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Elasticity Forces in Tourism Under Covid-19: The Model of the Imaginary Mechanical Tourist Spring

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The forces of contraction and expansion about the seasons in tourism behave like an imaginary mechanical tourist spring. The article discusses tourist activities in Bulgaria from 2009 to 2020, predictions concerning Covid-19, and tendencies expected in the last quarter of 2021 till the end of 2022 on data published by the National Statistics Institute and Eurostat. The system's dynamics observed before the pandemic crisis in tourism resembles the action of a mechanical spring that shrinks and extends, and we can empirically analyze the process of tourism activities. The study of this elasticity process of the system allows establishing a model with positive characteristics of the dynamics and further dealing with problems, better clarity in analysis and modeling of prognosis based on the potential of an imaginary mechanical spring concerning the possibility of the tourist destination.

Keywords: elasticity, mechanical tourist spring, tourist potential, tourist destination, prognosis

Introduction

There is seasonality in tourist practice. It is usually in four seasons called high, medium, low, and off-season, or advertising season. Seasonality can be related to the climatic features of the destination—spring, summer, autumn, or winter season, with specific periods—major annual events such as Christmas and New Year holidays, and Easter for Christendom, Eid al-Fitr, and Ramazan Bayram for Muslims, Easter for Judaism, and others. And others such as festivals, fairs, or places relate to historical events, as well as significant dates that are festive—the day of the country's national holiday and other dates specified in the calendar as holidays and non-working days. Seasonality is also observed in the weekly cycle where the middle of the week is busier than the weekly visits to business-oriented destinations, or vice versa; the end of the week is more dynamic due to the nature of the goal as a place for rest. In each case of seasonality, we observe processes related to the capacity and occupancy of individual tourist sites, resorts, tourist complexes, and tourist destinations, as a set of offering different services as each of the following parameters related indicators average employment, average price, the average income from the available room, number of tourists, number of employees, etc. It appears graphically in the x, y coordinate system as a sinusoidal curve y = y sin (x) for a certain period (Haralampiev, 2010).

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Bulgaria as a tourist destination is a highly dependent on the seasons and these are the well known spring, summer, autumn, and winter. There is a distinctive asymmetry in favor of the summer tourist season in a repeated year's cycle of the number of international arrivals. There is an analogy in the sinusoids of dynamics of the number of international arrivals in tourist system, and the elasticity of the mechanical spring, and it is possible to analyze the tourism cycle based on this analogy. Elasticity of mechanical spring is empirically defined and it's well known that it deflects when loaded and recovers its original shape when the load is removed. The destination itself, in accordance with the seasons, shows elasticity of its own which corresponds to the elasticity parameters of the mechanical spring and when analyzed in a longer time period demonstrates character of the falling spring and mimics its vibrations. The elasticity of the spring is empirically defined. This is to say that the elasticity of the tourist destination has a cyclic character and can function under greater or a smaller load (Haralampiev, 2010; Atanasov, 2018).

The asymmetry came from the mass summer tourism towards destination Bulgaria in the last 50 years and shaped two main trends: mass tourism organized by tour operators with a package price using land or air transportation, and individual tourism using land or air transportation. The major European tour operators, who were selling Bulgaria as a mass tourism destination in the last decades, created a type of tourism which we can call "industrialized tourism" that is non-interrupted, primarily conveyer stream servicing of the tourists following a particular program. On the other hand, there is different mass tourism for individuals and their chaotic movements that we could call "disperse tourism" because tourists behave like spreading tiny drops in the local travel environment. Once having arrived at the destination, they go in different directions according to their preference, following IPod or Android bits of advice (Lyonsi & Wearing, 2008).

Literature Review

There are no universal definitions of "industrialized tourism" and "disperse tourism". The popular terms are "mass tourism" (Claver-Cortés, Molina-Azorı´n, & Pereira-Moliner, 2007) which is "organized movement of people to specific sites" (Mldunbound, n.d.), and "alternative tourism" that "involves a small number of people who visit places that are not such popular travel destinations" (BAAT, n.d.). The obvious conclusion is that the critical difference between mass and alternative tourism by the number of visitors to the destination and organization of services provided (Hallway & Teylor, 2006; Butler, 1990). Industrialized tourism could not be interrupted. Chartered flights chain is for a short or long period. Once the charter chain has started, the supplier cannot cancel flights without severe damage to the tour operator. Therefore, during the Covid-19 crisis, most charter trips did not start at all. At the same time, we have seen a boom in the dispersed form of travel. Tourists did not have a concrete plan or could change it, depending on the current desires. This travel phenomenon shaped the entire summer season of 2020 and 2021, with increased domestic travel observed in all tourist destinations (Aleksova, 2020; Wearing, McDonald, & Ponting, 2005).

