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### A Geo-Statistical Analysis for Prediction Modeling of Filariasis (Elephantiasis) Transmission Risk in Bangladesh Using Geographic Information Systems

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**Abstract:** Various socio-economic and environmental factors play a vital role in the transmission of many infectious diseases of which some are among the most important cause of mortality and morbidity in the developing countries. Filariasis is the disease of the poor people and has been neglected for more than 50 years in Bangladesh and it is endemic in 23 out of 64 districts of Bangladesh so far. The affected people are generally the poorest and most vulnerable segment of the country. This research article has been made to analyze the prediction of filariasis disease. It discusses how GIS technology can be utilized as an array of several databases and as an effective tool for integrating different sectoral and information of various significant decision-making processes. It utilizes the kriging and cokriging methods of ArcGIS Geostatistical Analyst to predict filariasis occurrences using various socio-economic and environmental parameters and comparing the predicted models for Bangladesh's northern region which is highly filariasis prone. The resultant prediction model indicates that the probability of filariasis is higher in upazilas neighboring another upazila with high occurrences. The result also shows that the disease incidences decreases with increasing distance from the disease affected regions.

Key words: filariasis, geostatistics, kriging, cokriging, spatial interpolation

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#### **1. INTRODUCTION**

The environment is the basic determinant of health. Health depends on a flexible-equilibrium between human beings and the environment in which they live [1]. The term environment comprises three components: physical, biological, and social. These three components have close relationships with disease and ill health [2]. There is always a constant attempt towards adjustment and re-adjustments between these components of the environment. When an adjustment is achieved, there is health and harmony but on maladjustment between the three component results in disharmony, discomfort, disease, or death. The degree of disease or ill health is proportional to the maladjustment between these components.

Filariasis is a mosquito-borne infectious disease of the human being. Filariasis is a group of human and animal infectious diseases caused by nematode parasites of the order filrioidea, commonly called filariae [3]. It is a communicable parasitic disease caused by Wuchereria bancrofti, Brugia malayi or Brugia timori that can clinically manifest itself in the form of lymphedema or elephantiasis [4]. Filariasis

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has been identified as a major public health problem and is endemic in over 80 countries [5]. It is the world's second leading cause of long-term disability [6].

Throughout the year Bangladesh is a country of divergent climatic condition which has a complex influence on economic and social aspects, mainly for its geographic location and physiographic situation. Most of the people of the country live in rural areas and a large number of them are poor. Various socioeconomic and environmental factors play a vital role in the transmission of many infectious diseases of which some are among the most important cause of mortality and morbidity in the developing countries. Many studies were done on filariasis describing the transmission of the disease from the environmental point of view [7,8,9,10]. It was observed in Indonesia that the presence of a water puddle can be a source of filariasis [11]. The research found there was a connection between filariasis and the presence of the water body around the house of filariasis incidences. Education and awareness were directly associated with filariasis disease in Andhra Pradesh, India and there were significant differences of filariasis infection among the illiterate/undergraduate and the graduate respondents [12].

Temperature fluctuations during winter and summer seasons have a significant influence on the occurrences of filariasis [1]. It was observed that there existed a positive association with filariasis occurrence and annual daily temperature. Distribution of mosquitoes is also affected by different sites, depending on temperature, salinity, organic load, etc. [13]. In Ghana the incidences of filarial attacks considerably increase throughout wet seasons compared to the dry season [14].

In Bangladesh, very few studies have been conducted for the prevalence, spread, or cause of infectious diseases by the geographers. Most of these studies were done by researchers from the medical field. Recently some studies have been done on health and environmental fields. Recent advances in the availability of climatic and environmental data and increased use of geographical information systems (GIS) and remote sensing (RS) make the researchers build an operational disease Early Warning Systems (EWS) quoted in a report of World Health Organization [15]. The purpose of the present study was to create a filariasis prediction model using certain predictors with the help of GIS tools and focuses on morbidity situations due to filariasis, the physical environment, and socio-economic aspects of the northern region of Bangladesh.

#### 2. MATERIALS AND METHODS

#### 2.1. Study area

The study area (Rangpur division) is a part of the northern region of Bangladesh. Administratively the region is under the Rangpur division. It covers a surface area of 16320.26 and is situated between 25°20′ and 26°37′ north latitudes and between 88°50′ and 89°53′ east longitudes. The region consists of eight districts. It is bounded on the north by the Assam and on the west by the West Bengal state of India. The annual mean temperature is about 39°C in Summer and 7°-10°C in the winter. It receives rainfall from the monsoon started in the middle of June and continued till the end of September. But the total amount of rainfall in the region is low comparing to the rest of the regions of the country.

#### 2.2. Databases

This study has collected filariasis morbidity data from the Filaria Hospital at Syedpur in 2014-15, which is under the Nilphamari district of the region. It is a specialized hospital for the disease. This research has collected the data from the register book of the hospital and compiled them according to upazila (sub-units of districts) wise. Upazila wise socio-economic and geo-environmental data such as, population density, Literacy, kutcha households (Referrers to the households which are made of earth, bamboo, wood and corrugated iron sheets (CGI) or thatch as roofs.), jhupri households (Referrers to the households which are shacks made from branches, bags, tarpaulin, jute, etc.), having no sanitary, no toilet, Irrigated areas, annual maximum temperature, annual minimum temperature, annual mean rainfall, annual mean humidity were collected from respected government sources. The data relating to the socio-economic status were collected from Bangladesh Bureau of Statistics, Bangladesh Meteorological Department provided the necessary weather data. The spatial dataset which comprises the vector map coverages of 58 upazilas of Rangpur Division (1:50000 scale), were collected from LGED which depict many human and physical features (Administrative boundaries, Rivers, Lakes, Roads, Hospitals, etc.).

#### 2.3. Stepwise Multiple Linear Regression analysis

Variables have been selected in the light of the surveyed literature and found that several socioeconomic and geo-environmental parameters are associated with filariasis morbidity [11,1,14]. Multiple Stepwise Linear Regression was conducted for filariasis occurrences of the 58 upazilas (dependent variable) with various socio-economic and geo-environmental parameters (Independent variables) using SPSS version 20 to find out the helping parameters which may have influences for the filariasis occurrences in the study area.

#### 2.4. Geostatistical methods

Nowadays geostatistics is a frequently used technique for analyzing the spatial relationships among the datasets. It is a statistical technique used to analyze and predict the values associated with spatial or spatiotemporal phenomena incorporating the spatial (and in some cases temporal) coordinates of the data within the analyses [16]. A Geostatistical method investigates the presence of spatial correlation among the variables related to distance and direction in a landscape. Using kriging and cokriging techniques of ArcGIS geostatistical wizard this paper aims to find out how the different socio-economic and environmental variables are spatially correlated with filariasis and what their spatial effect in the surface of the region. In Bangladesh, very few studies have been conducted to study the spatial pattern of the disease using GIS tools and, in this context, the approach taken in this study kriging and cokriging techniques of the geostatistics methods are new to analyzing the spatial spread of filariasis.

Recently, increases in applications of kriging and cokriging are noted in the field of medical geography. Geographers are using these techniques for creating a risk model of a disease and assessment of necessary establishments of public health [17,18]. Using kriging has emerged in the last decade or so including the mapping of influenza-like illness in France [19].

Different spatial interpolation techniques including kriging and cokriging can improve the evaluation process of vector patterns mosquito, characterized their habitats and breeding conditions which are the cause of various infectious diseases [20].

In India researchers were succeeded to predict and forecast filariasis using different environmental variables as predictor vector mosquito density during different months and able to forecasting vector



Figure 1. Methodological framework

(mosquito) densities in forthcoming seasons [21]. Filariasis prediction for Africa showed that populations at risk to filariasis may range from 543 and 804 million currently, and that these cases could rise to between 1.65 to 1.86 billion in the future depending on the climate scenario used and thresholds applied to signify infection presence [7].

The geo-statistical predictive model was statistically significant and thus the resultant delineated map of filariasis transmission risk zone was useful for decision making to implement the filariasis control in India [9]. A geo-environmental risk model was succeeded to create a filariasis transmission risk map for India using spatial interpolation methods of the geostatistical technique of GIS [22].

There will be many situations in which a certain spatial analysis technique provides part of the answer and for this reason, it is always necessary to take into consideration the using of other techniques to get the total picture. Therefore, this study will examine the filariasis situation using kriging and cokriging methods of ArcGIS geostatistics analysis wizard and evaluate the influence of the different socio-economic and geoenvironmental parameters to the disease and the consequences on the study surface. A complete methodological framework adopted in this study has been shown in Figure 1.

#### **3. SPATIAL DISTRIBUTION OF FILARIASIS IN BANGLADESH**

Filariasis is at present endemic in 23 districts, mostly bordering India [23]. In a health bulletin report published by the Directorate General of Health Services [24] shows that the northern region of Bangladesh is filaria prone. Currently, outbreaks of filariasis occur in seven of the eight districts of this study area. The Endemicity districts are Nilphamari, Dinajpur, Rangpur, Thakurgaon, Panchagar, Kurigram, and Lalmonirhat districts of the study area (Figure 2). The report also shows 88.33% of filariasis infections exist in this northern region (38582 out of 43678).



Figure 2. Distribution of Filariasis morbidity of the study area Data Source: Filaria Hospital Sayedpur, Map: Own processing

#### 4. RESULTS AND DISCUSSION

#### 4.1. Preliminary analysis

Summary statistics of filariasis occurrences and other related data are given in Table 1. It can be seen that there was an average of 64.37 filariasis patients from each district who had been admitted or had taken treatment of the disease from the hospital. The maximum and the minimum number were 244.00 and 8.00 for the whole region. The other socio-economic and geo-environmental parameters had been selected through a lot of literature review. Table 1 shows the Pearson's correlation coefficients rounded to two decimal places. It depicts the relationship between irri area (Irrigated Area) and filariasis is the strongest (r = 0.77) but there is also a strong relationship between two of the independent variables (annual mean maximum temperature, r = 0.66 and jhupri households, r = 0.70) and a moderate relationship can be found for annual mean rainfall (r = 0.56).

				0	
	Minimum	Maximum	Mean	Std.	<b>Correlation coefficient</b>
	Mininum	Maximum	Mean	Deviation	(with Filariasis)
Filariasis	8	244	63.43	47.580	
Pop_den	526	2174	985.67	309.894	0.40
Literacy	31.2	64.3	46.490	6.2189	0.30
Kutcha	61	91	77.48	7.749	0.30
Jhupri	0.50	7.0	3.560	1.9352	0.70
No_sanitary	31	35.3	34.738	10.3324	0.26
Temp_max	31.0	36.0	33.148	1.1243	0.66
Temp_min	9.0	13	10.95	.945	0.42
Rain	1414	2014	1824.26	172.408	0.56
Humidity	72	90	78.92	7.045	0.21
Irrigated_area	6102	78351	42471.00	17412.384	0.77
	Sourco: Stopwi	ico multinlo rogr	occion analycic	using SDSS Vors	ion 20

 Table 1. Descriptive Statistics of the socio-economic and geo-environmental variables

urce: Stepwise multiple regression analysis using SPSS, Version 20

#### 4.2. Reporting regression

For ordinary cokriging analysis, multiple linear regression was carried out using SPSS version 20 to investigate the relationship between population density, literacy, kutcha, jhupri, maximum temperature, minimum temperature, rainfall, humidity, irrigated area filariasis.

	Store Store			Change Statistics					
Model	R	K	Adjusted D Squara	of the	R Square	EChanga	d£1	467	Sig. F
		Square	k Square	Estimate	Change	F Change	all	uiz	Change
1	<b>0.773</b> <sup>a</sup>	.597	.590	30.469	.597	83.000	1	56	.000
2	0.814 <sup>b</sup>	.662	.650	28.143	.065	10.636	1	55	.002
3	0.834 <sup>c</sup>	.696	.679	26.954	.034	5.962	1	54	.018
4	0.849 <sup>d</sup>	.721	.700	26.070	.025	4.725	1	53	.034

Table 2. Diagnosis of the stepwise multiple linear regression

a. Predictors: (Constant), Irrigated\_area

b. Predictors: (Constant), Irrigated\_area, Kutcha

c. Predictors: (Constant), Irrigated\_area, Kutcha Temp\_min

d. Predictors: (Constant), Irrigated\_area, Kutcha Temp\_min, Temp\_max

e. Dependent Variable: Filariasis

Source: Stepwise multiple regression analysis using SPSS, Version 20

Table 2 shows there was a significant relationship between irrigated area and filariasis (p < 0.000), kutcha households and filariasis (p = 0.002) and mean annual minimum temperature and filariasis (p = 0.002) 0.018), mean annual maximum temperature and filariasis (p = 0.034). On the other hand, humidity, no\_sanitary, and jhupri variables were excluded from the analysis as their p-value was greater than the usual significance level of 0.05. The adjusted R<sup>2</sup> indicates that 70% of the variation in filariasis can be explained by the model. The stepwise regression result contains 4 variables out of 10 and it provides fairly a reliable model. The result indicates that there exists a strong and moderate correlation between the filariasis and the causal variables in the study area. It suggests that these parameters may help to assess the filariasis incidences and create a prediction model when used as a secondary variable in the ordinary cokriging analysis.

#### 4.3. Performing Kriging and Cokriging

Using the kriging method, the full dataset was used to create interpolation maps from the primary variable, i.e., filariasis incidences data (Figure 2). Cokriging was then used to evaluate the contribution of different covariates when estimating the spatial distribution of filariasis occurrences. Based on the result of the stepwise multiple linear regression different helping covariates used in cokriging analysis were irrigated area, kutcha households, mean annual maximum, and minimum temperature.

#### 4.3.1. Variogram models for Ordinary Kriging analysis

The ordinary kriging analysis requires the estimation of the direct variogram models for filariasis incidences data. Kriging model accuracy was determined by intermodal metrics where stable semivariogram and true anisotropy selections produced the optimal model to predict filariasis occurrences of the kriged surface (Figure 3). The best-fitted variogram models were selected based on the minimum RSS values using a trial-and-error process. The selection of a lag size has important effects on the empirical semivariogram and it provides a reasonably good lag size, as every lag will have at least a few pairs of points in it [25]. The lag size was determined using the Average Nearest Neighbor tool located in Spatial Statistics Tools, under Analyzing Patterns. The variogram parameters are iteratively changed to get the best-fitted model, which produced the minimum RSS [26]. The cross-validation matrix produced a ME value centered around 0 (ME = 0.016), a low RMSE value (1.010), and the least difference among RMS (RMS = 38.440) and ASE (ASE = 38.452). However, with ME > 0, ASE > RMS and RMSE >1 indicates `the model's overestimation in determining the variability between the predicted value from the measured value (Table 3).

Variables	Mean	Root-Mean- Square	Mean Standardized	Root-Mean- Square Standardized	Average Standard Error	Model status		
Filariasis	0.837	38.440	0.016	1.010	38.452	Overestimating in the variability of prediction		
Kutcha with Filariasis	0.698	38.204	0.014	1.010	38.267	Overestimating in the variability of prediction		
Irrigated_area with Filarisis	1.944	38.407	0.035	1.011	39.927	Underestimation in the variability of prediction		
Temp_min with Filariasis	1.028	37.846	0.023	1.017	37.483	Underestimation in the variability of prediction		
Temp_max with Filariasis	0.447	37.652	0.006	0.995	38.179	Overestimating in the variability of prediction		

Table 3. Summary of the Kriging and Cokriging Prediction Model

Source: Kriging and Cokriging analysis using ArcGIS (ArcMap 10.2.1)

#### 4.3.2. Cross-variogram models for Ordinary Cokriging analysis

Table 3 summarizes the accuracy metrics for the kriged surface created from filariasis incidences as well as the metrics from cokriged surfaces created from the helping variables (Irrigated area, kutcha households, mean annual minimum temperature, and mean annual maximum temperature). All models produced ME values centered around 0. Filariasis and kutcha households produced the lowest RMS value (2.166) and lowest ASE value (38.267), Filariasis and irrigated area yield RMS value (38.407) and ASE value (39.927), mean annual temperature with filariasis produced RMS value (37.846) and ASE value (37.483).Mean annual humidity helped to produce RMS value (38.423) and ASE value (38.380). Additionally, the cross-validation statistics for all models also show the RMSE >1.



**Figure 3.** Prediction distribution of Filariasis using kriging and cokriging methods: **(a)** Kriging predictions model for filariasis; **(b)** Cokriging model with kutcha households; **(c)** Cokriging prediction with irrigated areas; **(d)** Cokriging model with maximum temperature; **(e)** Cokriging model with minimum temperature Data Source: Filaria Hospital Sayedpur, Map: Own processing

Therefore, the RMSE value and the difference between RMS values and ASE values for each surface yield the model's status. As it can be seen from Table 3 that filariasis and kutcha households had the least difference between RMS and ASE (-0.063) followed by filariasis and mean annual maximum temperature (-0.527), filariasis and irrigated area (-1.52), filariasis and mean annual minimum temperature (0.363). The results in Table 3 indicate that the kriging model overestimating the variability of prediction of filariasis. In cases of cokriging analysis, kutcha households with filariasis and annual mean maximum temperature with filariasis are overestimating the variability of our predictions. On the other hand, the irrigated areas with filariasis and mean annual minimum temperature with filariasis are underestimating the variability of the predictions.

The output surface of a model created using different input parameters has been examined and it helped to compare each of the geostatistical layers is relative to another model. It can be observed how the filariasis clustered areas are changing with the interplay of different variables (Figure 3a-e). Moreover, the cross-validation statistics in Table 3 indicate that both the kriging and cokriging analysis examined all neighborhoods for the study area and the cross-variogram models yield prediction maps which indicate that some of the socio-economic and geo-environmental variables are associated with filariasis disease. The RSS, ASE, and RMSE of the cross-validation statistics indicate how accurately an interpolator predicts the observed data [27].

May be the kriging and cokriging methods produce overestimating and underestimating the variability of our predictions, however, the resultant models provided a spatial pattern on the disease situation over the surface. This provides a spatial decision support system which may be used for filariasis elimination programmes and to explore possible environmental and socio-economical drivers of disease transmission of the country.

All the models revealed that the upazilas within the central parts of the region are the most intensely affected areas (Figure 3a-e). Six upazilas are very strongly predicted with filariasis disease including the upazilas like Nilphamari Sadar (Sadar upazila belongs the administrative headquarters of the district). Jaldhaka, Kishorganj, Khansama, Chirirbandar, and Sayedpur. Their grouping is within the area encompassed by the second group. There are nine upazilas, in a much tighter spatial grouping, are more strongly and the upazilas are Domar, Badarganj, Taraganj, Parbatipur, Debiganj, Dinajpur sadar and some parts of Birganj, Thakurgaon sadar, Gangachara and Rangpur sadar, and twelve upazilas, has fallen in the next group. Their position is at the outliers of the second group. The model shows that the probability of getting filariasis is higher in upazilas neighboring another upazila with high filariasis occurrences and the influence decreases with the increase of distance. Rests of the upazilas are grouped in the northern and southern part of the study area and reflects a low level of morbidity from filariasis. Therefore, it can be stated that the filariasis clusters vary from one upazila to another. ArcGIS Geostatistical prediction analysis using kriging and cokriging methods analysis can provide decision-makers with an understanding of the spatial patterns of filariasis or any other disease and enabled them to make more informed decisions about how to address the disease occurrences issue and allocate resources in this respect.

