of Romanian counties for this variable. The results of this analysis are presented separately for 2010 and for 2020 in two situations: (1) with *turnover in tourism* as *target variable* and the *entrepreneurship actions* and *GDP* as *features* by county as *case label*; (2) with *turnover in tourism* as *target variable* and the *tourism resources* as *features* by county as *case label* too.

For the first analysis, for 2010 we present only the results of Quadratic Map in the Figure 3. So, Constanța is grouped near Cluj, Brașov and Timiș by all the entrepreneurship actions and GDP, these counties are on the first five places in 2010 for these indicators with little exceptions for percent of tourism enterprises in total number of enterprises (only Constanța is on the highest five counties near Caraș Severin, Tulcea and Hunedoara) and for gross investment in tangible goods of active tourism units only for Constanța, Brașov and Cluj, near Ilfov and Bihor.

For the first analysis, for 2020 the Quadratic map is presented in Figure 4. It is an interesting cluster for each entrepreneurship indicators for 2020, practically the first COVID-19 pandemic year with travel restrictions for an important time of the year especially during the summer season holidays. It is interesting that, close to Constanța, Brașov and Timiș, Suceava county is included as nearest neighbor for these counties even that is not in the first five positions for these indicators.

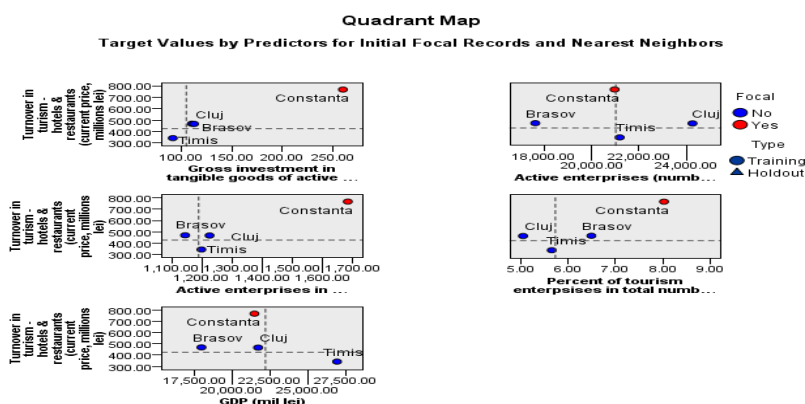


Figure 3

The KNN results: the Quadrant Map for entrepreneurial actions for 2010

Suceava is, however, on the first place by natural resources. Also, the KNN analysis emphasises that even a county on the first places for the entrepreneurial actions in 2020, these counties, from tourism point a view are not in the same clusters or similar. It is the case of Ilfov county for total number of enterprises and gross investment in tangible good of active tourism units, Mureş County for active enterprises in tourism, Caraş-Severin, Tulcea, Hunedoara and Harghita for percent of tourism enterprises in total number of enterprises, Iaşi for GDP.

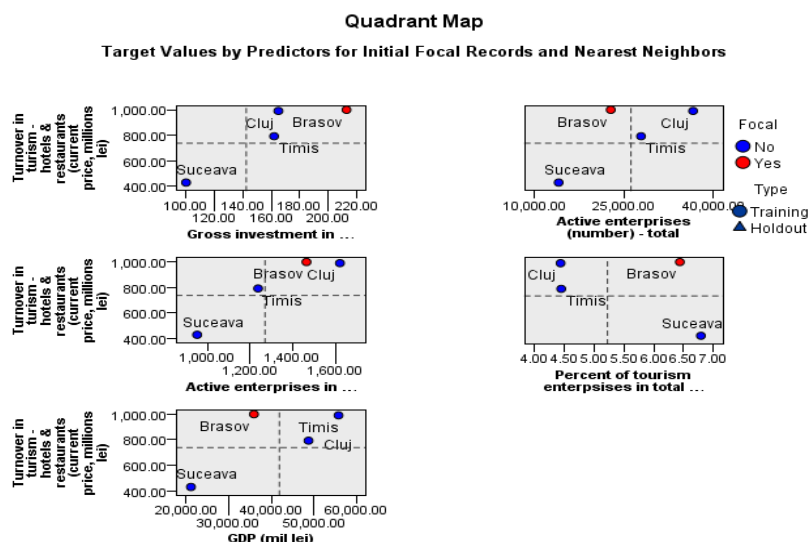


Figure 4

The KNN results: the Quadrant Map for entrepreneurial actions for 2020

For the second analysis, which is common for 2010 and 2020 due to the static characteristics of data, the results are presented in Figure 5 (the Quadratic Map).