There is no available research published comparing the dynamics of the tourist destination to a mechanical spring and its elasticity. Meanwhile, the Covid-19 situation requires analysis and prognosis of the future development of the tourist destination goals. Covid-19 precipitated a global stalling of the tourism industry. Now, as vaccine rollouts help lockdown measures ease, investment into the tourism cluster has started to pick back up, with domestic tourism leading the recovery (Tourism Investment Report, 2021). Nevertheless, we believe that fully preserved tourist structures retain their potential in a time of crisis as Covid-19 just as the mechanical spring when compressed.

The latest UNWTO data show that during the first five months of 2021, the world destinations have registered 147 million fewer international arrivals (overnight visitors) in comparison to the same period of 2020 or 464 million less if compared to the pre-pandemic 2019. Furthermore, data show a comparatively low increase in May. The arrivals have dropped 82% compared to May 2019, while the figure for April is an 86% drop. This slight improvement resulted from easing the restrictions to some destinations and the customer confidence subsequently improved (*UNWTO World Tourism Barometer (English Version), 19*(4), 2021).

According to UNWTO, the acceleration of mass vaccination worldwide, effective coordination, and communications are constantly changing travel restrictions. The advance of digital instrumentation to facilitate mobility will be of decisive importance in restoring confidence in confidence travel and reviving tourism (TTG Asia, 2021).

Model of the Spring

The tourist decline and expansion events regarding the seasonal changes behave similarly to the mechanical spring. If we follow the National Statistics Institute data (NSI) for the international arrivals yearly for the period of 2014-2019, we'll find repeated, vigorously asymmetrical waves resembling sinusoid curves (Figure 1).

Figure 1. International arrivals in Bulgaria, in months. Source: NSI data of international arrivals in Bulgaria (2014-2019).

We must use the time required to service overnight to measure the intensity. So first, we need to multiply the beds times the days of the month, thus calculating the total number of days. Next, we divide that number into the real overnights. The formula is:

$$tn_i = \frac{nh_i . d_i}{rn_i}$$

where:

tn_i—The time to service one overnight in a month i;

nh_i—Number of beds in the month i;

d_i—The number of days in the month i;

rn_i—The number of real overnights in the month i.

Because of the small numbers for a better presentation, we multiply the result times 100 and get the time to service 100 overnights.

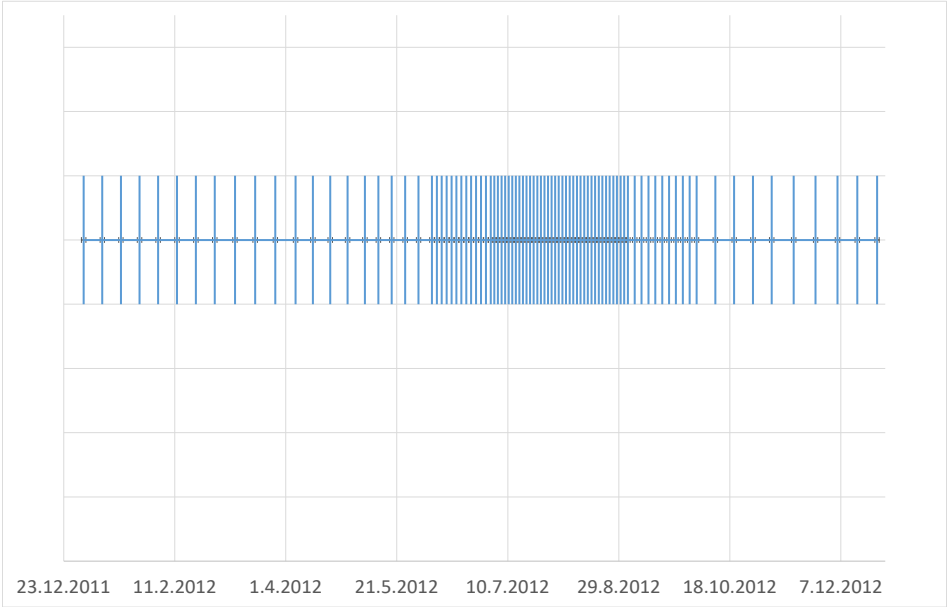

Figure 2. Longitudinal cross section of the spring for the tourist destination. Source: NSI data (12.2011-12.2012).

Figure 2 shows the cross-section of the imaginary tourism mechanical spring for the tourist destination from 12.2011 until 12.2012. This graphic is closest to the behavior of the tourist destination resembling mechanical spring. The figure shows the asymmetry of international arrivals in summer and the ease during the rest of the year. This model is the mechanical spring in tourism only for the Year 2012. But the pattern is repeated for the following years and again with a similar resemblance as in Figure 3 (2011-2015).