#### **5. CONCLUSIONS**

The study revealed that Spatial interpolation of filariasis incidences which poses various impact of mean annual minimum and maximum temperature, amount of cropping field under irrigation and having kutcha (house made of straw or bamboo) households. Geostatistical techniques within ArcGIS helped to produce different filariasis prediction models with the helping parameters.

Testing of various methods like correlation, stepwise multiple linear regression helped to do the ordinary cokriging, and using the different semivariogram models produced by kriging and cokriging analysis provides the overall good results. It is noticed that the amount of having kutcha households, areas under irrigation (produce stagnant freshwater and breeding site of mosquito), mean annual maximum and the minimum temperature had moderate to strong influence on the filariasis disease occurrences in the study region. It also found that the central part of the areas is predicted high-risk zones for the disease to show an effective way to help to investigate and increase the knowledge level of risk factors of filariasis (Elephantiasis). The prediction maps generated in this research provide visual representations of the spatial distribution, association with causal variables, and risk zones of filariasis disease.

This study will also help geographers and environmental professionals to do further study in the field of medical geography which will help authorities to take necessary measures for totally eradicating filariasis and other infectious diseases.

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#### **DISCLOSURE STATEMENT**

The authors declare that there is no conflict of interest.

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### European Urban Regeneration through Intelligent Applications

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Abstract: With the advent of new technologies, cultural heritage can be experienced within a more complex tourist offer based on highly personalized products, tailored to the needs of visitors through feedback, geo-localization, advanced services and multifunctional information. and in real time. Among the types of tourism in constant and rapid growth there is that linked to cultural heritage, with the inevitable repercussions on local economies, destinations and local communities. Cultural tourism attracts an increasing number of tourists / travelers with changing needs; no longer and not only linked to the search for fun but, also, to those of new experiences aimed at satisfying an intellectual, personal, and emotionally satisfying involvement. The importance of innovation, also seen as a new support for the tourist development of the territories, is translated through ICT that facilitate the use of the territory, but also as a system of informal networks between the population and the territories. The transformative power of intelligent technologies not only in terms of economic potential but also of social and experiential dimensions is now widely recognized. From this perspective, the new initiative of the European Commission "EUROPEAN CAPITAL OF SMART TOURISM - ECoST" should be read, which through the holding of a competition aims to identify the European Capital of Intelligent Tourism. In addition to the deepening of the most recent theoretical conceptualizations, the study will be based on the deepening of the ECoST Project and on the examination of the potential of some Italian cities.

Key words: Tourism, sustainability, development, technology, cities, potentiality

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#### **1. INTRODUCTION**

Cultural tourism is one of the types of tourism in constant and rapid growth, with inevitable effects on local economies, destinations, and host communities. It attracts an increasing number of tourists/ travelers with changing needs related to the pursuit of fun and the desire to live new and lasting intellectual, personal, and emotional experiences. In particular, advanced technologies, combining augmented, virtual and imaginary reality, can offer a deeply immersive experience. They aim to provide multifaceted information on the site visited and improve the attractiveness of a tourist destination at different scales (regional, national, local).

Innovation and competitiveness and the development of smart applications have aroused much interest in Europe; since their inception they have been designed for end users who wish to live enriched tourism experiences using existing data combined and processed in new ways [1–2]. A considerable transformative power of local economies (where they are widespread), of social characteristics and experiential modes, is now widely recognized in intelligent technologies.

The new initiative of the European Commission "European Capital of Smart Tourism - ECoST" fits into the context just described. Through the holding of a competition, it aims to identify the European Capitals of Intelligent Tourism. The project will showcase the results achieved by some European tourist destinations with reference to themes deemed strategic such as cultural heritage, sustainability, digitization, and accessibility.

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From a methodological point of view, in addition to the in-depth review of the most recent theoretical conceptualizations, the study is aimed at deepening the ECoST Project, with an initial assessment of the possible candidacy of Italian cities as future smart tourism cities. In fact, the purposes of the aforementioned European project can also be found in the four axes of the Italian Tourism Strategic Plan 2017–2022 [3], which has identified some strategic axes that appear to be in line with the European ones of "smart" interpretation: the enhancement of cultural heritage, tourism as an integrator of policies, and digital technology as a platform for meeting supply and demand.

#### 2. THE ALLIANCE BETWEEN TOURISM AND TECHNOLOGY

The growth of cultural tourism is also supported by the evolution in tourism models, which show a clear trend towards shorter stays and a fragmentation of holidays. The shortening of the holidays has resulted in a steady increase in short visits, mainly focused on urban and cultural tourism. According to a study by the European Commission (2010) [4], 20% of tourists in Europe and 60% of European tourists travel for cultural reasons. The increased demand for this form of tourism is also due to the changed needs of the tourist / traveler, no longer and not only related to the search for fun but also to those of new experiences. [5–8]. "Globalization, demographic changes, advances in technology and a shift in consumer value systems have shaped the demand for a new post-materialist tourism product. Experience-based tourism is the new concept that is gradually emerging to satisfy this need. This implies the need to go beyond the fleeting experience, expanding the tourist experience over time through an intellectual and emotional involvement able to continue even after the experience and to stimulate the fixation of recollection and memory [9] (p. 489). In general, producers of goods and services can no longer escape the need to diversify them in order to remain on the increasingly competitive market.

Even tourism, and in particular the cultural one, must adapt to this change, transforming the simple 'holiday' into an 'experience'. As McCann (2002) [10], states, the production of culture has therefore long become a central factor for tourism-based urban development strategies.

Since 1998 Álvarez [11], began to emphasize the importance of tourism management based on technological tools, such as intranet and Internet, which became part of the tourism system around the 1990s. His proposal promoted the commercialization of a tourist destination by increasingly using the Internet and other non-traditional channels, such as CD-Roms, or possible virtual communities, where information on tourist destinations can be collected.

What tools do tourism policymakers have today to implement the aforementioned strategies and improve the competitiveness of a tourist-cultural destination? Starting from the competitive success factors that make a cultural site attractive, these tools can be summarized as follows: particularities of cultural, artistic and historical values; level of accessibility; quality of the facilities and services (tangible and intangible) of tourism present; peculiarities of additional services. The latter may refer to the availability of multimedia services in the use of architecture, of historical-artistic works capable of determining an emotional involvement of the user: think of the possibilities of virtual reality and augmented reality, which allow the reconstruction in the space and time of a work and its context. More generally, technology can support the tourist offer and, therefore, the use of all its material and intangible, natural and artificial resources.

The technology is functional to the resolution of critical issues that have long limited the full development of the cultural sector. The use of technological innovations, adequately developed and applied, can facilitate the use and access to cultural assets and contents, to the advantage of a growing number of users [12–13]; and a greater enhancement of the historical and artistic favor of the whole community. According to Fusco Girard and D'Auria [9], the use of new technologies in the cultural heritage sector can be fundamental to reduce information asymmetries, and therefore the knowledge gap, between the demand side and the supply side; to reshape the structures and boundaries of the cultural tourism sector by increasing the number of potential visitors; to extend tourism demand in space, avoiding the well-known problem of concentration in limited areas also in order to redistribute the positive and negative impacts of tourism on the territory; finally to expand the tourist offer over time. Through effective intellectual and emotional involvement, the tourist experience would become unique and unforgettable; therefore, it would produce 'knowledge' and not just information thanks to virtual technology. The main requirement for sharing knowledge, communication and promotion is to integrate the physical experience with a virtual one, using tools that increase the information of reality by amplifying its contents and their value.

In addition, an increasing number of tourists express the desire to transform their travel experience from the usual one to a multi-sensory and more engaging one. [14]. Tourism experienced, therefore, as an experiential product also through technology and frequently multimedia. In this recent scenario, what Fusco Girard and D'Auria [9], define the "new urban cultural tourist" experiences the relationship with the

city according to three temporally different moments: the first refers to the pre-visit (virtual moment) with the acquisition of knowledge necessary for the visit such as accommodation, transport, places of interest; in the second moment, dedicated to the actual visit of the city (current moment), the tourist will use the information acquired virtually to better enjoy his stay in the chosen city; finally, there is the last emotional moment, attributable to the post-visit to the city, in which the tourist will spread their opinions, impressions and emotions about the city online. These, subsequently, can become information and knowledge in the pre-visit phase of other tourists.

According to Savelli [15], "The new information and communication technologies offer the local organized community enormous opportunities to present themselves to the stranger in all its articulations, even in the weakest and most exposed to the risk of disappearance; and to graduate the communicative intensity. The 'electronic rib' of the territory and the community that is settled there, allows the latter to present itself as a field of possibility that is always in excess of the tourist's capacity for experience, indeed, increasingly richer as the user there he ventures and builds his own access routes." In this scenario thus outlined, the initiatives are numerous and all aim to improve the tourist experience through a better use of technology.

Among the latest deployments, there is "ECoST" developed and proposed at community level to favor the transformation of tourist cities into smart cities. According to various scholars including Giffinger [16], and Hollands [17], the term smart city defines a city model that through the aid of new technologies is able to implement a transparent and participatory governance policy, aimed at improving the quality of life of its citizens and to pursue sustainable development goals. Hence, for cities, the need to employ skills and resources for the construction of cultural offers that are equipped with specific contents but, at the same time, that provide appropriate forms of communication and methods of use facilitated by the aid of techniques, technologies and innovative tools that can integrate more traditional organizational and fruition models [18]. Therefore, it becomes essential for the public decision-maker to develop development strategies for tourist destinations. In these strategies, the role of the "territorial brand" linked to sustainable tourism and its visible tools has proved successful over the years [19–20].

Territorial diversity, therefore, as a successful tool for the affirmation of smart cities. As Paradiso [21] states, "Far from being uniform and omnipresent, the digital dimensions of places are fragmented along various factors such as the location of networks, linguistic and cultural aspects in general, and social aspects. The result is a consequent mosaicization of the representations and a personalization of the same on the non-repeatable (unique) set of skills and environments of individuals." This implies the adoption of a general operational framework (as will be seen for the ECoSt initiative), applied to individual urban realities.

#### 3. THE ECOST INITIATIVE IN THE EUROPEAN CONTEXT

The European Capital of Intelligent Tourism-ECoSTinitiative implemented by the European Commission is part of a broader action or Preparatory Action, proposed by the European Parliament, to strengthen the role of tourism as a driving economic activity for the countries of the Union. The central idea is to consolidate, or in some cases promote from scratch, the awareness of the tourism development potential of European cities. The Preparatory Action generally aims to:

• promote the rich tourism offer of European countries and increase citizens' sentiment of sharing local tourism-related values;

• strengthen tourism-generated innovative development in cities, their surroundings and their regions;

• increase the attractiveness of European cities that are awarded the title and strengthen economic growth and job creation;

• establish a framework for the exchange of best practices between cities participating in the contest and create opportunities for cooperation and new partnerships.

This new initiative complements other EU policy actions and initiatives in the tourism sector [22].

Tourism is the third largest socio-economic activity in the EU and accounts for around 10% of the EU's GDP. According to European Commission (2010) [4], innovation, accessibility and sustainability will be crucial for the future of tourism. Hence the need to implement an initiative designed and managed by the Directorate General of the European Commission for the internal market, industry, entrepreneurship and SMEs, around smart tourism in European cities. Smart tourism responds to new challenges and demands in a rapidly changing sector, including the evolution of digital tools, products and services; equal opportunities and access for all visitors; sustainable development of the local area; and support for creative industries, local talent and heritage.

In 2018, the European Commission launched the first edition of the "European Capital of Smart Tourism" award, with the aim of rewarding two European cities that stand out for their accessibility,

sustainability and digitization and for their attention to cultural heritage and creativity. The award is aimed at cities in the European Union with at least 100,000 inhabitants (in the absence of cities of this size, states can nominate the largest city). The aim is to encourage the development of innovative and inclusive solutions for sustainable and accessible tourism, with the use of digital technologies, supporting the combination of cultural heritage, tourism assets and creativity. Overall, tourism is the third largest socio-economic activity in the EU. It plays a crucial role in growth and job creation through the implementation of strategies aimed at improving the visitor experience, creating new partnerships and cooperation opportunities and enhancing innovation processes in European cities and regions. The Award to the cities that more than others favor the so-called intelligent tourism, also intends to promote the sharing of best tourist practices among European cities in the medium term. In this sense, the prize will be awarded to the two cities that will present the most intelligent, innovative and inclusive solutions in all four of the above-mentioned sectors; but four other cities will still receive a smart tourism award in recognition of their outstanding achievements in individual categories.

According to the Commission [22], it can be defined as the Capital of smart tourism "A city that implements innovative, intelligent and inclusive solutions in the tourism sector, uses its own territorial, social and human capital for the growth of the tourism sector, for the prosperity of city and for a better quality of life of its inhabitants, offers a rich and personalized tourist experience through the enhancement of local assets, respecting and involving local communities, facilitating access to tourist services and products thanks to the new technologies, interconnection and interoperability of services."

To achieve this status, the cities concerned must adhere to four well-identified criteria that characterize the ECoST initiative (Figure 1). The first is accessibility, i.e. they must not present obstacles to the movement of travelers who have special needs, so they must be equipped with a functional and efficient internal transport network. The accessibility criterion must regardless of the age of the travelers, their economic or social condition. The second is sustainability. Cities that are deemed sustainable will be those committed to maintaining the balance between economic development and socio-cultural development, while respecting natural resources. The third criterion indicated is digitization; Smart tourism cities will have to offer tourism information, products, services, spaces and experiences using ITC digital tools. Finally, the fourth criterion is based on renewed and creative proposals of the cultural heritage present within its territory.



**Figure 1**. The four criteria of ECoST Initiative Source: https://smarttourismcapital.eu [23]

The implications for the cities awarded the title of European Capital of Smart Tourism are manifold. They will be able to benefit for a year from the advice of experts in the sector to consolidate the renewed tourist image, will benefit from special advertising campaigns that will emphasize their role as pioneer city of smart tourism and, therefore, will be able to benefit from new flows of those tourists attentive to four typing criteria. The winners will also receive a large interactive sculpture, which will be installed in the city center to demonstrate their commitment to sustainable, accessible, digital and cultural tourism. According to the intent of the initiative, a smart tourism city is therefore one where accessibility is undoubtedly the absence of barriers to movement, but it must also be understood according to the dimensions proposed by the geography of tourism, namely spatial, economic and cultural. The presence of multilingual services, for example, digitally available to all travelers or visitors regardless of age, cultural background or any physical disability can reduce the physical distance, but also the functional one (costs, times, expected benefits, etc.). Digital technologies will improve all aspects of the tourist experience, thus promoting the accessibility and usability of the destination's cultural heritage. If all of the above is organized according to a long-term perspective, the economic benefits will affect the entire community and not just the tour operators directly involved.

At the end of the application process first and then evaluations, the European Cities of Intelligent Tourism for 2019, first edition, were Helsinki (Finland) and Lyon (France).

The other four cities awarded for one of the four criteria identified by the Initiative were Málaga (Spain) for accessibility; Ljubljana (Slovenia) for sustainability; Copenhagen (Denmark) for digitization and Linz (Austria) for cultural heritage and creativity. The other six cities, among the ten invited to submit their candidacy (i.e. the ten cities that passed the first selection) before a European jury in Brussels, are 18

Brussels (Belgium), Nantes (France), Palma de Mallorca and Valencia (Spain), Poznań (Poland), Tallinn (Estonia). Thirty-eight cities, belonging to nineteen EU states, have sent the candidacy. Gothenburg (Sweden) and Málaga (Spain) have been selected as the winners of the 2020 European Capital of Smart Tourism competition. In the overall assessment that earned it the ECOST Award, Gothenburg stood out particularly in the digitization of city services. They include current and future improvement solutions for traffic, transport, open data, and sustainability measures. Smart tourism is taking place in this city through the partnership between the various parties involved. The hope is that this model can be implemented in other European tourist destinations. Málaga has been awarded for its great commitment to transform itself into a modern city of intelligent tourism. The coastal city has a strong focus on using new technologies to enhance the visitor experience and increase the innovative capacity of local businesses. The widespread notoriety of Málaga will be useful in spreading a new model of intelligent and sustainable tourism.

In addition, four cities received 2020 European Smart Tourism Awards for their outstanding achievements in one of the categories of the competition: Breda (Netherlands) for Accessibility, Gothenburg (Sweden) for Sustainability, Ljubljana (Slovenia) for Digitalisation and Karlsruhe (Germany) Cultural heritage and Creativity. The following cities were also among the shortlisted finalists competing for the European Capital of Smart Tourism 2020 title: Bratislava (Slovakia), Bremerhaven (Germany), Nice (France), Ravenna and Torino (Italy). These four cities were also recognised with 2020 Awards for their outstanding achievements in the initiative's four categories. Theyreceived the highest individual category scores of all 35 applicant cities, during a pre-selection phase carried out by an independent panel of experts.

#### 4. THE POTENTIAL OF ITALIAN CITIES

As mentioned above, the main requirement for candidacy for the European City of Intelligent Tourism is the demographic size of at least 100,000 inhabitants, in addition to the four pillars of the initiative which are accessibility, sustainability, digitization, attention and creativity. towards cultural heritage. From the analysis carried out considering the demographic factor in the first instance, it emerges that only 46 municipalities out of 7,954 total (ISTAT 2020 data), have a population such as to be able to present a possible candidacy for 2020 (Table 1).