From the Figure 5 it can be observed that from the three types of tourism resources only the natural resources are a good predictor for overnight stays, tourist arrivals and turnover in tourism. Also, the focal point of the KNN results indicate and practically confirm the first position of the extreme outlier's analysis with Constanța as the most visited Romanian county and with the high-level of turnover from tourism activities both in 2010 and 2020. The KNN reveals therefore an interesting aspect of Romanian tourism from the tourism resources point of view because, according to the results from Table 2, the Prahova County is in the first places and only by the built heritage resources, not the natural ones. By selecting the tourism resources as predictors for turnover in tourism the Quadrant Map from Figure 5 reveals that Constanța is similar Brașov, Prahova and Vâlcea in terms of tourism resources. Constanța and Brașov are on the first and the second place in 2010 and 2020 for turnover, arrivals and overnight stays. Prahova is on the fourth place in 2010 for turnover but not in the first five places in 2020. Vâlcea is on the third place in 2010 and the fourth place in 2020 for overnight stays.

The above-mentioned results from correlations matrices, descriptive statistics and extreme outliers' analysis pointed out some particularities for Romanian tourism at ten years differences. Therefore, to detailed and revealed more insides we applied, according to the second research objectives the decision tree analysis with CRT (correlate and regression tree) and CHAID (Chi-Square Automatic Interaction Detector) growing methods with the tourism indicators as dependent variable in two cases: (1) with data as continuous variables as they are collected from INSSE and (2) with dichotomous data as under/above median values for each year according to the results from Table 1.

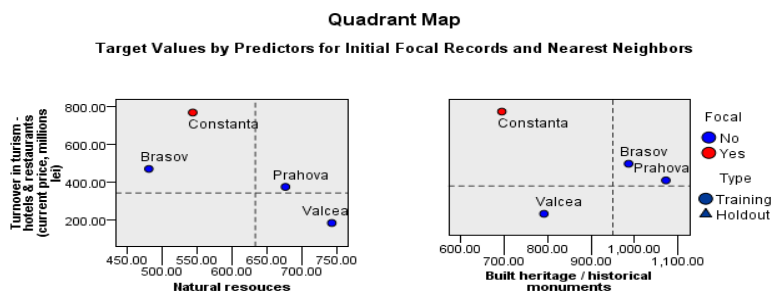


Figure 5

The KNN results: the Quadrant Map for tourism resources for 2010 and 2020

In the Figure 6 (a-c) are presented the decision trees with CRT growing methods in the following cases of dependent variable: (a) turnover, (b) overnight stays and (c) arrivals. In the first case of turnover as dependent variable the best predictor is the total number of active enterprises. In the second analysis, for overnight stays, the best predictor is the number of active enterprises in tourism and for the arrivals the best predictors is the gross investment in tangible of active tourism units.