	Municipality	Population	Area km²	Density of inhabitants / km <sup>2</sup>	Rank in ICityRate 2019
1.	Roma	2.873.494	1.287,36	2.232	15°
2.	Milano	1.351.562	181,67	7.440	1°
3.	Napoli	970.185	119,02	8.151	73°
4.	Torino	886.837	130,01	6.821	5°
5.	Palermo	673.735	160,59	4.195	77°
6.	Genova	583.601	240,29	2.429	32°
7.	Bologna	388.367	140,86	2.757	3°
8.	Firenze	382.258	102,32	3.736	2°
9.	Bari	324.198	117,39	2.762	62°
10.	Catania	313.396	182,90	1.713	85°
11.	Venezia	261.905	415,90	630	7°
12.	Verona	257.353	198,92	1.294	16°
13.	Messina	236.962	213,75	1.109	92°
14.	Padova	209.829	93,03	2.256	13°
15.	Trieste	204.234	85,11	2.400	24°
16.	Taranto	199.561	249,86	799	94°
17.	Brescia	196.670	90,34	2.177	11°
18.	Parma	194.417	260,60	746	8°
19.	Prato	192.469	97,35	1.977	31°
20.	Modena	184.727	183,19	1.008	9°
21.	Reggio Calabria	182.551	239,04	764	99°
22.	Reggio Emilia	171.491	230,66	743	10°
23.	Perugia	166.676	449,51	371	40°

**Table 1**. Italian municipalities with 100,000 inhabitants

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24.	Ravenna	159.057	653,82	243	18°
25.	Livorno	158.916	104,50	1.521	51°
26.	Cagliari	154.083	85,01	1.812	37°
27.	Foggia	151.726	509,26	298	101°
28.	Rimini	148.908	135,71	1.097	20°
29.	Salerno	134.850	59,85	2.253	82°
30.	Ferrara	132.009	405,16	326	28°
31.	Sassari	127.533	547,04	233	78°
32.	Latina	126.151	277,62	454	72°
33.	Giugliano in Campania (NA)	123.839	94,62	1.309	
34.	Monza	122.955	33,09	3.716	34°
35.	Siracusa	122.031	207,78	587	84°
36.	Pescara	120.420	34,36	3.504	61°
37.	Bergamo	120.287	40,16	2.995	4°
38.	Forlì	117.946	228,20	517	22°
39.	Trento	117.417	157,88	744	6°
40.	Vicenza	112.198	80,57	1.393	29°
41.	Terni	111.455	212,43	525	54°
42.	Bolzano	106.951	52,29	2.045	26°
43.	Novara	104.284	103,05	1.012	36°
44.	Piacenza	102.355	118,24	866	23°
45.	Ancona	100.696	124,84	807	38°
46.	Andria	100.331	402,89	249	96°

Source: www.tuttitalia.it [24]

According to the "ICityRate 2019" [25] which annually draws up the ranking of smart Italian cities, or rather "closer to the needs of citizens, more inclusive, more livable, more capable of promoting development by adapting to changes" (p. 2), the top five smart cities in Italy are ranked in order of points: Milano, Firenze, Bologna, Bergamo and Torino. Milano is confirmed as the most advanced Italian city with respect to the use of urban intelligence tools to promote and manage development in sustainable ways. Firenze and Bologna follow it, which are detached from all other urban realities, increasingly assuming the value of reference models.

The overall score of Milan is the transversal result of all the sustainability indicators; that of Florence, on the other hand, depends on its consolidated role as a tourist city, which in addition to the usual touristcultural attractions has achieved a profound digital transformation and sustainable mobility. The Bologna score, then, comes from its primacy in the field of governance/civil participation and in that of digital transformation, education, research and innovation. Bergamo and Torino, although of quite different demographic sizes, have worked hard in recent years to implement intelligent solutions. The ICity Rank is the ranking of Italian cities, drawn up every year by FPA, which measures the dimensions of the sustainable development of a smart city. The index and the ranking of the ICR are built starting from 6 indices (and relative rankings) dedicated to the 6 dimensions in which urban quality can be expressed: economic solidity, sustainable mobility, environmental protection, social quality, governance capacity and digital transformation. The 6 indices are, in turn, elaborated from over 100 indicators (which use more than 250 variables) taken from qualified sources or from specific surveys. The sector indices are then transformed and aggregated into a single summary value that allows the calculation of a final index.

Among the indicators there is tourist and cultural attractiveness (Table 2). The tourist and cultural attraction indicator places Firenze in first place: followed by Bologna and Milano. The tourist and cultural attractiveness index is based on ten indicators (four municipal and six provincial) which also consider activities indirectly linked to tourism (Figure 2). The score of Firenze and, therefore, its position at the top, is the result of sectoral indicators relating to the attractiveness and density of cultural heritage (more than 20 properties subject to restrictions per sq km). While the third place in Bologna is the result of a maximum score in the indicators of cultural employment and entrepreneurship.

Which, then, are the Italian cities that could be candidates for European Capitals of Intelligent Tourism? Starting from a further consideration that smart cities or intelligent cities are those centers capable of developing innovation processes using digital technologies in a widespread manner in order to favor businesses, improve the quality of life of citizens and pursue economic sustainability objectives. and environmental and by comparing the information referred to above, it is clear that based on the demographic criterion and the other four requirements envisaged by the European ECoST initiative, only



fifteen cities would be eligible (Roma, Milano, Torino, Genova, Bologna, Firenze, Venezia, Verona, Padova, Parma, Modena, Reggio Emilia, Bergamo, Trento, Piacenza).

**Figure 2.** The ten indicators of tourist and cultural attractiveness Source: Own elaboration on Data processing https://forumpa.it, 2019 [26]

Among the latter, only Milano, Roma, Torino, Firenze and Bologna could meet the five requirements necessary for candidacy as the European Capital of Intelligent Tourism; the other ten possess satisfactory requirements to apply for the Award in only one of the four categories of the competition. Table 2 below compares the four cities that have already won the European Smart Tourism Award 2019 and 2020, and the others who have won the prize in individual categories. However, this implies visibility on the initiative's website and a promotion of one's image.In the column on the right, the Italian cities that are possible candidates to compete for the next 2021 Award. The candidacy is important not only to spread the knowledge of the city; the crucial aspect would be the conversion of some of them towards sustainable and smart tourism models. In short, an opportunity not to be missed. In this phase, the role of public actors will be increasingly important. They are entrusted with the role of decision maker and promoter and also guardian of the heritage of a place. A cultural, natural and social heritage that must be preserved and enhanced according to the modern standards of tourism sustainability [27–30].

2019 WINNING CITIES AND MAIN MOTIVATION	2020 WINNING CITIES AND MAIN MOTIVATION	POTENTIAL ITALIAN CANDIDATES FOR THE 2021 AWARD
Helsinki • Ranked second at the Accessible City Awards in 2015 • 143 measures in place to help Helsinki become carbon neutral by 2035 • An innovative approach to cultural tourism	<ul> <li>Gothenburg</li> <li>The Municipality has made large investments for widespread digitization</li> <li>City authorities, in collaboration with local tourism industry stakeholders, make use of all digital channels to enhance the visitor experience</li> <li>The city was a sustainability pioneer in issuing green bonds and was one of the first places to set consumption-based emission targets</li> </ul>	Milano, Roma, Torino, Firenze, Bologna, Venezia, Bergamo, Padova, Reggio Emilia, Piacenza

Table 2. European Capital of Smart Tourism, winning cities and potential Italian candidates

Antonietta Ivona

Lyon	Málaga	
<ul> <li>Lyon-Saint-Exupery is one of 25 airports in just nine countries to be classed as carbon neutral</li> <li>Sustainable development is one of the city's main priorities</li> <li>The 'Bouchons Lyonnais' quality label guarantees the restaurateurs follow strict traditions, serving local dishes in a convivial environment</li> </ul>	<ul> <li>Sustainability, innovation and culture have been concepts present in the strategic plans of the city for many years</li> <li>The principles of sustainability have been implemented in all urban economic sectors</li> <li>It has successfully transformed itself from a city known for its sunny beaches to a city of art and culture</li> </ul>	Milano, Roma, Torino, Firenze, Bologna, Bergamo, Modena, Reggio Emilia, Parma, Genova
2019 EUROPEAN SMART TOURISM AWARDS IN FOUR CATEGORIES	2020 EUROPEAN SMART TOURISM AWARDS IN FOUR CATEGORIES	
<b>Ljubljana</b> - Sustainability	Gothenburg - Sustainability	Milano, Roma, Torino, Firenze, Bologna, Venezia, Bergamo, Padova, Reggio Emilia, Piacenza
<b>Málaga</b> - Accessibility	Breda - Accessibility	Milano, Roma, Torino, Firenze, Bologna, Venezia, Bergamo, Padova, Reggio Emilia, Piacenza
Copenhagen - Digitization	Ljubljana - Digitization	Milano, Roma, Torino, Firenze, Bologna, Bergamo, Modena, Reggio Emilia, Parma, Genova
<b>Linz</b> - Cultural heritage and creativity	<b>Karlsruhe</b> - Cultural heritage and creativity	Milano, Roma, Torino, Firenze, Bologna, Bergamo, Modena,Reggio Emilia, Parma, Genova

Source: author's elaboration

#### **5. CONCLUSIONS**

Table 1 shows, in summary, the "state of the art" of Italian cities on the theme of the new intelligent tourism and its fields of action. In many cases the potential is already present and therefore it will be necessary to further highlight it or, in other cases, to aim for an application that emphasizes other resources. The case of Linz, in 2019, can help; won its award in the category "Cultural heritage and creativity" also for its membership in the Unesco Creative Cities Network since 2014 and European Capital of Culture in 2009. The Unesco Creative Cities Network includes 9 out of 180 Italian cities overall. They are: Milano (for literature), Roma (for cinema), Torino (for design), Bologna (for music), Parma (for gastronomy), Alba (for gastronomy), Carrara (for crafts and popular art), Fabriano (for crafts and popular art), Pesaro (for music). The first five are among the cities also eligible for the European Smart Tourism award. Certainly, the selections are complex, but from what has been said so far, some Italian cities seem ready to apply. A final consideration concerns the gap between the cities of central-northern Italy and the southern ones; data from the 2019 FPA Report confirm the delay of the latter in addressing the challenges of ICT in general, and in tourism in particular. The competition between tourist desti1nations will increasingly have to base its strategies on the ability to intercept visitors through new experiences also through the use of new technologies available (multimedia, virtual museums, augmented reality, cultural communities on the web) and through a simpler use of the tourist-cultural offer of the city suitable for all people without any distinction. Once again, the possibility of carrying out new projects in the area cannot ignore the dialogue between private parties and institutions.

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### Possible Ways of Renewal in a Touristic Destination: A Case for Integrated Destination Development in Hungary. The Case of Orfű

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**Abstract:** The paper demonstrates the complex issue of the life cycle and renewal of destinations by the example of a destination in Hungary. These days, due to the ever increasing competition among destinations both in domestic and international markets, this is the central issue in the development and management of destinations, especially where recreational and excursionist functions are dominant. The target area chosen can be found in the hinterland of a regional centre, where, in addition to recreational functions, the repositioning efforts of the last ten years led to the more and more important role of sport tourism and supplementary tourism products like ecotourism, heritage tourism and festival tourism. This versatility means another challenge for the actors of the destination, as the main pillars of the renewal of the destination concern all actors in the destination (inhabitants, non-governmental organisations, service providers, and local authority) in some way. During the research thus authors also carried out a questionnaire survey with the local stakeholders (inhabitants, local authority and actors interested in tourism, e.g. holiday home owners, service providers), in addition to the processing of secondary data sources.

Key words: destination management, destination life cycle, renewal, Hungary, Orfű

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#### **1. INTRODUCTION**

The issue of destinations is one of the topics that are in the centre of the international tourism literature. It is a topic analysed from several aspects, including especially marketing communication focusing on image development and positioning [1-5], management aiming at competitiveness [6-9], the validity of the life cycle model [10] and the guarantee of sustainability [11], to mention some of the most frequent issues discussed in the publications. The present paper is an attempt to justify, using a case study from Hungary, the complexity of the renewal/rejuvenation of a destination, in which of course the issues raised previously are also dealt with.

The destination analysed can be found in the southern part of Hungary, in the hinterland of a regional centre, the city of Pécs. It is a touristic destination consisting of several villages, at the northern foot of the Mecsek Mountains. It is hard to fit this destination into the classic life cycle-model [12], as the area that has both recreational and touristic functions has had half a century of turbulent history, with continuous development phases and interruptions and significant impacts by the change of the socio-political regime. The loss of markets after the regime change (a drastic decline in the number of inbound foreign guests), the rapid change of tourism trends (growing popularity of alternative forms of tourism, appearance of new destinations), the availability of development resources (EU supports), a paradigm

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shift in tourism management (the appearance of TDMO-s), the active role of the local authorities are all factors in the touristic processes in Hungary that posed challenges not only for Hungary as a whole but also destinations of various size at local level.

The Orfű destination that has only been able recently to leave behind the phases of stagnation and decline, and renew itself is a best practice example for the renewal of touristic products and the change of image and also for the motivation of the local society (local authority and non-governmental organisations). Our paper is an analysis of this complex issue, in which the issue of the renewal of destinations is discussed, embedded in the framework of the life cycle model.

In their research authors proceeded from the following 4 hypotheses:

- 1) The life cycle of tourism destinations with significant recreational functions may differ from that of destinations with purely tourism function.
- 2) The development of attractions, reception capacities and management structure, if carried out simultaneously, will greatly influence the success and speed of destination renewal.
- 3) In the period of decline decrease in the number of guest nights will be, with a slight delay, followed by the decrease of accommodation capacity.
- 4) Repositioning can only be successful if it is based on realistic and objective assessment of the situation and is focused on the development of such tourism products in which the destination has relative advantage over other destinations.

#### 2. THE THEORETICAL BACKGROUND OF THE RENEWAL/REJUVENATION OF DESTINATIONS

The renewal of destinations is a topical issue of the tourism of the world [13]. The life cycle of touristic destinations [12] differs in many aspects from that of the life cycle curve of the classical, "common" goods, one of the results of which is that it has been relatively easy in the last fifty years for the destinations to reach a development path sustainable in the longer run [14], but the changes of the recent decades, concerning the tourism market itself and also its environment, have raised many times the issue of the importance of the renewal of destinations [15]. In this, sustainability is the foundation of the whole process [16]. The product rejuvenation strategies of organisations [17] (factors causing weakness, external environmental factors, brand name, potential segments, consumer value) are generally valid in the tourism sector as well. Accordingly, during product life cycle management the following strategies can be applied: major modifications of the product, amendment of the image of the product, new distribution channels and new ways of usage. In Butler's model [12] two ways of rejuvenation are mentioned: in the framework of artificial attraction development (like in Atlantic City) or in the form of renewal based on formerly unused, untouched natural environment.

Two basic ways of the renewal of a destination are distinguished by Kovács [18] as well: the application of reconquering and repositioning strategies. In the framework of the reconquering strategy, the already existing resource that has already been used by tourism is renewed and modernised by a major capital investment, whereas in the case of repositioning the destination is renewed by the conscious or spontaneous transformation of the services and attractions. The most expensive way of repositioning is the shift of function which means the involvement of spaces, formerly not used by tourism, in uses for touristic purposes (brownfield investments for tourism purposes, like e.g. the Ruhr area (Germany), or Pécs-Zsolnay Quarter (Hungary).

If we look at the possible ways of the renewal of a destination, in our opinion three major solutions can be drafted, basically starting from the supply side. On the one hand, the attraction can be renewed; so can the related services on the other hand (primarily the reception capacity in the narrower sense); and thirdly, management can be renewed. It is rare that the above typology is implemented in a pure form; it is usually the combination of solutions that is applied. In this paper authors wish to demonstrate this by the example of a Hungarian destination. The selection of the sample area was defined by the fact that it is a tourism destination that appeared on the tourism market in the 1970s, following the East-Central European model of the time for the spatial development of recreational areas [19,20], then, after a rapid progress, the 2000s saw the signs of decline. In the late 2000s, due to several – mainly internal – factors, a new growth track can be seen. Orfű was found a suitable sample area also because the development of the destination takes place by the principle of community-based integrated rural development (CIRD).

## 3. DEVELOPMENT OF THE ORF $\Tupu$ destination from the beginning to date – destination life cycle of orf $\Tupu$

The history of today's destination of Orfű started in the extensive industrialisation and urbanisation phase of the Hungarian socialist era, when planned recreational areas were created all over Hungary to

meet the demand for leisure time activities by the rapidly growing urban population [21]. This is the type to which Orfű belongs. Orfű is a village in the northern foreground of the Mecsek Mountains, part of the recreational area of the city of Pécs. The development of the village into a recreational area started in the 1960s when the county council initiated the developments in the area of Orfű (at that time there were five sovereign villages in the stead of the present Orfű, mostly engaged with agricultural activities). The foundations of the developments were the excellent natural endowments, which was reinforced by the creation of four lakes. Each lake had definite recreation functions ordered to them already in the planning phase (e.g. the Orfű Lake and the Pécs Lake were designed for recreation, the Herman Ottó Lake was built to be a reserve for fish and bird species, whereas the Kovácsszénája Lake had angling functions, only), which has consequences to date and also determines their development paths.

The lakes were built from 1962 to 1970; this was the foundation phase in the life of the destination. This was the time when the infrastructure developments of the settlements took place, as did the establishment of the bases of the tourism attractions.

In the 1970s the subdivision of land plots along the lake shores was done, and the construction of "second homes" [22] started on the shore of the Orfű Lake and the Pécs Lake where social tourism, so typical of the era, started: it was manifested in the form of company/trade union tourism, on the one hand, and as youth tourism, on the other hand (summer camps for children). This was actually a new phase in the destination life cycle: the phase of involvement. The hospitality sector built basically on company holiday houses and private accommodations, however, did not allow reaching significant volume of tourism; that required the appearance of commercial accommodations.

The first step in this direction was the establishment of a camping site with significant capacity (in 1982), the appearance of which on the international market and the inbound tourism activity of Mecsek Tourist (the official tourism authority of Baranya county) led to the restructuring of the composition of the guests. Besides the formerly typical domestic tourists, larger numbers of international guests, primarily from Germany and the Netherlands, arrived. The next phase in the development of the destination was the construction of the spa on the shore of the largest lake, the Pécs Lake (in 1985). The development of the camping site and the spa, in their direct vicinity, had mutually reinforcing impacts and induced a further growth for the village. This decade is definitely the development phase, demonstrated both in the composition of guests (domestic and international ones) and the structure of the accommodations (commercial and private accommodations).

The late 1980s saw the signs of consolidation, which refers to a kind of maturity phase. Although the number of guests and guest nights went on increasing, the enlargement of capacities slowed down. External factors can make this phase extremely short, not followed by the phase of stagnation at a higher level, as suggested by Butler's model.

As an effect of the socio-political regime change and the Balkans War, the number of foreign guests drastically decreased in the first half of the 1990s. In the early 1990s more than 70 thousand guest nights were registered, including 45 thousand guest nights by foreigners, but this figure fell to a third by 1995 and this number did not increase until the early 2000s (Figure 1 and Table 1).



Source: Hungarian Central Statistics Office [23]

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Та	Table 1. The number of guest nights spent at the accommodations of Orfű									
	1975	1980	1985	1990	1995	2000	2005	2010	2015	2018
Commercial accommodations (foreign)	n/a	n/a	n/a	45,411	13,087	11,910	9,336	7,736	5,404	609
Commercial accommodations (domestic)	1,800	10,000	68,000	40,113	36,312	36,862	32,981	55,101	43,534	55,225
Other (until 2009: private) accommodations (foreign)	n/a	n/a	n/a	n/a	n/a	2,072	711	912	3,129	3,116
Other (until 2009: private) accommodations	1,900	2,100	1,800	n/a	n/a	12,362	7,810	2,3098	19,141	21,883

Source: Hungarian Central Statistics Office [23]

This period is definitely the phase of decline. This fact is contradicted by the continuous increase in the number of accommodations in the 1990-2005 period (Figure 2), which was actually not a real increase in the capacities: the reasons for this growth are to be found in the privatisation that started after 1990. The privatised state-owned companies got rid of their social tourism facilities and the private sector had the majority of these establishments re-classified as commercial accommodations. Also, the "whitening" (i.e. legalisation) of the market of private accommodations was the vested interest of the local authority (each Forint collected from the local tourism tax was supplemented by two more Forints by the Hungarian state at that time).



**Figure 2.** The number of beds at commercial and other accommodations (1975-2016) Source: Hungarian Central Statistics Office [23]

After 1995 the decline slowed down, the destination lost much of it attractiveness, the composition of guests changed, with the dominance of domestic guests. This period can be called the phase of stagnation following the decline, stabilising at a lower level. In addition to the obsolete attractions and reception capacity, the lakes themselves that are the foundation of the destination were in need of reconstruction. The bed of the Pécs Lake was dredged in 2006/2007, but after the extremely dry summer of 2007 it took a long time to reach the optimum water level again. The fun spa integrated in the lake could not be opened, either, in 2007, as a mass decay of shellfish occurred and this led to the loss of a large number of guests in the destination [24].

It was evident that the destination was in bad need of a comprehensive renewal strategy, the frameworks of which were set by the carrying capacity of the environment, the local endowments themselves and the natural and cultural values. The focal point of the paper is the survey of the *renewal* strategy that launched Orfű on a new development track in 2008.

If we put the processes described above into Butler's [12] destination life cycle model, we have to face several difficulties. The separation of the respective stages is possible by different indicators, among which the quantification of the indices of demand is extremely hard in a destination with such an excessive

weight of recreational functions. This made authors choose the demand index, as a supplementation, from Johnston's [25] model, which distinguishes destination cycles by the capacity of accommodations. Authors further broke it down into internal structure of accommodation capacity (private and commercial accommodations), as in our opinion this is a good representation for the development history of the destination that has recreational and touristic functions at the same time. The renewal of a destination is closely related to the product and service life cycles, in this respect authors also relied upon Zimmermann's [26] model (product life cycles), as the case study is an excellent illustration for such correlations in the renewal phase (Table 2). In addition to the cited life cycle models authors also used primary researches for the survey of the renewal phase.

Besides Orfű with its lakes, the destination is made by three more settlements (Abaliget, Husztót and Kovácsszénája), of which Abaliget possesses touristic functions from before the development of the destination, but its situation in the destination is ambiguous now. The use of the stalactite cave of Abaliget for curative purposes had started and gained a nation-wide recognition before the development of Orfű, but the development of Abaliget was stuck in the 1990s, and the touristic use of the attractions is far less intensive than in Orfű. Accordingly, now Orfű is the engine of the development and renewal of the destination, with the other three settlements playing auxiliary role, only.

	1962-1970	1970-1982	1982-1990	1990-1995	1995-2007	2008-2016
Phase	Exploration	Involvement	Development/ Maturity	Decline	Stagnation	Rejuvenation/ Renewal
Guests	A low number of domestic guests	Domestic	Domestic/ international (especially German and Dutch)	Striking decline in the number of international guests	Domestic	Domestic
Product development	Infrastructure developments and construction of the lakes, foundation of the recreational functions	Subdivision of land plots – creation of "second homes"	Beach development	-	2006-2007: dredging of the lake bed	2008: Fishing on Orfú (alternative music festival) 2010: EFOTT (University and College Students Festival) 2010: opening of the Aquapark 2010: construction of the Pécs-Orfú cycling path From 2010 on: construction of alleys and study paths in Orfú, signposting of the paths and the sights of interest 2016: Bear Garlic House – Ecotouristic Visitor Centre 2016: development of the mills 2016: EDEN (European Destination of Excellence) award
Product/ attraction	-	Recreation built on the natural environment and the lakes Social tourism Youth tourism	Social tourism Youth tourism Waterside tourism	Waterside tourism Recreation	Waterside tourism Heritage tourism Ecotourism Recreation	Intensifying forms of product development: Festival tourism Further strengthening of sport tourism (sport events of national and international relevance) Heritage tourism Gastronomy/Herita ge-Gastronomy, Eco-Gastronomy

**Table 2**. Life cycles of the destination of Orfű

Reception capacity	-	Subdivision of land plots – low capacity	Creation of the first larger capacity commercial accommodation → camping site - significant enlargement of capacities Company holiday homes Children's camps	Privatisation – of the company holiday establishmen ts Private accommodat ions, smaller boarding houses, camping sites	Holiday homes, camping sites Privatisation – of the company holiday establishments Boarding houses – development of higher quality accommodatio ns	Holiday homes, camping sites Boarding houses – development of higher quality accommodations
Management	-	_	-	_	-	2008 - Tourism Association 2010 - TDM organisation → creation of image → repositioning - "Re-colour your life" Successful TDM cooperations - an activity recognised by the inhabitants and the municipality New TDM tender

Source: own processing

#### 4. THE ROLE OF THE MANAGEMENT IN THE RENEWAL OF THE DESTINATION

Tourism management offers intervention possibilities from other aspects during the renewal of destinations, as it is built primarily on existing resources, and it can also encourage, in line with the preliminary set scenario and objectives, the developments and improvements of the tourism attractions and service providers operating in the destination [27]. Accordingly, one of the aims of the different management models is to extend the life cycle of the respective destinations, and to promote rejuvenation phase in different ways of networking [28,29].

During destination management the goal is to create products and full product packages matching the profile of the area, in order to make sure tourists have many experiences as possible, by the broad involvement of stakeholders from the supply side [30-34]. Of course this does not simply mean the provision of amenity functions, only, as successful operation improves the popularity and recognition of the area, contributes to the increase of tourism revenues and the rise in the indices used for measuring the performance of tourism (e.g. number of guests, number of guest nights, and duration of stay).

The model of tourism destination management organisations (TDMO-s) has been used in Hungary for more than 10 years [33,35] as it was the National Tourism Development Strategy (NTDS) published in 2005 that first defined and expressed the need for the reform of the management of tourism. Taking Western, mostly Austrian and German examples and literature into consideration [31,32,36,37] the creation of the system was started, with the following basic principles: bottom-up approach, partnership and cooperation, professionalism and (joint) financing [33]. These principles were basically new in the management of tourism in Hungary, as opposed to the former control system lacking cooperation and long-term planning [30]. Evidently, the building out of the system was not free from initial problems, but now there are a total of 86 destinations operating in the framework of the TDM system in Hungary [38]. The operation of the overwhelming majority of the organisations is financed from project funding: the establishment and maintenance of the organisations was formerly financed by the Regional Operational Programmes and the resources of the so-called New Széchenyi Plan, in 2016 from the resources of the Economic Development and Innovation Operational Programme. The dependence on project funding and the rigid tendering system, however, is a challenge in many respects for the TDM organisations [34]. Although the latest TDM tender preferred major destinations with higher numbers of guest nights, we can see some success stories also in smaller destinations [39,40], like in Orfű for example [41,42]. The members of the Orfű Tourism Association started collaboration for the development of local tourism in 2008.

In Hungary there is no legally regulated background for the operation of the TDM organisations, and so a major part of the topical tasks are defined by the conditions in the current calls for tenders [34].

In order to establish a successful operation, each newly starting TDM organisation had to create and approve three vital strategies and carry out their activities in accordance with these.

As a result of the "foundation" phase, the "Competitiveness and positioning strategy" was made, with the aim of making a logical inventory of the resources, working out tourism development concepts built on this, and positioning the respective destination on the market of tourism (depending on the size of the destination both on the domestic and international market). This requires the combined and carefully selected application of primary methods and secondary sources, as this founding phase is the basis of the long-term planning of a destination. It is crucial then that a rational and realistic analysis of the existing situation is made and the destination positions itself correctly, as it happened in the case of Orfű (Figure 4).



Figure 4. Founding phase of the TDM activity Source: own processing

Operational activity is built on this, during which the respective actors must jointly define the future scenario of the destination, the objectives, and the strategic milestones and projects necessary to achieve these. This often coincides – like in the case of Orfű – with the appointment of new directions for product development, and re-positioning. One of the results of this process is the "Network development and partnership action plan" that envisages the practical implementation of the principle of "coopetition", and also contains ideas about the enlargement of the membership, the involvement of the major tourism service providers into the activity of the TDM organisation. In Orfű it works so well that is has become almost natural by now for any new tourism attraction and service established in the village to turn immediately to the TDM organisation, with the intention of joining.

The writing of the "Service development plan" of the TDM organisations was necessary for the foundation of the long-term financial sustainability. This strategic document had to feature the possible service concepts that the management of the TDM organisation is able to offer, partly to assist the members and partly for the revenues necessary for the maintenance of the organisation, and also for the realisation of the goals defined by the TDM organisation and the touristic actors.

The planning phase is followed by implementation, i.e. the renewed activity, which in the case of Orfű is product development, the introduction of new products (ecotourism and heritage tourism), joined by an intensive marketing activity. We must not forget the importance of monitoring, however, as following up the realisation of the goals set and the mapping of their success is important not only for today's work but also for planning in the future. During the monitoring we find whether the objectives defined have been adequately defined, the applied tools and methods have been successful, and whether the destination has actually reached the result and position on the tourism market that was required by the future scenario created in the early planning phase (Figure 5).

The information about the activity of the TDM organisation operating in Orfű was collected by questioning the service providers and the operators of attractions, who were asked about the major issues concerning the planning of the destination. It is of vital importance for the repositioning of the destination whether the management correctly defined the key competence of the area and the tourism product development efforts are built on realistically defined resources and strengths. It was clearly reinforced in the case of Orfű that the service providers and the TDM organisation have the same opinion about the

(potential) endowments of the village, the strengths that can serve as the basis of the development of tourism and the motivations of the demand built on these strengths. The findings also reinforced that the TDM organisation chose a right direction in repositioning when in their activity they emphasised bathing and other recreational possibilities offered by the lakes; family holidays; ecotourism; sport tourism and the diverse range of events in Orfű.



The role of local authorities can be vital in some destinations [43], because even if the endowments, the attractions and the reception capacity of a destination are given, a successful market performance requires supporting attitude of the municipal authority, and the creation of good relationship between the authority and the TDM organisation and also among the tourism service providers. It is clear in Orfű that the tourism friendly attitude of the municipal authority is one of the factors of the success of the village. Respondents of the questionnaire survey designed for service providers had a very good opinion about the activity of the municipal authority (an average score of 4.32), which is an evident promotion for the management activity of tourism in the destination and the success of the sector. Of all respondents, 53.5% gave a score five to this question, on a range from one to five (where one meant the lowest level of satisfaction and five was excellent performance).

#### **5. RESEARCH METHODOLOGY**

The methodological basis of the research is the application of primary methods, in addition to the processing of secondary information. The primary research methodology of the survey is built on three questionnaire surveys: the survey of the local inhabitants and the holiday home owners, and of the service providers. The aim of the questionnaire survey in all three cases was the examination of the main processes of tourism (Table 3).

Table 3. Features of the questionnaire surveys							
	Statistical population	Size of sample					
survey of inhabitants	1,000 persons	120 persons					
survey of service providers	65 service providers	65 service providers					
survey of holiday home owners	1,600	156 holiday home owners					
Source: own processing							

**...** 

Source: own processing

The statistical population of the questionnaire survey of local inhabitants was the population registered in Orfű as permanent residents: their number is almost 1,000. The size of the sample was 120 people. The different parts of the village have very much different intensities of tourism, authors found it important to consider this fact in the survey to make sure it is representative, and so had questionnaires filled out in each part of the settlement, in proportion with the number of population in the respective village parts. As regards the questionnaire survey of the service providers, totality was targeted, due to the limited size of the sample. During the questionnaire survey made with the holiday home owners, the target value was 5%. Also in this case, each part of the village was included in the survey.

During the three surveys, the questionnaires were adapted to the characteristic features of the respective segments. Several questions were featured in all three questionnaires, and so authors got some answers directly comparable with each other in some issues.

#### **6. RESEARCH FINDINGS**

#### 6.1. Attraction-centred renewal

Attraction is a central concept of the touristic supply, also in the centre of creating a destination. It may be a key element of rejuvenating destinations and is given a selected role in the renewal process. Attraction-centred renewal can be adjusted to the former profile but can be basically different from that as well. In Orfű, the renewal was started by the development of attractions harmonising with the former image. The renewal of the destination has three basic messages that also refer to the positioning of the region: "Re-colour your life!", "Great experiences at a small distance" and "Discover it again!". It is clear that all three slogans are concentrated on renewal, or re-exploring the destination (Table 4).

Slogan	Message	Target groups
"D ] 1:6-1"	renewal, diversity,	explorers, re-explorers, activity driven
Re-colour your me:	experiences	travellers
"Creat amorian and at a	experiences, proximity	those seeking experience and active
Great experiences at a		recreation, inhabitants of the
sman distance		neighbouring region
"Euplone it again!"	renewal, experiences	returning guests, frequent visitors,
Explore it again!	-	inhabitants of the neighbourhood

Table 4. Basic message, slogan and target groups in the product strategy of the Orfű destination

Source: own processing, using orfu.hu

These refer to the re-discovery of the area, on the one hand, and address the inhabitants of the nearby settlements – especially the citizens of Pécs –, on the other. In the early 2010s all there messages were used by the management of Orfű, by now only the slogan "Re-colour your life!" has remained, referring to the success of the market repositioning.

The foundation of the destination is the natural environment, as the main profile of the area is attractions and services related to water. The lakes themselves were the basic elements of the recreational space development started in the 1960s, and waters, going through a continuous diversification, were also given a special role in the renewal of the destination. The findings of the questionnaire survey also reveal that all local actors have a consensus about maintaining this development direction. Most of them see the future of the destination in the protected natural values, besides the lakes. Of course this also means limitations, as long-term sustainability requires a special attention paid to the carrying capacity of the area (Figure 3).

Natural attractions – including the lakes – are the foundations of certain products, including active and passive water tourism, and contribute to the exceptional beauty of the landscape. Among the attractions of Orfű it is the beaches that are nature-based attractions for a large number of guests. It is not accidental that among the attraction developments it was investments related to natural values that were given a priority. The basis of the creation of today's destination was the dredging of the bed of the Pécs Lake in 2006, supplemented by further developments (construction of a promenade, study paths and bicycle road). The other major investment was the construction of the Aquapark, as a result of the previous beach development, also co-financed by the European Union. This is actually a smaller Aquapark that fits into the character of the rural landscape, despite its artificial look. Another major development was the construction of the bicycle road between Orfű and Pécs, completed in 2010-2011 with the use of project funding. The Orfű Tourism Association founded in 2008 has been an active participant in attraction development, in addition to organisational development projects, and so they took part in e.g. the implementation of project-funded programmes or other activities (e.g. signposting of attractions, placement of bicycle racks, construction of a playground for adults etc.). Attraction developments have been continuous since the foundation of the Association, in which the resources of the municipal authority and the TDM organisation have been supplemented by project funding and also private capital. This is a clear indication of the fact that the return of the investments is expected within a foreseeable future. The latest project completed is the establishment called Bear Garlic House, designed to demonstrate the natural and cultural values of the area, named after a plant so typical of the Mecsek Mountains and used in many forms in gastronomy. The Bear Garlic House has visitor centre functions as well.

Possible ways of renewal in a touristic destination: a case for integrated destination development in Hungary. The case of Orfű



Figure 3. Long-term factors in the tourism of Orfű

 Natural factors, protected natural values; 2. Cultural values and sights; 3. Supply of sport tourism;
 Lakes, beaches, bathing opportunities; 5. Gastronomic supply; 6. Events; 7. Pleasant climate;
 Reputation of Orfű; 9. Child and family friendly environment; 10. Good value for money Source: own processing, using authors' questionnaire survey findings

Product developments of the recent years have focused on four pillars, each marking a strategic profile and also well supplementing each other: "Green rhythm – Naturally", "For small and big guests", "Magic of days gone by" and "From drop to splash" (Table 5).

<b>Fable 5.</b> Relationships of prome and products in the destination of Orlu		
Profile	Associated tourism product	
Green rhythm – Naturally	ecotourism, hiking, cycling tourism	
For small and big guests	recreation, ecotourism, passive and active water tourism, festival tourism	
Magic of days gone by	heritage tourism, festival tourism	
From drop to splash	active and passive water tourism, angling, ecotourism	
2		

Table 5. Relationships of profile and products in the destination of Orfű

Source: own processing, using orfu.hu

It is clear that natural endowments enjoy a priority, but values of the past are also present in the supply of the area. These values of the past are not so much the values of static culture (the village has only two objects that are protected monuments), they are much more typically parts of animated culture: traditionalist programmes and the restoration of farming methods and agricultural activities typical of the region. This trend is well supplemented by the use of the bear garlic for the creation of the distinctive image of Orfű. The most renowned and popular attraction of the destination is the popular music festival called Fishing on Orfű, listed by several reviews as one of the best Hungarian popular music festivals. Its impact on the destination is clearly indicated by the number of guest nights, which in the month of the event reaches the number of guest nights registered in the city of Pécs.

A critical factor in the success of product developments is how the local inhabitants judge them, how much they identify with them and acknowledge the respective attractions and events. The findings of the questionnaire survey show that local inhabitants have a positive opinion on the whole about the local attractions, the evaluation of almost all locations were given mark four on a scale up to five. The attractions of Orfű that local inhabitants visit in the largest numbers are the Kemencés Udvar ("Courtyard of Ovens"), Mill Museum and Bear Garlic Festival. The inhabitants are most satisfied with the Fishing on Orfű festival, the Mill Museum and Bear Garlic Festival.

#### 6.2. Reception capacity and willingness

Developments related to the reception capacity are just as important in the rejuvenation of destinations as renewal efforts related to attractions. In reception capacity, the accommodation sector is a key area, often suitable of taking over the functions of the other actors in the tourism market. When talking

about reception capacity, both the qualitative and quantitative aspects must be taken into consideration. The renewal of declining destinations is usually linked to quality developments, as the former phase, maturity already required higher accommodation capacities in quantitative sense. After the qualitative improvement of the reception capacity, consumer demands can be met at higher level, which may induce the appearance of new clientele and the realisation of higher revenues from tourism at the service providers, and thereby at the municipal self-government (through tourism tax, local business tax etc.).