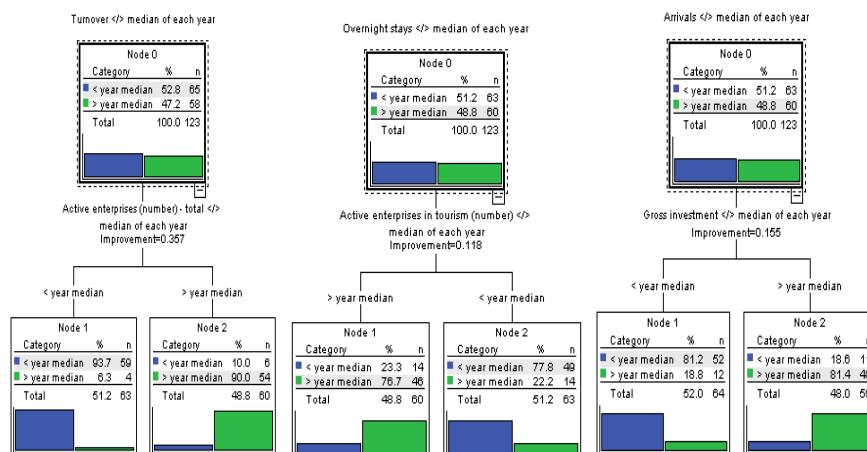


Figure 6 a-c

Decision trees with CRT growing method

The normalized importance of these decision trees pointed out that (Figure 7a-c): (1) for the *turnover*, the most important independent variables are (from high to low): total number of active enterprises (100%), number of active enterprises in tourism (77%), gross investment in tangible of active tourism units (75%), GDP (55%); (2) for *overnight stays*, the most important independent variables are (from high to low): number of active enterprises in tourism (100%), gross investment in tangible of active tourism units (100%), total number of active enterprises (75%), built heritage/historical monuments (55%), natural resources (50%); (3) for *arrivals*, the most important independent variables are (from high to low): gross investment in tangible of active tourism units (100%), total number of active enterprises (100%), number of active enterprises in tourism (100%), natural resources (50%), GDP (50%).

After the detailed the analysis based on decision tree for 2010 and 2020, we find out important differences after ten years in Romanian tourism at the county level and, more important, this machine learning algorithm emphasis these particularities. In Figure 7 (a-c) are presented the normalized importance for 2010, separately for each case of dependent variable and Figure 8 (a-c) for 2020 in the same conditions. Analyzing the results from figures 6 (a-c) for 2010 the gross investment is the most important indicator which separates the counties according to the median value of each tourism indicators (turnover, arrivals and overnight stays). However, in the case of turnover the hierarchy is as follows: gross investment, GDP, active enterprises in tourism, built heritage. In the case of overnight stays, after gross investment follow active enterprises in tourism, percent of enterprises in tourism in total number of enterprises and natural resources. For the arrivals, the gross investment is followed (from distance) by the active enterprises in tourism, percent of enterprises in tourism in total number of enterprises.