The rapid growth in the number of accommodations in Orfű started with the construction of second homes in the 1970s. In this decade, the 1970s there were only 105 real estates "inhabited only in the summer", in addition to the 282 homes that were permanently inhabited. New settlement parts were born in Orfű, with clear recreational and holiday-making profile. According to data from 2001, in addition to the 241 permanent homes there were 1,156 holiday homes in Orfű (the same figures in late 2020 are 448 and 1,200, respectively). Besides holiday homes it is commercial accommodations that make the basis of accommodation capacity. Commercial accommodations have been continuously established since the 1970s.

The highest level of the hierarchy of accommodations, hotels cannot be found as yet either in Orfű or in the neighbouring settlements. Typical accommodations include, in addition to boarding houses, a camping site, while the most frequent form of private accommodations are paying guest service facilities. We can see thus a dominance of smaller units, which, although may better match the image of a rural destination, do not favour organised inbound tourism.

The supply of accommodations in Orfű, in the opinion of the local inhabitants, is excellent (by 59.84% or respondents) or good (32.79%), the same proportions expressed by holiday home owners are 35% and 35%, respectively. A much larger standard deviation can be seen, however, if the weight of the lack of adequate supply of accommodations is taken into consideration among the potential future threats. Of all local residents questioned, 18.03% said it was a great danger, by another 34.43% it was a threat for the future of the destination. Local stakeholders agree that in the middle run it is a must to create the supply of quality accommodations that matches the endowments of the destination, in order to offer a larger capacity of accommodations for the guests.

In the reception capacity, catering units also play an important role. In Orfű the catering and commercial sector plays more important role, as few of the available accommodations offer full board, in fact, a large proportion of them offer no catering at all and so guests have to provide for their own meals. The problem is even worse if we also take one-day visitors into consideration. Orfű has 4 restaurants and 6 buffets, which, with only one exception, are open in the tourism season, only: from early May to late October. The provision of the village with trading facilities is even worse: there are only three shops in Orfű. The situation is perfectly reflected by the level of satisfaction of actors with catering and commercial facilities; also, the need and necessity for a change can already be felt at all levels. There are several efforts and initiatives for the creation of quality catering, such as the opening of restaurants representing quality gastronomy and local products.

In the renewal of the destination the local actors, as human resources of tourism, are given a key role as soft factors. In addition to the preparedness of the service providers directly involved in tourism, the attitude of the municipality and the local inhabitants, and their cooperation is a prerequisite in the authors' opinion for the success of the destination as a whole, and also for its renewal capacity. In the sample area the surveys highlighted that on the whole it is the inhabitants who evaluate most positively the attitude of the local actors. The dedication of the municipal authority is most positively judged by the service providers, which is a clear indication of the role of the local authority in the developments of tourism. The lowest figures were attributed to the preparedness of the service providers (3.47). The survey of the service providers found that the services exist but their quality must be improved in the future (Table 6).

	Hospitality of the local inhabitants	Dedication of the local authority	Preparedness of the local service providers
Inhabitants	4.32	4.26	4.15
Holiday home owners	3.95	3.55	3.92
Service providers	3.77	4.32	3.47

Table	6. Attituc	te of loca	al actors	to t	ourisn

Source: own processing, using authors' questionnaire survey findings

In the reception capacity of Orfű, non-governmental initiatives are important among the local actors. There are more than 20 non-governmental organisations in Orfű that are active in the life of the destination.

#### 7. CONCLUSIONS

Using a diverse approach supplementing the classic destination life cycle-model [12] authors analysed a destination whose guests arrive both for recreational and tourism purposes. The research focusing on the renewal phase with its differentiated methodology and the breakdown of the renewal to its basic elements contributed to the examination of this mixed profile destination in its complexity.

The conclusions regarding the 4 hypotheses formulated at the beginning of the research are as follows:

- 1) Hypothesis 1, according to which the life cycle of tourism destinations with significant recreational functions may differ from that of destinations with purely tourism function has been confirmed and presented in detail in the Chapter 3 of the study.
- 2) Hypothesis 2, according to which the development of attractions, reception capacities and management structure, if carried out simultaneously, will greatly influence the success and speed of destination renewal has been confirmed through the example of Orfű.
- 3) Hypothesis 3, according to which in the period of decline decrease in the number of guest nights will, with a slight delay, be followed by the decrease of accommodation capacity, has not been proven. In the case of Orfű during the prolonged privatisation period after the change of regime decrease in guest nights, the elimination of social tourism and the privatisation of state and public corporation owned holiday accommodations occurred simultaneously, which resulted in a significant increase in commercial accommodation capacities.
- 4) Hypothesis 4 has been proven in the research, which means that repositioning can only be successful if it is based on real and objective assessment of the situation and is focused on the development of tourism products in which the destination has relative advantage over other destinations.

From the *supply* side it is attraction-centred renewal that is in the focus of the process, for which reception capacity is by and large present in a quantitative sense, but as regards its composition and quality indices, it only partially follows tourism developments. The local inhabitants and the non-governmental organisations make a safe background with their activity and positive attitude, both as regards developments and hospitality. The appearance of local tourism management opened a new era in the life of the destination. The activity of the management organisation had an impact on resource acquisition, activation of the local population and service providers, management of the touristic attractions and the initiation of the change of the image.

As an effect of this, the volume of *demand* slowly reached to the statistical indices of the "good old days", after a considerable transition of the composition of guests. The destination that now lives from domestic tourism in the first place has become, in addition to waterside holiday and recreational functions, a Hungarian centre of festival and alternative tourism, but in the process of the image shift it will only be able to keep its positions in the future with an intensive management activity – also, development projects must be kept within the frameworks limited by the sustainability of the natural environment that is the basis of the attractions.

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### **Object Based Image Segmentation Algorithm of SAGA GIS for Detecting Urban Spaces in Yaoundé, Cameroon**

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Abstract: Present study is focused on the satellite image processing by means of SAGA GIS. The objective of the study is assessment and analysis of the core urban areas and its spatial distribution in the limits of the city and suburbs. The study area includes Yaoundé and its surroundings, Republic of Cameroon. The methodology includes Object Based Image Segmentation (OBIS) approach by SAGA GIS. The paper presents a methodologically structured workflow used in SAGA GIS for segmentation of the Sentinel-2A image. The segmentation techniques includes adjusting technical parameters, performing neighborhood approach and post-processing procedures (unsupervised classification, number of clusters). The OBIS model and SAGA GIS were used as main methods and machine learning techniques for image segmentation. Data include Sentinel-2A satellite image with high resolution (10 m). The image was analyzed by two approaches of cell neighborhood analysis: Moore and Neumann. The results showed following numerical parameters of the computed area: the perimeter of 1,060,560 km and an area estimated for the Yaoundé city 191,745,000 km<sup>2</sup>. The Neumann approach demonstrated better results for image clustering. The results presented automatically detected and separated segments of the city areas and other land cover types (savannah, forests, mountains). The spectral reflectance of various land cover types on a satellite image enables to group pixels of the image into classes using segmentation technique which has an important impact on the conceptual methodology of the urban mapping. The results of the image segmentation show the average values of the Neumann approach more correct in urban area than Moore approach. The accuracy assessment demonstrated 74.63% for the core urban area by using the Neumann method. The applicability of SAGA GIS for automated methods of image processing using machine learning algorithm of OBIS is presented and the advantages are discussed. The study demonstrated the effectiveness of the high-resolution Sentinel-2A for socio-economic studies, exemplified by urban mapping where remote sensing data serve as reliable sources of geoinformation. The advantages of the OBIS are discussed with detailed explanation of the SAGA GIS workflow.

Key words: Sentinel-2A, object based image analysis, segmentation, machine learning, SAGA GIS

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#### **1. INTRODUCTION**

The Object Based Image Analysis (OBIA) or Object Based Image Segmentation (OBIS) approaches applied for satellite imagery is an effective tool to analyze contours of the urban districts using objects geometry and spectral brightness of the pixels on an image. This is especially actual in urban mapping where city spaces and suburbs should be separated from other land cover types. An OBIS approach enables to classify image into clusters by grouping pixels of the original image into homogenous, similar regions on a final map. Such a detection of urban spaces on a satellite scene can be performed using the

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machine learning approaches by a variety of existing GIS-embedded segmentation algorithms, reviewed, compared and analyzed in the existing literature [1–4].

The most important feature of OBIA that differs it from the standard image analysis consists in the algorithm approach. While the traditional pixel-based image classification separately groups each pixel into classes, the OBIA automatically groups multiple neighboring pixels into one polygon based on similar spectral characteristics of these pixels, using the machine learning algorithms [5–7]. The applications of the computer techniques in cartography have an indisputable value nowadays, due to the increased speed and precision of cartographic workflow. Machine learning plays a significant role in contemporary cartography – and especially in image analysis. Satellite image analysis have become an increasingly important part of the environmental studies. Image analysis presents new information on the Earth's surface derived from the machine based algorithms of image processing. Examples of the machine learning applications in cartography include background modeling, human tracking and extraction, 3D reconstruction moving target detecting [8], marine geological studies [9–11].

As a result of the application of the machine learning methods, the OBIA has a more meaningful semantics to the human eye, since image is classified into groups of objects, rather than standalone pixels, e.g. it can be 'tree', 'forest', 'agricultural field', 'building', 'car', or 'city', depending on classification scale. The OBIA utilities the phenomena of spectral brightness that differs for pixels on an image representing various land cover types [12–14]. That is, the differentiation of pixels and grouping them into objects is based on the machine-based analysis of their spectral brightness. The OBIA is available in a wide variety of geospatial applications. Among others, these include both socio-economic and physio-geographic studies, for instance, geomorphological mapping [15], detecting road networks [16], agricultural mapping [17], vegetation mapping [18–20], detecting buildings using geometry of roofs and spectral reflectance [21–23], soil studies [24], marine mapping [25], built-up regions [26].

There are many factors that explain the advantages of the machine-learning methods of image segmentation over the human-made classification. These include (but are not limited to) the significantly increased speed and precision of data processing. Thus, the traditional classification can produce errors in the most complex landscape patterns due to the wrong recognition of pixels on an image and result in misclassification. The approaches of geodata processing and spatial analysis are diverse and may include laser scanning point clouds using panoramic images [27], neural networks, regression and relevance analysis, cluster analysis [28–30], data analysis and modelling in geological studies [31–33] and scripting methods in cartography [34] as well as ArcGIS and GRASS GIS based thematic mapping, spatial analysis and overlay [35–40], to mention a few.

Comparing to these studies, the use of OBIA method of detecting clusters presents prospects in urban studies, given rapid development of the machine learning algorithms than traditional semiautomated GIS mapping. Using OBIA presents new horizons which open up due to the capabilities of the machine learning in cartography. An automated OBIA method that selects information from the satellite images forms the applications that enable to solve the tasks of monitoring in urban studies and agriculture, in water resource management and forestry. This study aimed to detect urban space of the Yaoundé, Cameroon, and evaluate two neighborhood grouping methods (Moore and Neumann) for the Sentinel-2A high-resolution (10 m) multispectral image based on the OBIS approach in SAGA GIS.

#### 2. STUDY AREA

The study area is located in Cameroon, Yaoundé (Figure 1), in western coasts of central Africa with spatial extent 3°47'N and 3°56' N and 11°10'E and 11°45'E. The precise coordinates of the study area in a Sentinel-2A image include the following extent: 10°8'E, 3°5N'–11°8'E, 4°5N' (Figure 2). It covers an area of 100 km<sup>2</sup> according to the technical specification of the Sentinel-2A tiles in UTM/WGS84 projection. The study area is rectangular, with a visible flow of the Sanaga River. For the purpose of urban segmentation, this research cropped a rectangle that contains the entire extent of the Yaoundé city and its suburbs (Figure 2). The regions containing other land cover types, such as savannah, tropical rainforests, deserts and mountains, were excluded to focus on the city space of Yaoundé and suburbs (Figure 2).



Cartography: Generic Mapping Tools (GMT) Source: author

The exploitation of natural resources in a context of poor governance quality creates conditions for rapid urbanization and urban concentration [41]. As a result, Cameroon nowadays faces up serious problems including economic growth, urbanization, and soil degradation [42]. The environmental degradation can be illustrated by the deforestation in Cameroon with forests reduced to 1/3 after 90 years of land cultivation. For instance, agricultural activities resulted in the reduction of the area of Zamai forest reserve from ca. 50% in 1970 to ca. 30% in 2016 [43].

In recent years, Yaoundé is experiencing rapid urbanization [44]. The urbanization process is as essential as its economical and ecological outcomes. On the one hand, it facilitates dwellers to achieve the intended career plans, gives an access to education and medicine, and provides living conditions. On the other hand, it increases the burden on the landscape environment. The population of Yaoundé grew from 318,700 inhabitants in 1976 to 2.8 million by 2020. The population doubled after every decade since the 1970s: grew by 90% in the 1970s, doubled in the 1980s, and grew by 91% in the 1990s [45]. These processes are especially intensive in the peripheral areas, such as Mbalngong and Nkozoa, with high urbanization rates. The Bamenda city faced rapid and unplanned urbanization that happened since 80s.

The growth of population necessarily involved urbanization processes in the cities of Cameroon and its capital Yaoundé. Some cities in Cameroon change in functionality from the traditional agriculture

villages to the complex heterogeneous cities [46]. The processes of urbanization in turn involve changes in ecosystem service provisioning areas related to the current land tenure system which are reflected in the land management of Yaoundé and urban spaces [47]. For instance, a gradual increase in population is often accompanied by the construction of the unplanned buildings, which resulted in changed geometric contours of the city.



Figure 2. Sentinel-2A image Map of Yaoundé in false colour composite of Sentinel-2A: Red as 8, Green as 4, Blue as 3. North: river Sanaga. Mapping: SAGA GIS. (a); Enlarged fragment Yaoundé city and suburbs: clipped image in false colour composite of Sentinel-2A: Red 8, Green 4, Blue 3. Mapping: SAGA GIS (b) Source: author

The unplanned urban expansion necessarily resulted in land surface change. The increased urban spaces in various city districts including suburbs can influence urban development of the country in general and may have environmental consequences in particular, because new urban spaces are modified in their unit boundaries and structure. Besides, the location of the suburban often becomes a part of the city, transforming from the fenced farms or unfenced agro-pastoral small-holdings with crop cultivation covered by the semi-natural savanna vegetation, used as livestock or wildlife ranches to the urban cities [48]. Besides socio-economical dynamics, other concerns of Cameroon include environmental industrial and market waste management, pollution and poor town planning [49], as well as the progressive deterioration in the environmental quality. Changes in vegetation cover are caused by farming, grazing land and de-bushing. For additional info and a comprehensive overview of the current knowledge on urban planning challenges and prospects in Cameroon, the reader is referred to the literature [50–55].

#### **3. METHODS AND DATA**

#### 3.1. Data and Software

The changed city dimensions and increased urban spaces can be visualized and calculated through the OBIS image segmentation method amongst others. The Sentinel-2A satellite image was processed by SAGA GIS, for a case study area of Cameroon. The selected region has contrasting land cover types including urban spaces, bare soils and various types of vegetation (grasslands, savannah, tropical rainforests). The visualization of study area via the Sentinel-2A displays a shift in the urban spaces. Due to the open source availability and regular uploads to the GloVis repository, the Sentinel-2A imagery can easily be received by the end-users. Thus, a period of receiving imagery by a Sentinel-2A mission enables frequent surveys repeating every 5 days at the equator and occurring every 2-3 days at mid-latitudes.

Another important parameter of the Sentinel-2A image is its high spatial resolution, which was considered while selecting the data for this research. The 10-m resolution of the Sentinel-2A presents an

excellent source of data both for environmental and urban studies. As a general rule, the finer resolution of the input data (e.g. a 10-m Sentinel-2A satellite image), the more accurate is the resulting OBIA segmentation. Conversely, a coarser resolution of the input data (e.g., the 30-m Landsat TM satellite image) may show the effect of the over-generalization. For instance, using coarse resolution imagery might result in a simplified boundary of the urban districts and buildings, as well as merging of the small patches with the smallest pixel area into one class. Therefore, the value of the resolution of the input data increases the overall precision of the map. The original Sentinel-2A image has the selected coordinate extent ( $10^{\circ}8'E$ ,  $3^{\circ}5N' - 11^{\circ}8'E$ ,  $4^{\circ}5N'$ ) taken in 2020 (Figure 2).

The image has the 13 spectral bands with various spatial resolution and no cloudiness (0%). It was sensed on January 27 2020 at 10:45 by Sentinel-2A satellite, sensing orbit number 136, WGS-84 coordinate system in European Petroleum Survey Group (EPSG) Geodetic Parameter Dataset. The downloaded Sentinel image bands were loaded into GIS, opened in a UTM coordinate Grid System and displayed as colour composites RGB. The Sentinel-2A image processing and segmentation were completed using the OBIS algorithm in the open source GIS software SAGA GIS [56].

From the total 13 bands of Sentinel-2, only bands 2,3,4,8 were used for the OBIS classification. These bands were selected due to the spectral properties of the Sentinel bands and spatial resolutions. The Band 1 contains information on coastal aerosol which was not necessary for this study. The bands 2, 3 and 4 were selected, since they contain spectral information for Red (Band 2), Green (Band 3) and Blue (Band 4). The bands 5 to 7 contain red edge and were not appropriate, while the Band 8 has an infra-red, which enables to detect vegetation. The Band 9 is useful for detecting water vapor, Bands 10 to 12 contain Short-wave infrared data (SWIR), which were not necessary for this study. The Band 8 was displayed as red with composition bands 4 for Green and 3 for Blue. The image was then prepared for segmentation by clipping necessary area from the whole image using the following SAGA GIS path: 'Gris> Grid System > Clip Grids interactive' and then applying a 'Clip to Extent' menu for the selected square capturing the Yaoundé city and its suburbs (Figure 2, a). A new grid with a smaller extent (11°32′E, 3°67N′ – 11°72′E, 4°1N′) was used for further image processing. This square area now corresponds to the city of Yaoundé, the capital of Cameroon, and its suburban surroundings (Figure 2, b).

#### 3.2. Workflow

The algorithm of OBIS module in SAGA GIS utilizes the chain of tool functions that allow several modules to be linked together into one process of the automatic image segmentation. The theoretical methodology of the segmentation algorithm of OBIA/OBIS implemented in eCognition software is described in a variety of works, [57–60] while applications of SAGA GIS are mainly focused on spatial analysis, vegetation mapping, terrain modelling and geomorphometric analysis [61–63]. In this study, a workflow included a chain of seven techniques in the methodology of OBIS image processing in SAGA GIS:

- 1) Loading the Sentinel-2A original image in false colour composite, bands 8-4-3 (Figure 2);
- 2) Clipping the study area using a mask for the city space from the original image (Figure 2);
- 3) Visualizing the clipped study area in false colour composites;
- 4) Detecting city area using OBIS approach by von Neumann and Moore approaches;
- 5) Performing automated image classification with 12 classes as a subtask (Figure 3);

6) Separating the city from the other land cover classes (forests, grasslands, savannah, water, roads) and deleting the unused contours (Figure 4);

- 7) Merging the machine-selected contours of the city into the one contour (Figure 5, a);
- 8) Computing the square and perimeter of the area (Figure 5, b)

The cropped part of the original Sentinel-2 image was processed using the segmentation clustering techniques by the following path in SAGA GIS menu: Geoprosessing> Imagery> Segmentation> Object Based Image Segmentation.

Using the pointer tool a box was dragged across the polygons of the Yaoundé city area. This automatically selected all polygons of the same class of the city and suburbs which resulted in all the selected squares and districts of the city. Afterwards, the selection was inverted and all other areas of 'not-city': forests, wetlands, savannah, mountains, etc. (Figure 4, b). This result in all the not-city area polygons was first selected and then deleted, to leave only the polygons of the city of Yaounde. by 'clear Selection' in the SAGA GIS menu. This resulted in only the city area polygons remaining were visualized to enable calculation (Figure 5). After the processing of the image, a post-processed unsupervised classification of

the image was applied with identified 20 clusters. The square area and perimeter of the Yaoundé city and its suburbs have been calculated using the SAGA GIS path: Shapes> Polygons> Polygon Properties.

#### 3.3. Algorithms

The technical details regarding the segmentation algorithm implemented in SAGA GIS are well described with reviewed OBIA algorithms, their strengths and weaknesses [64]. The workflow of SAGA GIS methodology of OBIS was applied according to the SAGA GIS documentation [65]. The two methods used by SAGA GIS analyse cells on an image using an approach similar to the lattice network. The two algorithm approaches tested in this study include von Neumann approach with Neighbourhood 4 and Moore approach with Neighbourhood 8. The algorithms determine the most effective object features in OBIA that ensure high separability among landscape features [66]. The Moore neighbourhood is one of these methods, based on a 2D square lattice with a central cell and the eight cells around it. Another method is the contrasting von Neumann method, which uses a central cell and four adjacent cells.

Besides, it allows four more cells as 'neighbours of neighbours' as extended neighbourhood of cells. Using approach of neighbourhood analysis approved for pixels on an image, the machine can easily group pixels based on the similarity of the spectral brightness of their neighbours (that is, other pixels surrounding the target one). Both methods of neighbourhood analysis are a well-known technique used for analysis of the pixels in cell automata of the object based image segmentation [67,68]. The OBIS merging technique detects groups of pixels from the pool of pixels on an image in an iterative process. In this case, the bandwidth for seed generation was selected as 10 for the both approaches. The segmented outputs are controlled by a post-processing with includes an unsupervised classification of the output image, performed automatically by the machine. The 12 classes were used with split clusters to complete the procedure. The high-resolution SRTM topographic data was used for mapping study area (Figure 1) to visualize the extent of Cameroon.

The Google Earth imagery was used for detecting urban spaces to assess the quality of the segmentation and filter the natural and urban areas. The open-source availability of the Google Earth imagery was applied for validation of the results with comparative analysis of the Moore and Neumann methods derived from the two approaches of OBIS in SAGA GIS. A confusion matrix [69,70] was computed to present the classification accuracy, a useful technique for the accuracy and validation assessment in remote sensing data analysis [71]. The workflow included the input image (Sentinel-2A) OBIS data, and Google Earth Engine (GEE) classifier (<u>https://earthengine.google.com/</u>) with reference points for testing. The GEE was selected, as it provides a cloud-based opportunity to perform a variety of the advanced geospatial analysis, such as those based on the spectral imagery and object-based methods (<u>https://developers.google.com/earth-engine/guides/image\_objects</u>).

#### 4. RESULTS

The challenging aspects of the machine-learning perspective in cartographic data processing persuaded the approaches in this study to adopt OBIS algorithm for image segmentation in order to better facilitate analysis of the urban growth in the selected study area. This paper dwells into the depth of image segmentation techniques using OBIS algorithm of SAGA GIS to know which technique of neighborhood, the Moore or the von Neumann, can perform better. The Sentinel-2A image was used to extract the region of interest, the city of Yaoundé. The results demonstrated that Neumann technique performs better compared to the Moore approach because the segmentation is being produced in a more generalized approach and the contours of the city quarters are selected more corrected. More precisely, the Neumann algorithm (Figure 3, b), the area of the Yaoundé city has clearer clusters in the segmented image, whereas applying the Moore method (Figure 3, a) has a higher threshold level and the contours are therefore more detailed, which in this regards is noisier.

Besides the visual assessment of the output results, the determination of the quality, the appropriate of the method and its suitability was performed using comparative analysis of the areas detected by the two different methods, in terms of location and extend, with a reference area. For this purpose, a Google Earth map with the boundaries of the urban area of Yaoundé city has been used showing the extent of the urban space on an aerial image. The accuracy assessment was based on the segmentation results (Figure 4 and 5) showing a final output of the Sentinel-2A classified image against the Google Earth aerial image covering the study area after SAGA GIS processing. The Google Earth map

shows the overall contours of the city where the city spaces are clearly visible by the spectral reflectance on the image. The cloud computing platform of the Google Earth Engine enables to run the machine learning algorithms of both image classification and validation by generating the Error Matrix (Accuracy Assessment), classification of the imagery and results assessment (<u>https://developers.google.com/earth-engine/guides/classification</u>). Here the algorithms consisted in three steps: 1) making a Random Forest classifier for training pixels; 2) classifying the input imagery by GEE; 3) getting a confusion matrix representing re-substitution accuracy.



(a) (b) Figure 3. Results of the OBIS, Moore approach (a); Results of the OBIS, Neumann approach (b) Source: author



Figure 4. Selected contours of city and suburbs: lines highlighted blue against the suburb areas as cyan (a); Google Earth Engine cloud based platform aerial image used for verification of the results (b) Source: author

The selected contours of city and suburbs are shown in Figure 4, a: contours highlighted red against other areas as black. To better visualize the remaining area the intermediate stage included selecting the

contours of the city and suburbs, colored as blue vectors, while other areas were deleted (Figure 4, b). The selected segments of the city and suburban polygons now have a new attribute in the polygon table of the area in square meters. The properties of the attributes tool of this table were checked up (Figure 5, a) and the area and perimeter received in  $m^2$  and m, respectively. These included the calculated area of the Yaoundé city with suburb, which is 191,745,000 km<sup>2</sup>, and the perimeter which is 1,060,560 km (Figure 5, b).



**Figure 5.** Merged area of the city (yellow lines) and suburbs (red lines) **(a)**; Computed area of the city (light green lines) and suburbs (bright green lines) **(b)** Source: author

The final results (Figure 4) present the image of the Yaoundé city exemplified with detailed images of the Google Earth at a higher zoom level for a better presentation of the output results. At the next step, once the OBIA image classification results were received, the accuracy assessment was performed using independent validation data by the Google Earth aerial imagery using the Google Earth Engine processing environment (<u>https://earthengine.google.com/</u>). The result indicate the accuracy of the segmentation for both Neumann (74.63%) and Moore (71.47%) both attained over 70% accuracy in both categories (user's and producer's). This study included a comparative analysis of the effect of two methods, the Neumann and the Moore, on OBIS image segmentation in SAGA GIS. The used Sentinel-2A image high-resolution data with selected three bands 8-4-3 from a variety of different combination of the multi-spectral data with 13 bands in the visible, near infrared, and short wave infrared (SWIR) part of the spectrum finally produced a map for a separated urban area of Yaoundé in Cameroon.

This study implemented the experiment on the use of OBIS verified by a Google Earth image. The results of the segmentation were selected for the Moore and Neumann neighborhood approaches, respectively, and analyzed against the Google Earth for validation.

The results demonstrated that all the two methods resulted in moderately to highly accurate urban segmentation maps, with an overall accuracy of 74.63%. Among the two methods, the segmentation based on the Neumann method produced the highest accuracy (74.63%), followed by the Moore approach of the same input Sentinel-2A image (71.47%). The presented results from the classified Sentinel-2A results by OBIS in SAGA GIS and Google Earth. The Neumann and Moore approaches show the correct and misinterpreted results in the respective category of the segmented class.

The SAGA GIS based OBIS module demonstrated to be a useful technique for analysis and interpretation of Sentinel-2A images and can be used on similar imagery. Some flaws include two notes. First, data processing has rather a lower speed, which strongly depends on the size of the image. For instance, segmentation of the whole Sentinel-2A image was also tested but could not be completed due to the too long time needed by the computer memory for the whole image of 100 km<sup>2</sup>. Second, the manual selection of the segments in the process of merging contours into one segment 'city' could not be replaced

by the machine. That is, this part of the process is rather semi-automatic and may be subjective to a certain extent. However, despite these drawbacks, OBIS results in general present object based segmentation of the image and is a step further compared to the pixel-based image classification [72–74]. The algorithm includes the two repeatable approaches that can be chosen: a von Neumann and a Moore neighborhood pixel classification. Comparing the two approaches, the demonstrated method of Neumann works well with Sentinel-2A image having negligible noise in contour generation, while the Moore approach performed noisier.

#### **5. DISCUSSION**

This study adopted an OBIS image segmentation methodology. Image segmentation is an effective approach in remote sensing data processing. It is a specific machine-based computer vision methodology that facilitates the study of the land use types without human-based classification and prior knowledge using the applied theoretical algorithm of image processing. The OBIS is a methodology, in which the cartographer attempts to analyze city contours without the need for the supervised classification.

This study presented a comparison of the two methods in OBIS approach produced by SAGA GIS and remote sensing data such as Sentinel-2A and Google Earth. The OBIS method presented better results in merge of the city districts on the Sentinel-2A image, as their contours have been generalized to a city shape. Whereas both methods were applied and compared, the OBIS technique better performs using local threshold of the Neumann approach. The presented map (Figure 5, a) shows the differences between the areas of the city Yaoundé (yellow contour) read from the Sentinel-2A scene and that of the other land cover types. Figure 5, b, shows the selected and highlighted contours of the city with its suburbs with computed geometry (perimeter and area).

The SAGA GIS image segmentation seeks to characterize contours of urban areas and detect agricultural fields and other objects in a geographical space in a manner in which the pixels would be grouped into clusters based on their properties. The size of the detected objects is related to the spatial resolution of the satellite image and not to the image segmentation algorithm, which is useful for multi-scale segmentation. The research emphasizes that processing of the Sentinel-2A image was only partially adjusted by hand, while the major workflow consists of a machine learning algorithm for automatically detected urban areas based on the geometry and brightness of the image pixels using embedded algorithm in SAGA GIS. Categorizing pixels into clusters, or segments, on an image based on their spectral intensities, enables to yield a 'smart' image showing contours of objects, not the isolated pixels. This methodology of the segmentation is reviewed in the available literature both in theoretical and in practical aspects [75–77].

The comparison of the two approaches, the Moore and Neumann although demonstrated certain differences in the algorithm, but shown no major differences in the layout of the resulting images of the Yaounde city. In general, both methods are acceptable for image segmentation in SAGA GIS. The automatically detected contours of the urban core area of the Yaoundé city extends beyond the whole area including the city and its suburbs and on the margins of surrounding districts, because the geometry of their contours was also detected automatically and not mapped by hand.

The machine learning and programming techniques are progressively used in Earth sciences. Emerging literature also highlights the value of the machine learning in geographic studies where there is either a great deal of automatic data processing or, where the methods of the statistical data analysis are applied [78–82]. In brief, automatization in cartographic studies reduces the computational time of data processing due to the faster machine-based analysis and increases the precision of the final output by reducing misclassification in image segmentation. The OBIS method of SAGA GIS for image segmentation is a promising and faster way to cluster the satellite scene and receive an object-based machine-generated image against the pixel-based clustering. Machine learning methods in cartography, presented in this study, presented the analysis of the two approaches of image segmentation using Neumann and Moore neighborhood on a Sentinel-2A satellite image performed using a SAGA GIS indicated that Object Based Image Analysis is a promising cartographic method of spatial analysis of urban areas.

#### 6. CONCLUSIONS AND RECOMMENDATIONS

Several broad conclusions can be drawn based on the results of the presented machine learning method in cartography. Image segmentation of urban areas against forest is related to the three factors: i) 46

image resolution, ii) scale of the map, iii) research goal and object. Given these details, the theoretical approach of the OBIA algorithm may be adjusted to the final aim of the research and data quality and may vary [83–85]. It is essential that machine learning algorithms and computer vision of high-resolution data are used as important techniques for mapping. Therefore, the 2-m detailed VHR Pléiades image would be an asset for further studies. Testing of the OBIA/OBIA image segmentation models in other software (such as GRASS GIS, eCognition), besides the SAGA GIS are recommended in future studies for improving cartographic technologies and accuracy of the automatization and machine learning techniques.

Embedded OBIA algorithms available in various GIS software may result in segmentation of the images using GRASS GIS or eCognition vary from those using SAGA GIS. However, the OBIS algorithm of SAGA GIS does the machine learning based segmentation in cartographic output as a map based on the Neumann and Moore approaches and Sentinel-2A remote sensing data. The spatial coherence among the segmentation results by Neumann and Moore approaches was acceptable together with general high accuracy, showing that SAGA GIS is a suitable software for image segmentation.

The results communicate OBIS as an effective approach for image segmentation and, in conjunction with SAGA GIS, describe image analysis as promising approaches in environmental and urban studies that should be applied in cartographic workflow. The selection of the input data used in the OBIS is a crucial step, as they control the output segmentation results, particularly with mixed land cover types, and areas with intensive urban growth. Therefore, a recommendation for future studies would be to use a Very-High-Resolution (VHR) imagery for more detailed studies on building level. This would allow detecting building using spectral reflectance of roofs which differs from vegetation. The provided figures visualizing segmented original Sentinel-2A image present the algorithm of the OBIS in SAGA GIS for the remote sensing data processing. The accuracy of segmentation of the urban areas is specified with an initial resolution of the satellite scene (10 m for the Sentinel-2A). As the next recommendation for further studies, a combination of various datasets using vector layers and raster data can be applied.

This study answers the questions aimed to describe and characterize spatial discrimination between the urban and non-urban areas on a satellite Sentinel-2A image using SAGA GIS, and to perform segmentation in the geometry of the quarters within the city using selected bands of the multispectral image using advanced methods of OBIS. The image processing was performed in a straightforward and automatic manner to avoid errors. To automatically distinguish the urban areas from all other land cover types (savannah, forest, mountain, etc.) and to depict the contours of the city and distinguish it from the sub-urban areas using their geometric properties and spectral settings on an image, a comparative analysis of the two approaches of image segmentation, implemented in SAGA GIS, the Moore and Neumann was applied.

The study shows that: 1) urban areas are distinguishable from the neighbor land cover types on a Sentinel-2A multi-spectral satellite image, because its resolution (10 m) enables to discriminate them using a computer based approach; 2) The Neumann segmentation method provided better results for image clustering comparing to Moore method; 3) The OBIS automatization method of image segmentation significantly improves the environmental mapping increasing both the speed and the precision of the remote sensing data processing.

This conclusion justifies a rule concerning the use of multi-source geographic datasets and a comparison of various data. Data selection is crucial for quality research, and selection of the best image resolution and quality (e.g. no cloudiness) relating to the study area is a strong predictor of the final research results. An optimal scene coverage overlaid with detailed topographic vector map would assist in image interpretation and generalization. As a final recommendation, the application of various methods would increase the applicability of GIS analysis. For instance, besides the OBIS applied for remote sensing data, other methods include a statistical analysis and spatial metrics for environmental studies [86–87]. Therefore it is advisable that selected software and algorithms of image processing also target research aims and goals applied to the study area in future research.

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### The Rebirth of Sustainable Post-Pandemic Tourism. Case Study: Romania

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**Abstract:** Traveling is definitely a way of life for many of us. However, the year of 2020 is the year of great changes, the tourism sector collapsing with the appearance of the COVID-19 pandemic. It is still too early to see the long-term effects caused by this SARS-CoV-2 virus, especially since this paper aims to analyze the situation of the tourism sector in the first half of 2020. Thus, the review of the impediments encountered in international tourism and of some possible ways of tourist recovery for the post-pandemic period represented aspects of great interest for the author. Romania being a Carpathian-Danubian-Pontic country, has a natural tourist potential that can attract tourists and generate profits that can propel the Romanian tourism sector among the national economic sectors that contribute greatly to the formation of national GDP. It is interesting how this paper presents the situation of a country in which the tourist potential is not properly valued and in the difficult context of the present COVID-19 pandemic, can by implementing key strategies aimed at practicing sustainable tourism, gain "ground" in the international tourism, respecting by the way, at the same time as practicing tourism, the health safety measures that currently represent a daily priority.

**Key words:** sustainable development, COVID-19 pandemic, Romania, tourism, post-pandemic tourism, politics and strategies, sustainable tourism

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#### **1. INTRODUCTION**

Accustomed to living in a time when we had privileges that facilitated favorable living conditions, with rights and freedoms conducive to a modern lifestyle, we were put in a delicate situation, namely the outbreak of the COVID-19 Pandemic and, implicitly, the inability to be free, as we were used to living. Thus, we found ourselves in a position difficult to understand, all the more acceptable, because the appearance of the SARS-CoV-2 virus changed our perception of life. Isolation in their own homes, being just one of the many measures imposed internationally to combat this new threat to personal health.

The health crisis caused by the pandemic COVID-19 has been of such magnitude that the drop-off in economic and tourist activity in most countries is generating an economic crisis with consequences that are still difficult to measure [1]. The end of 2019 ended sadly with the registration of cases of pneumonia with an unidentified cause until then in Wuhan, Hubei Province, China [2]. From that moment it was obvious that humanity is facing a delicate problem, difficult to manage, because "We have never before seen a pandemic sparked by a coronavirus. This is the first pandemic caused by a coronavirus." [2]. Gradually, the situation worsened from day to day, the cases of infection multiplying, which led to the implementation of measures aimed at counteracting the virus.

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The concept of tourism and related terms changed with the change in the number of tourist journeys and the growing interest of many fields of science [3]. At present, the world and the entire tourism industry face the COVID-19 pandemic, which has spread across 206 countries [4].

So, in such a difficult-to-manage context, in which endangering of one's own health, the difficulties encountered in the medical field and the economic and social crises generated are the order of the day, how can we bring a ray of sunshine into our lives? Practicing tourism is a good way to relax. However, when COVID-19 spread all over the world, many countries and regions introduced restrictions on traveling and closed their borders in order to curb the pandemic [5]. At the present time of the COVID-19 pandemic, the importance of tourism and its sustainable development is extremely important [6]. According to the World Tourism Organization, sustainable tourism is tourism "that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, industry, the environment and host communities" [7], therefore, what can be better welcomed in this period of restrictions, in which the tourism industry is difficult to try, than the practice of a different form of tourism than the traditional ones, the form that satisfies to some extent both the tourist demand and supply?!