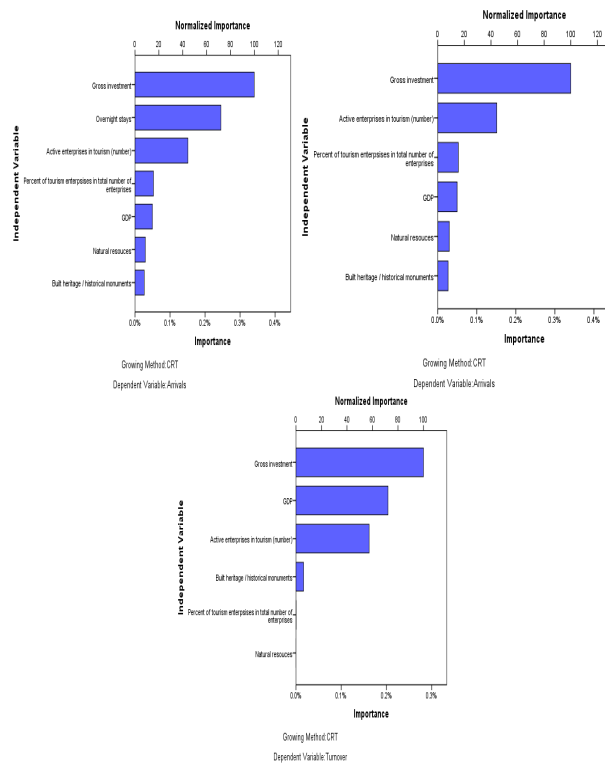


Figure 7 a-c
Normalized importance of independent variables for 2010

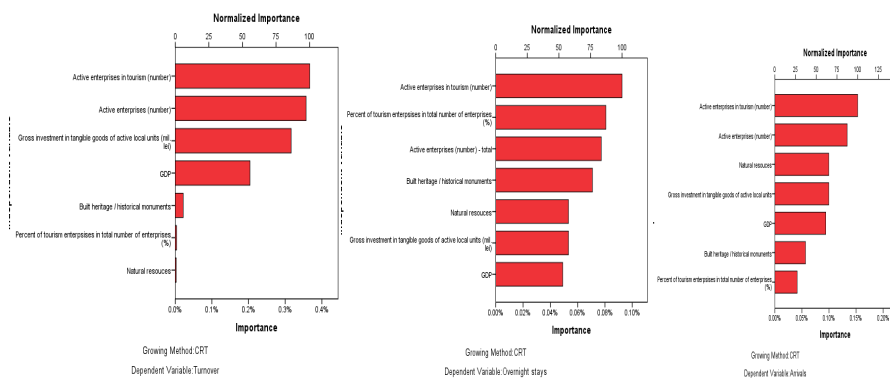


Figure 8 a-c
Normalized importance of independent variables for 2020

The situation for 2020 is somewhat different. For example, for the turnover in tourism, the most important independent variables which group the counties are

(from high to low): active enterprises in tourism, total number of enterprises, gross investment in tangible good of active enterprises and GDP.

For the analysis with the overnight stays as dependent variable the hierarchy is: active enterprises in tourism, percent of enterprises in tourism in total number of enterprises, total number of enterprises, built heritage/historical monuments, natural resources, gross investment, and GDP. For the last situation, with the arrivals as dependent variable of the analysis, the most important independent variables are the active enterprises in tourism follow by: total number of enterprises, natural resources, gross investment, GDP, built heritage/historical monuments, and percent of enterprises in tourism in total number of enterprises.

Conclusions

The attractions of destinations for tourists normally dependent on destinations' resources as primary tourism products [61]. Our research results emphasis important aspects for Romanian tourism at county level: (1) due of the uniform territorial distribution of tourism resources in Romania is still available the destination-based tourism product concentration and diversification [61]; (2) nature continue to be (and in our opinion for 2020 it could be the effect of travel restrictions during COVID-19 pandemic) the most important experience element for tourists confirming the theory of nature-based destination [59] and the results of Wang & Zhang [62] that natural resources are still an important part for tourism; (3) confirm that the big and medium cities the cultural resources represent the attractive resources for Romanian tourists [63; 5] while for the small cities the natural resources have a strong relation with tourists arrivals [52]; (4) the role of entrepreneurship in tourism reveal the changes in the tourism demand and the need to adjust products and destinations to meet these changes [38] during the analyzed ten years, from 2010 to 2020. For Romania, for example, there are potentially many opportunities for a sustainable entrepreneurship in tourism, to develop different type of tourism nature -based destination (such as: wine tourism, wildlife tourism, adventure tourism, winter and ski tourism, babymoon tourism, medical and spa tourism) or cultural-based destination (dark tourism, Dracula tourism, communist heritage tourism, etc.). Practically the "raw materials" for Romanian tourism are invariably the local resources [38], the tourism sector being a full of entrepreneurial opportunities and relatively easy access to the market [38]; (5) our results confirm the results of Dan & Popescu [39] that regions with reach cultural heritage have registered more entrepreneurial inputs. Practically the regions (in our case counties) with a tourism strategy and targeted strategies to support entrepreneurs predict tourism growth [64].

Our study is a first step to find the most important factors influencing the main tourism outputs. We started from the question, what is more important to develop tourism and to attract visitors: the existing natural and cultural resources or the business culture, the level of entrepreneurial spirit and the general economic development of a region? There are several papers that claim postmodern tourism

needs less classical resources, but more creativity, more invented attractions [65-66] and more entrepreneurial activity [67; 64]. Since the creativity is hard to measure, especially at tourism enterprises level, we proposed to capture the number and the share of tourism enterprises, the extent of investments in tourism, and the general economic development, expressed by GDP.

We have found in the first place that the means of the most economic figures have raised between 2010 and 2020, only the overnights in tourism have decreased since 2020 was an atypical, and a very negative year in global tourism. We have also seen, that some counties in Romania hold a dominant position, not only in terms of the economic development, but in many cases this is overlapped by a higher the tourism development, too: Brasov, Cluj and Constanta counties have high incomes and GDP/capita, due to their developed urban economy, but also developed a dynamic and strong tourism as well, thanks to their highly valued natural and cultural environment. Counties like Tulcea and Covasna, despite their rich resources (Danube Delta in Tulcea and mineral waters in Covasna), do not bring excellent results in tourism only in a few dimensions such as overnight or the number of tourism enterprises.