Due to the geographical position and the presence of natural and semi-natural ecosystems in a percentage of 47% of the country's surface [8], with a minimum of effort an exercise of imagination can be made regarding what beauties of nature are present on the Romanian territory. Therefore, we chose to analyze Romania's main priorities in terms of the development of the tourism sector, starting from satisfactory statistical data, which represents a first step in aligning at the same level with the giants in the international tourism sector. In this sense, we have detailed aspects such as: why the practice of sustainable tourism is a form of tourism that helps the tourist demand, both in the pandemic and post-pandemic period; but also Romania's need to promote and develop sustainable national tourism, as its own "business card".

#### 2. LITERATURE REVIEW

The statistics data that exposed gloomy scenarios related to tourism in 2020, were noted by comparative studies. Thus, the World Tourism Organization (UNWTO) claimed that export earnings would be 60% to 80% lower than in the same period of 2019 [9]. The World Travel & Tourism Council (WTTC) reports a good course of tourism in 2019, but also highlighting a nostalgic side generated by the current collapse of the tourism sector [10], especially in view of the fact that the European Travel Commission (ETC) publishes a press release at the end of April 2020, stating that "the European Union is the largest region in the world in terms of international tourism revenues", but from over 27 million places generated by the tourism sector, 13 million of them will suffer due to the current pandemic [11]. On the other hand, the impact of declining tourist travel in Europe in 2020 was reported in a well-documented study published in Oxford Economics [12].

According to Higging-Desbioles, the 2019–2020 COVID-19 pandemic can change tourism industry and the contexts in which it operates [13]. This global crisis during which traveling, tourism, hoteling and events were frozen in many parts of the world creates an opportunity to find new possibilities in this historic moment of the transformation. The COVID-19 pandemic can constitute a rare and invaluable occasion to re-consider and redirect tourism toward a better path in the future.

In one of papers it was highlighted the fact that, 2019 was a promising one in terms of international arrivals, registering more than 1.5 billion, the trend being an ascending one for the last decade, since the last global financial crisis [14]. The crisis generated by COVID-19 has blocked the entire tourism sector. However, as the world grapples with the realities of the global pandemic there is an opportunity to rethink exactly what tourism will look like for the decades ahead. Thus, through the current pandemic, radical transformations will be imposed in the tourism sector, the impacts being long-term, both on the tourist demand and offer.

The statistical data from March to July denote the difficult trials to which the Romanian people were subjected, not only because of restrictions on the movement of individuals from one place to another, but especially because of losses in the Romanian tourism business. The HoReCa website clarifies the situation at national level from June 1, 2020, when out of the 85.3% of restaurants which reopened their doors after their closure, according to the 54,7% of respondents registered losses of at least 80% of the turnover of 2019 [15]. In fact, the study conducted by Restograf in partnership with HORA (Employers' Organization of Hotels and Restaurants in Romania) reports a series of grim data on the reduced activity of over 50% of the Romanian hospitality industry, also the percentage of reduced incomes, the reduction of the number of employees, suspended activity / completely closed locations and the percentage of insolvent businesses [15].

This paper also presents statistical data on the Romanian tourism sector during the last decade, regarding to investments in tourism infrastructure, specialization of human resources involved in tourism activities, application of the quality-price-sustainability principle, application of sustainability principles, adaptation to the needs of tourism demand etc. Thus, following the interpretation of statistical data, solid arguments will be formed that will create a clear image of the need to develop a sustainable Romanian tourism, even now, in difficult times.

We also mention the fact that the second part of this study, which focused on the huge tourist potential of Romania and what tourism should mean for this country, presents strategic plans, such as "Tourism and transport in 2020 and beyond" initiated by the European Commission (EC, 2020), which is intended to be a guide for those engaged in tourism sector [9].

#### **3. METHODS AND DATA**

The current paper was based on both qualitative and quantitative data, which mainly highlighted the crisis that the international tourism sector went through in the first half of 2020. Our attention was directed to a study area, namely Romania, a the country with a promising development in terms of sustainable tourism, currently difficult to manage and knowing the repercussions of the COVID-19 pandemic. The main research method was the inductive one, through which the particular case was analyzed by which the SARS-CoV-2 virus managed to block the international tourism sector, deepening this aspect, by exposing the case study targeting Romania as a sustainable tourist destination. Following the application of this research method, the foundations of personal observations were laid in order to obtain a much more detailed image of the subject under analysis.

#### 4. THE INFLUENCE OF COVID-19 ON INTERNATIONAL TOURISM

The reality we all live in has been characterized by major changes, driven by the need to slow the spread of the current SARS-CoV-2 virus among the population. The states of the world have been severely affected by this pandemic, the repercussions being visible first of all on the world medical system, but as expected also among the different economic sectors, tourism being no exception. And as the virus that everyone is talking about, day by day, has not ceased from its fierce spread, here we are in the position to spend not only spring in his difficult "company", but also the first summer, autumn, and as the current situation tends to acquire a repetitive character, from month to month, and the first winter. The COVID-19 pandemic is an exogenous shock for almost the entire world, hitting countries unevenly in terms of citizens' health [16]. In fact, according to Guangyue Nian and collaborators, this pandemic is most felt in the world's major cities, where exist a big problem due to the pressure generated by the tens of millions and high-density populations [17]. So, what can we do, as long as practicing tourism is the "good virus" that was not discovered to us overnight, but we were born with it, being as a primary need of our existence?! In the absence of vaccines and antivirals, we need to rely on new public health measures to curb the epidemic generated by this "enemy" [18]. Therefore, the primary goal of public health measures is to prevent person-to-person spread of disease by separating people to interrupt transmission [18].

National authorities are imposing all sorts of safety measures, all in order to slow down the infection rate. In fact, as expected, the measures came with the negative side, not just with the protective one. Thus, we witnessed a series of deprivations of liberty, which until the outbreak of the pandemic, few thought could catch them in two lives, let alone in one?! We mention in this sense: isolation at home or hospitalization of people found positive with the new COVID-19, symptomatic and asymptomatic; imposing the wearing of surgical protective masks when traveling in public; the obligation to respect a social distance of at least 2 meters between individuals; closing some state borders and implicitly forcing the movement of individuals from one place to another, stopping the activity of several important economic branches etc. In any case, Mengna Guo affirms that in addition to the imminent health crisis that occurred with the spread of the virus, social issues affecting people's well-being have also emerged, including those related to coping with the crisis [19]. Also, accurate, timely information, and the development of pandemic risk management plans are necessary commodities during a health emergency [20]. In fact, the suffering in the field of tourism was best observed in the case of SMEs (Small and medium-sized enterprises) and the hospitality industry - HoReCa (Hotels-Restaurants-Cafes), but also among employees in the tourism sector. Bars, restaurants, hotels, tourism SMEs and more have powerlessly closed their doors in front of customers. Stopping the infection with the new virus is the biggest goal to be achieved by 2020, worldwide. The statistical data that will follow to be presented draw our attention to the current gloomy pandemic situation that seems to have quickly overwhelmed global tourism, but also to scenarios, which if managed well, we will return to our beloved travel habits.

We start by mentioning that the World Tourism Organization has initiated a grim statistical situation regarding the tourist life cycle in the summer of 2020, while also referring to the period at the end of this year. Thus, we recall that the decline of international tourism in terms of export earnings is expected to be 60% to 80% compared to 2019, which translates into losses between 840 billion and 1.1 trillion EURO [9]. According to the World Tourism and Travel Council, "in 2019, the Travel & Tourism sector grew by 3.5%, surpassing the growth of the global economy by 2.5%, for the ninth consecutive year." In fact, "in the last five years, one in four new jobs have been created by this sector, making Travel & Tourism the best partner for governments to generate jobs" [10]. We note the vital importance of this sector for the world economy, but COVID-19 shook this upward trend, as the European Commission for Travel (ETC), on 27.04.2020 issued a statement concluding that "The European Union is the largest region in the world in terms of international tourism revenues" [11]. At the same time, the Travel & Tourism sector was responsible for the existence of over 27 million jobs in the European Union, but it is expected that over 13 million jobs will be affected by this pandemic [11]. Furthermore, Oxford Economics predicted that in Europe, the current pandemic would be responsible for reducing travel by 38.5%, so 287 million fewer international arrivals in 2020 than in 2019 [12]. The same source mentioned the idea that 2021 will be the one in which a rapid return of the entire tourism sector will be required, tourist arrivals in Europe increasing by up to 31.75% (Figure 1) [12]. However, the losses from 2019 and 2020 will not be recovered until 2023 [12].



Figure 1. Tourist arrivals from Europe, by destination region

Source: Data taken from <u>http://resources.oxfordeconomics.com/travel-tourism-europe-updated-coronavirus-</u> impacts-and-the-path-to-recovery?source=tewebsite [12]

The situation of the tourism sector internationally is not a promising one at all, although optimistic scenarios exist in this regard, a conclusive example being the one previously analyzed [12], but we remain skeptical, because stopping the pandemic is difficult, the number of cases of SARS-CoV-2 virus infection increases from day to day. It seems that a return close to post-pandemic normalcy could occur with great difficulty. In this regard, Rodríguez-Antón mentioned that thousands of lives were saved by adopting security measures such as distance and social isolation or limitations in the field of transport, but the collapse of national economies was inevitable [1]. He also wanted to emphasize that within the affected economic sectors, the tourism sector was the first affected by these limitations and will be the last to return to the "new normal".

#### 5. WHAT DOES TOURISM MEAN FOR ROMANIA?

Due to its geographical position, Romania, being a Carpathian-Danubian-Pontic country, has a very attractive tourist potential, being made various forms of tourism, among which the most popular being

stays in the coastal, mountain or balneary area. As expected, COVID-19 shook the national tourism sector, among other things.

According to the data provided by the Romanian Government, on the mioritic lands, the date of March 16, 2020 would be historical, because at that time, the President of Romania, Klaus Iohannis signed the decree on establishing the state of emergency throughout the territory for a period of 30 days, and on April 14, following that a new decree will be adopted for the same purpose [22]. Until the documentation of this article, Romania was in a new pandemic stage, namely the imposition on June 17, 2020 of the second month of alert on the entire territory of the country [23]. Admittedly, this type of decision from the authorities was intended to be seen as a "breath of fresh air" for the country's industries, industries that had come to be on the edge of an abyssal chasm.

Small businesses in the field of tourism, hotel chains and Romanian restaurants, as well as those abroad, have suffered the most from the Coronavirus, being totally or partially closed. According to official data found on the HoReCa Romania website, since June 1, when more than 85% of restaurants reopened their doors, according to the 54,7% of respondents to case study registered losses of at least 80% of the turnover of 2019 [15].

Moreover, the same study conducted on the sample of 423 respondents, between July 7-22, by Restograf in partnership with HORA (Employers' Organization of Hotels and Restaurants in Romania), highlighted the compassionate situation of the over 300,000 of employees in the HoReCa industry [15]. On average, there were 88 employees before the current pandemic, but, being technically unemployed 71 employees, to which are added, on average, another 14 employees who were laid off [15]. We mention that the same study managed to highlight many other data on the dominant image of what Coronavirus meant for the Romanian hospitality industry (Figure 2) [15].



Figure 2. Romanian hospitality industry after its reopening on 01.07.2020

Source: Study conducted by Restograf in partnership with HORA, from <u>http://www.horeca.ro/restaurante/5908-</u> studiu-mai-mult-de-jumatate-dintre-restaurantele-care-s-au-redeschis-la-1-iunie-au-inregistrat-pierderi-de-minim-<u>80-din-cifra-de-afaceri-a-anului-2019.html</u>[15]

Therefore, it came to the natural situation of implementing a series of measures that aimed in addition to the aspects related to saving the economy and some restrictions for citizens, because otherwise the spread of the virus was becoming unstoppable. In any case, we will not go into the depths of the details, trying not to criticize, but also not bringing a laurel wreath for the situation in which the infection rate with the new COVID-19 virus was managed. However, we will analyze along the way the aspects related to the field of tourism, because only this is the subject of this paper, a topic that arouses our interest. Therefore, the figures mentioned above denote a reality of the tourism field, which seems to be on a difficult precipice, the disaster being all the more significant if we consider that it will probably take years for the tourism industry to regains the crown of "the strongest economic branch in the world".

Romanian tourism is a sensitive topic at the moment, in times of pandemic, but this trend has been known and cultivated over time, so the industry analyzed in this paper failed to align among similar countries in terms of the tourist potential. "Romania is a unique country", would say the majority of those who step on our lands, fact for which the officials from the tourist environment should insist on a series of

priorities, otherwise, the Romanian tourism will remain in the shadow of indifference. In this regard, we recall the following priorities:

- Investments in tourist infrastructure. According to Catudan J.M.J., the degree of qualitative and quantitative diversification of tourism infrastructure is closely related to the attractiveness of tourist attractions and the number of tourists [23]. In fact, the tourist infrastructure and tourism are in a relationship of interconditioning, each stimulating and conditioning the appearance, development and evolution of the other [24]. In the integrated retrospective investment analysis in romanian tourism made in the period 2007-2016, important data are stipulated that denote the involvement of the Romanian authorities in the development process of the national tourism. Thus, in 2015, Romania registered approximately 120 new investments in tourism due to the increase in tourist flows and the amounts spent, on average, by one person [25]. The same source presented the situation from the end of 2016, which exposed the situation of tourism investments at national level. Thus, national funds amounting to 14,700,000 lei were allocated, representing 8.1% of the total investments at national level, expecting annual increases of 2.6% for the next 10 years, so in 2027 it should be that tourism investments to represent 8.4% of the total national investments [25]. In fact, notable investments are also needed in terms of access roads, because only in 2018 the arrivals of foreign visitors to Romania were made in proportion of 73.7% by road (out of the total number of arrivals), so we are witnessing an increase of 8.0% in this sector, compared to 2017 [26]. At the same time, foreign tourists also showed interest in air transport, registering a percentage of 23.9% of the total, so an increase of 5.6% compared to 2017, while the transport by waterways (1,4% of the total) and the one on railways (1.0%) also showing gratifying increases, of 0.7%, respectively of 3.5% [26]. In fact, notable investments were also registered in the case of tourist accommodation units, as in 2018 there was a substantial increase of 6.9%, so with 548 more units compared to the total of 7,905 tourist units in 2017 [26]. Therefore, as a brief conclusion on this priority of investments in tourist infrastructure, I consider that the existence of ascending figures in case of foreign tourists arriving in Romania, is both living proof that this country has not only a significant tourist potential, but and the fact that investments in the tourism field must be of a continuous nature, adapting to the wishes of tourists, as well as to the needs of the tourist offer. The COVID-19 pandemic is a topical issue for the entire Romanian tourism sector, the investments in this sector are minimal, which should not surprise us at all, in the current context in which measures to stop the virus are encouraged, such as keeping social distance or worse, temporary closure of accommodation, catering, agreement, transports, etc.

- Specialization of human resources engaged in touris. Given the fact that in 2016 the Romanian tourism sector generated 6.2% of total jobs nationwide, and the trend is upward [25], we must certainly focus on improving staff engaged in the tourism sector. Undoubtedly, quantity without quality cannot lead to a prosperous tourism. In fact, thanks to the data provided by the National Institute of Statistics in the "Tourism Satellite Account in 2017", we can get a good overview of employment in the national tourism sector. Thus, of the total number of jobs, by sex, in the Romanian tourism sector, 34.7% is the value registered by men in the field of road passenger transport, compared to the value of 3.7% found among females in the same sector [27]. Significant employment is also found in food and beverage services, the statistical data being as expected, women (51.3%) being more numerous compared to men (29.7%) [27]. According to the same source, the accommodation services sector it is not to be neglected either when we discuss its contribution to the total number of jobs in the tourism sector, as 18.9% of employees in 2017 were women, while only 7.1% were men. In order to obtain a high yield in the tourist activities, as well as to obtain a positive feedback from the tourists, the human resource engaged in the tourist sector must be specialized in this sense. According to the Tourism Law of 2018, in the sixth chapter there are a series of articles that provide the main criteria for professional training in the Romanian tourism sector. Thus, Point 1 of Article 44, presents the following provision: "Vocational training of adults in the field of tourism is carried out through vocational training programs that ensure the acquisition and development of professional skills in accordance with the legislative provisions in force" [28]. We note, therefore, that there are legal provisions that encourage the professional training of staff engaged in the tourism sector, but there is no obligation to this approach, because according to Article 42, "Acquisition of professional skills in tourism can be done formally, informally and informally, in accordance with the legislative provisions in force" [28]. Clarifying the term "informal way", we understand the acquisition of professional skills in tourism by practicing activities specific to the tourism sector directly at work or selftraining [29]. We believe that, in order to obtain the practice of qualitative and quantitative national tourism, specialization of human resources engaged in tourism must be seen as a priority by the authorities and actors involved in the tourism sector. After all, one of the first interactions between the tourist and the tourist offer is made within the tourist reception units, through the employed staff.

- Application of sustainable tariffs, on the criterion of quality-price-sustainability: In this sense, the practice of tourism, referring not only to the case of Romania, but to the whole world, should be based on the three criteria mentioned before, when it is necessary to apply certain tariffs. In fact, it is normal to take into account the fact that the existence of a qualitative as well as quantitative diversity within the tourist offer, can be justified in the price fluctuations. Sustainability must be seen in this case as a key factor leading to the current and future practice of tourism to ensure a balance between tourism demand and supply. The application of a sustainable tariff can be interpreted, if you want, as a "different kind of feedback", being also a good proof of "responsibility" in tourism. Practicing a fair price, which is consistent with the services offered, for example those related to accommodation, it is the action through which the tourist service provider can help to the customer loyalty, while customers will be much more receptive in making the decision to return to the place where the environment has a fair link between the quality of services offered and price. In the case of Romania, according to official data, in 2018 there were 11,720,000 arrivals of foreign visitors in Romania, with 794,000 more arrivals than in 2017 (respectively by 7.3%) [26]. In fact, out of the total of 11,720,000 tourist arrivals of foreign visitors, we mention the fact that 2,797,000 foreign tourists preferred to spend the night in accommodation units, so an increase of 0.7% compared to 2017. Therefore, in the conditions of delaying the flows of foreign tourists, the Romanian tourism officials must improve the experiences of these guests, and the practice of prices that do not present discordant notes with the quality of services must always be a priority. The break in national tourism imposed by the current pandemic is an opportunity to reflect on sustainable tariffs.

- Tourism promotion constantly updated according to the needs of demand and the development of online trends: We can consider that the tourist promotion represents the way in which the tourist demand and supply "meet for the first time". The tourist field must be adapted according to the tourist's behavior. The more elaborate the range of tourist offers, the more tourists can practice their travels depending on their own budget, free time, tourist potential, quality of tourist services, etc. The trends in tourism are very popular in the online environment, especially on social networks, which is why we believe that notable investments in online advertising must be indispensable. Online advertising can be the persuasion of the tourist to visit a specific destination. Companies could strategically use social media to interact with potential consumers and to exercise more persuasive marketing practices [30, 31].

- Adapting to the needs of the tourist demand (investments in leisure spaces, diversification of the tourist offer): In 2018, the total number of tourist accommodation structures was 8453 units, registering, compared to 2017, an increase of 548 units (respectively + 6.9%) [26]. Investments in leisure spaces are present at national level, which is gratifying for Romanian tourism, sector that must be capitalized at its true value. However, it must be taken into account that the accommodation spaces at national level must be in accordance with the size of the tourist flows. We consider auspicious the start of architectural projects for the tourist reception units, which should ensure sufficient accommodation space for tourists. According to some studies, there is clear evidence that increased tourist flows can be detrimental to the quality of the tourist experience [32-34].

- Applying the principle of sustainability across the spectrum of the tourism industry: In this regard, we would like to mention the significance of sustainable development by the World Commission on Environment and Development: "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" [35]. Therefore, the principle of sustainability must be implemented within the tourism industry as a condition of its existence, of the present and future good functioning. In Romania, due to the steps taken by the Romanian Ecotourism Association (REA), the foundations have been laid for a stable partnership for nature conservation and tourism in Romania between tourism associations, non-governmental organizations for local development and nature conservation, nature conservation projects and travel agencies [36]. Thus, within this association the emphasis is on three major priorities (Table 1) which is an important step in applying and promoting sustainability in Romania.

Promotion and marketing	Development strategies	Ecotourismcertification(Creating a certificationmechanism for three types oftourism products)
Creating and promoting a well- defined image of Romania as an ecotourism destination at international level;	Development of tourism strategies in and around national / natural parks and protected areas;	Ecotourism programs / excursions offered by tour operators or guides (eco tours for a maximum of 15 participants);
Development of ecotourism	Development of tourist	Small-scale accommodation

Table 1. Romanian Ecotourism Association priorities in applying and promoting sustainability

services and infrastructure at the level of Eco-Destinations proposed in Romania;	products: themed trails, tourist routes, interpretation and visitor centers.	structures in rural and natural areas (eco-lodge type and pensions of maximum 25 rooms);
Nature conservation and sustainable development in Romania;	-	Eco-destinations (one or more communities within natural areas).
National press campaigns focused on the development of ecotourism in Romania;	-	-
Participation in national tourism fairs.	-	-

Source: https://www.asociatiaaer.ro/misiune-si-obiective/ [36]

In fact, the current moment of the COVID-19 pandemic can mean a boom in the popularity of sustainable development, through the Romanian Ecotourism Association being implemented tourism actions, especially eco-tours in which a maximum of 15 participants can take part [31]. In this way, the small number of participants, not only is in accordance with the principles of sustainability of nature conservation by reducing the impact of the anthropogenic factor on the environment, but is a good way to respect the social distance measures imposed by the COVID-19 pandemic.

-Supporting and encouraging local communities involved in tourism: The involvement of local communities in the tourism sector is achieved mainly due to the implementation of the principles of sustainable development at the national level. Thus, nature conservation and the support and development of local communities are encouraged [36]. An eco-destination would lose its authenticity in case of the disappearance of the anthropic factor from the landscape. According to an old saying known to the Romanian people, "man sanctifies the place". Therefore, in the case of local communities located within natural areas, they ennoble the entire eco-tourism landscape. Failure to provide financial support would mean the loss of traditions and customs, authenticity. The support coming from tourists can be visible by: purchasing typical traditional products, for example handmade products or gastronomic products; overnight stays in local accommodation structures; involvement in agreement activities. Another way in which tourists can help local communities would be by promoting the destinations visited on social networks, for example. This would be a way to reduce the costs of tourism promotion undertaken by tourism actors. Therefore, as a final overview, we can say that eco-destinations gain authenticity and due to the local communities in the area, not only due to a vast natural tourism potential. The support and investments in them it must not be long in coming.

Romanian tourism is the country's inexhaustible "gold mine", that's in the case where we'd want this fact more. With a significant cooperation from tourism actors, correlated with the efforts of the Ministry of Tourism, this sector would be able to make a significant contribution to the country's GDP, but also regain a prestigious image of Romania, image on which, for example, had during communism period. Romanian tourism not only gives us the chance to overcome this difficult situation, but thanks to him, there is the possibility to be on the same level with the giants of European tourism, maybe even surpassing them, because Romanians are hardworking, ambitious and persevering people.

#### 6. KEY OBJECTIVES FOR SUSTAINABLE TOURISM IN TIMES OF PANDEMIC

Man has become skeptical about travel, fear taking deep roots in mentalities everywhere, but as the need to meet new people and places is uncontrollable, the resumption of tourism in maximum safety for the health of each of us is vital. In this regard, the European Commission launched on 13 May 2020 the strategic plan "Tourism and transport in 2020 and beyond", which aims to ensure the health of citizens by increasing confidence that travel can again be a safe and enjoyable activity, but also the recovery of transport and tourism [9].

Fortunately, the face mask can not prevent our eyes from staying focused on the beauty that is revealed to us everywhere, so in order to practice safe tourism, the European Commission has implemented a series of measures in this regard (Figure 3) [9]. hat is the purpose pursued by the European Commission, I highlighted it in the figure above (Figure 3), but we consider it auspicious a brief review of each measure implemented.



**Figure 3.** What "*safe travel*" means during the COVID-19 pandemic Source: Data taken from "European Commission - Tourism and transport in 2020 and beyond" [9]

**Step 1.** "Restoring safe movement without restrictions and reopening internal borders": After all, the tourism sector, without tourism potential and in the absence of the human factor, would no longer exist. However, we can add to this general conception the free movement of the tourist masses in safe conditions, both inside a country and outside its borders. The COVID-19 pandemic imposed a restrictive measure to close the borders of certain countries, in order to prevent infection with this dreaded virus, but at the same time, the question "We keep the state borders closed, but until when?". The current restriction would affect not only an economic sector, that of tourism, the negative impact being on the chain for most industries in the world. A reopening of borders, safe for citizens, supported by other measures with a similar purpose, meant the naturalness of a society worthy of these times dominated by human freedoms and technological-scientific progress.

**Step 2.** "Safe restoration of transport": We remind the fact that the essence of epidemic control measures is to restrict the movement and gathering of people which can normally be conducted by travel restrain [17]. With the establishment of fear among the population, was felt the need to instauration the feeling of preservation of one's own health. To this end, limiting the interaction between individuals and maintaining social distance have encouraged travel by personal means of transport, to the detriment of public transport. In any case, for a better understanding of the current pandemic phenomenon, we mention that public transport users have dropped by more than 90% in some European cities [37, 38]. Avoiding crowded places is a priority during this period, and maintaining a social distance of at least 2 meters between individuals is certainly a visible problem among those who are constrained to use public transport for travel, means of transport that seem unsafe from this point of view [39].

However, the European Commission has encouraged travel, many of which being made for tourist purposes, even through the use of public transport [9]. The relaunch of a safe transport for the health of each of us, meant the orientation towards adopting a preventive behavior, by wearing a protective mask, disinfecting hands, but also disinfection of the interior of the respective vehicles.

**Step 3.** "Resumption of tourist services with minimized health risks": The courage to overcome this bad moment, in this way this measure would be best interpreted measure proposed by the representatives of the European Commission [9]. In tourism, and not only, the gradual economic recovery was indispensable, because otherwise, the financial collapse would take over the entire market economy worldwide. The resumption of tourist services, in a gradual way, without endangering the health of tourists, but also of all staff working in the tourism field was the revitalization of tourism in 2020.

**Step 4.** "Use of digital technology": The tourist must always be responsible the period of crisis generated by the current pandemic is no exception. In this sense, a rigorous prior information is required, usually using the digital means that each of us has in different forms. Thus, it must be quickly known information such as: areas with a high risk of infection, travel recommendations, availability of tourist reception structures, travel restrictions etc.

Furthermore, Wang D. et al. say that mobile technology is touted as the next technology wave that can fundamentally change tourism and hotels [40], while other researchers affirm that mobile technology is

playing an increasing role in the travel experience, and increasing travel research is concentrated in this field [41].

**Step 5.** "Protecting people's rights": We travel, but we also, in addition to the responsibilities we have, we also have some rights, isn't it?! In this regard, the European Commission encourages those tourists who have purchased certain travel packages in advance, and who have been canceled, to use the advice provided through the network of European Consumer Centers [9]. Even if the current pandemic has generated a very delicate situation, the relationship between the tourist and the actors in this field should remain a balanced one. A negative feedback in the present period, correlated with the fear of contacting the COVID-19 virus with the movement from one area to another, would mean the collapse of tourism by reducing tourist arrivals.

Tourism, severely affected by this current crisis, must overcome this difficult period, with the focus on new directions aimed at the niche of sustainable tourism. Why sustainable? Improperly said, but if it were necessary to think about whether there is something good about this pandemic, in addition to increasing concern for one's own health, sustainable tourism is in a position to embrace as many tourists as possible.

Sustainability has not been a topic of interest to most tourists so far, addressing a well-defined typology. However, I believe that through the current difficult situation in which all mankind finds itself, we can bring to light the feeling that has been left in the shadows in our hearts, namely the good relationship between man and nature. In fact, this connection represents a condition of human existence, because what man would do without the environment, but also vice versa, because everyone has a well-established place on this Earth, as a well-cohesive continuous circuit, in other words.

In order to achieve the practice of sustainable tourism, more than ever, the entire sector needs an energetic boost from tourists. Therefore, the data mentioned below clarifies and promotes at the same time the ways in which each of us can be useful during this period:

- Adoption of a responsible tourist behavior, necessarily related to the post-pandemic period;

- Initiating trips in rural areas discovering new traditions and customs, people and landscapes, as well as contributing to the existence and development of the tourist areas in question, by purchasing products from local producers. In fact, the duration of a tourist stay, for the whole experience to be a favorable one, must be at least three days. Otherwise, the tourist would not be able to contribute to the support of the communities in question, the traditions and customs would also be neglected, and the anthropic potential, and especially the natural one, would not be able to show its beauties in one day, for example. Traveling involves patience, the desire to know the unique, to discover our roots as individuals, to regain inner peace and tranquility, but last but not least and to make a lifelong friendship with our second mother, nature;

- Using the sustainable means of transport as much as possible. Circulating in tourist areas can be done with the help of bicycles, scooters, animal-drawn vehicles, or even walking on their own feet.

On the other hand, according to the provisions encouraged by the European Commission, the involvement of the authorities, but also of all those responsible in the tourism sector, in the process of arousing the interest of tourists to the sustainable side of the traveler is vital, so the following measures are welcome [6]:

- Emphasizing value, quality, sustainability and innovation in tourism;

- Initiating a more sustainable transport at affordable prices, in order to efficiently manage tourist flows;

- Diversification of the tourist offer in order to attract tourist flows in the off-season;

- Development of sustainability skills for tourism professionals;

- Promoting sustainable tourist accommodation structures (through voluntary systems, such as the EU Ecolabel and EMAS);

- The transition of tourism to digitalism, in the sense that a fair approach to the Internet can help, offering new ways in which tourism flows can be managed, the use of limited resources being much more efficient;

- Digitization in tourism during pandemics can also mean a measure to regain the trust of tourists, ensuring access to the latest data on the place where the actual trip is to take place, at the same time, at the opposite pole, tourism actors also need to become familiar with the deeper use of the Internet (referring mainly to areas where sustainable tourism is practiced, places where the connection to the online environment can be difficult). For example, connecting local businesses to a database can provide important information about accommodation, transportation, tourism potential in the area, but also about the degree of security that tourists can have. Such information often remains difficult to access if we talk about sustainable tourism, which is fragmented in rural areas.

#### 7. CONCLUSIONS

The COVID-19 pandemic surprised each of us. Scenarios regarding the outbreak of such a threat to humanity have been brought up in recent years, but until we were confronted with the fact, we remained indifferent to this danger. I conclude by expressing my interest and at the same time the ecstasy towards this subject, of the situation of the tourism sector during the COVID-19 Pandemic. The current circumstance is a new one, in which the current generations have not taken part until now, and tourism is also put to a difficult test, apparently, more than six months after the introduction of the COVID-19 virus.

I hope that the global tourism sector will return to its promising pre-pandemic form, and in terms of Romanian tourism and sustainable tourism, this is certainly the right time to revalue it and increase confidence in Romania's natural potential, thus motivating my state of ecstasy mentioned in the above lines. In fact, the social distance will culminate in the tourist's desire to avoid areas with increased passenger traffic, so rediscovering their roots through sustainable tourism will become dominant. This is the time when the tourist will realize the richness of sustainable tourism, so I can commit to making the following prediction: sustainable tourism will become in the coming years the main reason why tourists will feel at ease when traveling.

Respecting the measures issued by the European Commission, I am convinced that the health of people everywhere will cease to be endangered, fear will be replaced by hope and confidence, and tourism will once again be crowned as one of the most prolific sectors of the world economy.

Unfortunately, the principle "in life man learns from his own mistakes", can be adapted to this pandemic period that will pass at some point, but until then, man must learn to take care of the health of his own home, the Earth, for so that he too can live a harmonious life.

"Tempora mutantur et nos mutamur in illis", in translation "Times change, and we in them", the Latin would say ... Change, adaptation and continuous improvement, man must guide his life according to these natural processes of our existence.

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### **BOOK REVIEWS**

### LES ROUTES DE LA SOIE NE MÈNENT PAS OÙ L'ON CROIT...

#### CLAUDE ALBAGLI L'Harmattan, Paris, France, 2020, 276 pp. ISBN 978-2-343-19828-6

#### **Reviewed by** ANTONIETTA IVONA, University of Bari Aldo Moro, Italy



The promotion of the New Silk Road began in 2013 by the Chinese President Xi Jinping when he presented the "One Belt, One Road" project with the clear aim of increasing infrastructure connections (railways, roads, ports, gas pipelines,

oil pipelines, etc.) and trade between the People's Republic and the rest of the Eurasian continent and Africa. The OBOR, now renamed Belt and Road Initiative (BRI), constitutes the pillar of Chinese foreign policy, on the basis of which the Chinese government intends to build a future world order that will have its reference pole in the People's Republic of China. A global transport network is turning into a cooperation network between China and the countries involved. The largest post-war infrastructure investment plan was met with controversial judgments; they range from the "pivot of contemporary relations", the engine of a new globalization, the Chinese solution to world problems, the Chinese Marshall Plan, up to a 'political-financial error", a pretentious plan. In short, the great Chinese geopolitical strategy has not gone unnoticed.

Inevitably the breadth, the complexity and the singularity of this project have favoured the confusion and the controversy. Free trade treaty, investment program, cooperation platform or even multilateral organizations also embody a strategy within the dimension, framework and flexibility described by numerous actors in the world.

The disorientation also stems from the fact that for the first time the BRI seems to put an end to the hegemonic Western vision since the end in force since the end of the Cold War.

With the arrival of Xi Jinping to power, China is ambitiously outlining a new world strategy with the aim of reshaping the new global political and economic assets. Through the BRI China is strategically projected into the world by distancing itself from the Western model and also offering developing countries an alternative way to that Western model. The stakes are very high and as Claude Albagli states in the text "For the first time in half a millennium that a new planetary momentum is not driven by a Western country".

As a careful development scholar and through his rich knowledge of China, the author has included in his book a very enriching point of view on the BRI and more generally on the type of development China is undertaking; above all it is a look without partisanship. The goal is not "to predict but to inventory" and therefore this book essentially consists in discerning the effects of this Chinese strategy and identifying the key elements of its realization without wanting to be either an exercise in speculation or prediction of the results of this project still in progress. implementation phase.

The book is structured in two large and strictly interconnected sections; in the first "The foundations of a coherence" Albagli analyzes the dynamics and processes. In the second, "The stakes of a strategy", the analysis moves to tools, configuration and impact. However, the current strategy cannot be understood except by retracing the historical excursus that has led China, in over forty years, to weave / build a dense network of alliances and infrastructures that have allowed it geo-economic and geostrategic alliances with at least one hundred and forty countries. In the first part, the contemporary evolution of China is considered with particular attention and more generally it is considered that in order to understand the current situation well and try to imagine the future evolution of China, one must be able to examine the situation as it evolves over time.Some dates are fundamental for understanding China today: 1978, 1992, 2001, 2008 and 2013 determined the evolution process of China today and help to understand how the initiative of this modern silk road fits perfectly and coherently with Chinese development. According to the author, we cannot make the mistake of considering this project as а simplistic revitalization of a fascinating and mythical trade route.

The second part of the book is entirely reserved to the Belt and Road Initiative. The tools used for its design and that China has skilfully used for its international prospecting. The project is outlined through three implementation are trade, finance and the forums concentric belts; the first is the Asian one which involves numerous countries in the area such as Vietnam, Laos; Burma. Its gas pipelines from Central Asia will enter the country through the Pakistani corridor, but also the Siberian axis of the great Russian neighbour. The historical belt is taking shape through the Eurasian railway corridors and the bifurcation of the Mediterranean towards Piraeus, Genoa and Trieste. Finally, the continental one which includes the Arctic route, Latin America and Africa reached by different routes, from the Djibouti bridgehead to the southern ramp via Angola. The impact of the strategy is defined as "a palette of adhesions with nuances" given the multiple responses to its implementation and equally multiple heterogeneities of the countries involved. Awareness of the final outcomes makes the BRI a terrain of easy disagreement. According to Albagli, the fundamental question is whether China will be able to transform the BRI into a truly beneficial multilateral project.

In this context, Europe is probably the most exposed to the consequences of the Silk Road for its identity and its relations with the world; due to its history, its absence of a spirit of territorial domination and its diversity, it is also the most suitable for establishing a dialogue with China first and for carrying it on. However, a common vision between China and Europe is needed so that the main actors involved, public and private, can use the same language and an ambitious and pragmatic approach at the same time.

Albagli's text therefore represents a useful tool for scholars and researchers to reflect on China's new hegemony and on the consequences that the BRI is already generating in the world.

The book begins with a preface by Jean Pierre Raffarin, a great connoisseur of China, and a preface by Professor Zhan Su, a specialist in Chinese politics at Laval University in Quebec. Both confirm the author's analysis in his description of the reality of the Chinese project.

Concluding Abagli's book tries to outline the new path of Chinese polarization at both the regional and international levels, also taking into account the trends relating to the original concentration and subsequent geographical disintegration of the productive activity that occurred in the last stages of the globalization process. It represents an interesting contribution to understanding the new trajectories of global development but also the composition of new geopolitical alliances unimaginable only until a few years ago. The Silk Road is not just a geo-economic plan but above all a strategic vision for the near future.