We considered the turnover of tourism enterprises, the overnights and the arrivals as output variables, the main indicators of a destination's success. On the other hand, there could be several independent or input variables which influence in many ways tourism performance [68-69]. Out of the many, we chose some with high relevancy, namely the number of enterprises and the number of tourism enterprises, the gross investments at tourism enterprises, the GDP at county level, and the natural resources and the built heritage and monuments, on the other hand. With correlation we checked every relation between these variables, for the 41 counties from Romania. The results show that the tourism turnover correlates best with the travel data (overnight and arrivals – which makes sense, the income usually is higher where the circulation is high). The main travel indicators go together the best with the turnover and enterprise data, less with the resource type indicators. The number of tourism enterprises only medium to low correspondence show with the natural and built heritage resources, more the percent of the tourism enterprises correlate with resources. This could mean, in a primary interpretation that resources alone do not generate tourism, they could generate enterprises, but only in rural areas where there are no other economic options. The high number of tourism enterprises not necessarily bring higher tourism travel results, as we can see here, without a well-structured and strong economic background, steady investments and good service environment tourism cannot flourish.

In both years analyzed (2010 and 2020) the tourism travel indicators (overnights and arrivals) are realized where investments in tourism are on high-level, and not where natural resources and historical monuments are vast. There is a medium relation between resources especially in Brasov, Prahova, Constanta and Vâlcea counties, so in those places where economic development and modernization is advanced. In 2020, Brasov, Cluj and Timiș counties have high number of tourism

enterprises and investments in tourism, and high tourism turnover, showing similar development patterns, according to KNN method. All three counties have major cities and a well-established urban society, good infrastructure (airports, industrial parks, relatively good position and access within the country, etc.).

Best predictors for turnover in tourism has proven the number of active enterprises, the number of enterprises in tourism and the gross investments in tangible goods at tourism enterprises. For arrivals, the number of total and tourism enterprises, but also the natural resources can be held responsible (the latter in a lower extent, though). As we have seen, for overnights beyond the entrepreneurial indicators the historical monuments and heritage also can bring some improvement. Altogether, we can claim that this is a first – and important step – to evince with exact numbers that not the classical resource-based tourism concept is working in practice, the tourism needs entrepreneurial skills, investments in tangible goods, and of course a sound and safe economic background, based on a modern service-focused structure. Resources and the attractions that derive from resources are important, but they can be easily replaced with human creativity, virtual and real experiences [47]. In recent evolution, tourism creates its own attractions, such as theme parks, cultural events, gastronomy, or sport infrastructure.

Our study has its *limitations*, too. There could be a larger scale of territorial observations, in more than one country for example or in local, city level too (if there would be data on local level). Moreover, economic development could be expressed better with more indicators, such as the structure of the territorial units (here: counties) or the innovation capacity; the tourism development should include the level of qualification of the human workforce employed in tourism or the number of tourism institutions and civil initiatives are present in every destination, too. Ideally, the tourism resources should be expressed at the attractions level, too: how many resources are included in tourism processes, how well developed and sophisticated are these cultural and natural attractions, of what kind of man-made attractions are present in different destinations. Knowing all this at large scale (more than 100 destinations, or relevant territorial units) could help to complete a tourism demand and supply model, which expresses the exact influence of each input indicator to the tourism output. One of the important *limits* of our research is given by the methodological aspects of collecting data for natural resources and built heritage in Romania, being a quite static data and the missing data from National Plan for territorial Planning for localities not listed here [48].

Our theoretical contributions confirm, at the county level for Romania, that spatial proximity of among products and resources/attractions increased likelihood that tourist who visit one attraction to visit others [61]. Also, from the methodological point of view, the geographical clusters of attractions and resources increase aggregate visitors number and create business opportunities and extent length of stay [61]. Our practical contribution is helpful for Romanian local governments and tourism resources developers.

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