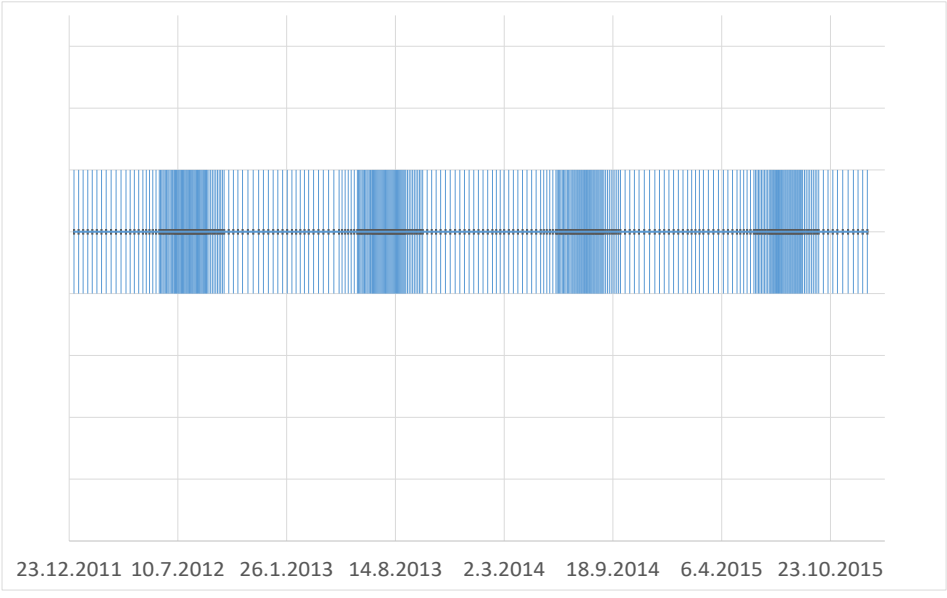

Figure 3. Longitudinal cross section of the spring for the tourist destination. Source: NSI data (12.2011-12.2015).

If we calculate the minimal, maximum, and the average values of the servicing times for 100 overnights in the respective months from 2012 till 2019, we'll get the following Table (Figure 4).

Month	Minimal time	Maximal time	Average time
January	6.45	8.62	7.52
February	5.61	8.51	6.71
March	6.97	9.23	8.18
April	6.39	9.65	7.64
May	4.62	6.22	5.43
June	2.13	2.82	2.30
July	1.61	1.91	1.72
August	1.64	1.82	1.69
September	2.65	3.39	2.96
October	6.67	8.60	7.68
November	7.23	9.87	8.70
December	6.93	8.91	7.95

Figure 4. Minimal, maximal, and average values of the times to service 100 overnights in months for the years 2012 till 2019.

The only cycle with repeated periods for the first two columns is the 12-month cycle, corresponding to the mechanical spring.

International arrivals in Bulgaria:

$$f_{ЧБ}(t) = 605\,007{,}52.\,sin\frac{2\pi(t-4{,}44)}{12}$$

Bulgarians traveling to foreign countries:

$$f_{БЧ}(t) = 103\,646{,}61.\,sin\frac{2\pi(t-4{,}05)}{12}$$

Accordingly (Haralampiev, 2010):

$$f_{ЧБ}(t) = \frac{605\,007{,}52}{103\,646{,}61}.103\,646{,}61.\,sin\frac{2\pi(t-0{,}39-4{,}05)}{12} = 5{,}84.\,f_{БЧ}(t-0{,}39)$$

The last formula shows that during the 12-month cycle, the number of foreigners visiting Bulgaria in a specific month is 5.84 times bigger than the number of Bulgarians traveling to foreign countries 0.39 months earlier.

The system has proved that the travel destination has worked in a long interval of time (over 10 years) under severe strain during specific periods with the elasticity of the tourist destination resembling that of the mechanical spring. These fluctuations give the system's characteristics with its potential in the superstructure and infrastructure of the destination. It is a model in itself that we can load with random events and the system's parameters and observe how it'll react in future periods, which is preserved in crises and allows the system to continue after the crisis with the same elasticity parameters. A substantiated assertion that the tourist destination works under these strains, i.e., has the necessary elasticity. The destination might function under a more significant load, but no data are available for the cited period. The empirically tested study data prove that at least these minimal times in our case show the cyclicity (Levitt, 1965).

Our study aims to make a prognosis for the dynamics of the destination in the Covid-19 crisis and beyond. That means that if we know the availabilities in the given destination or any tourist destination, we can predict

how many the actual overnights under the maximal load of the system will be. And we accept this to be the optimistic prognosis scenario allowing an even more significant burden on the tourist destination than the current results. But, on the other hand, we can also predict how many the overnights under a minimal load of the system with continuing Covid-19 pandemic will be. That is the pessimistic scenario prognosis. Next, we can vary with the average numbers to bring the realistic prediction for the overnights at the destination under median load.

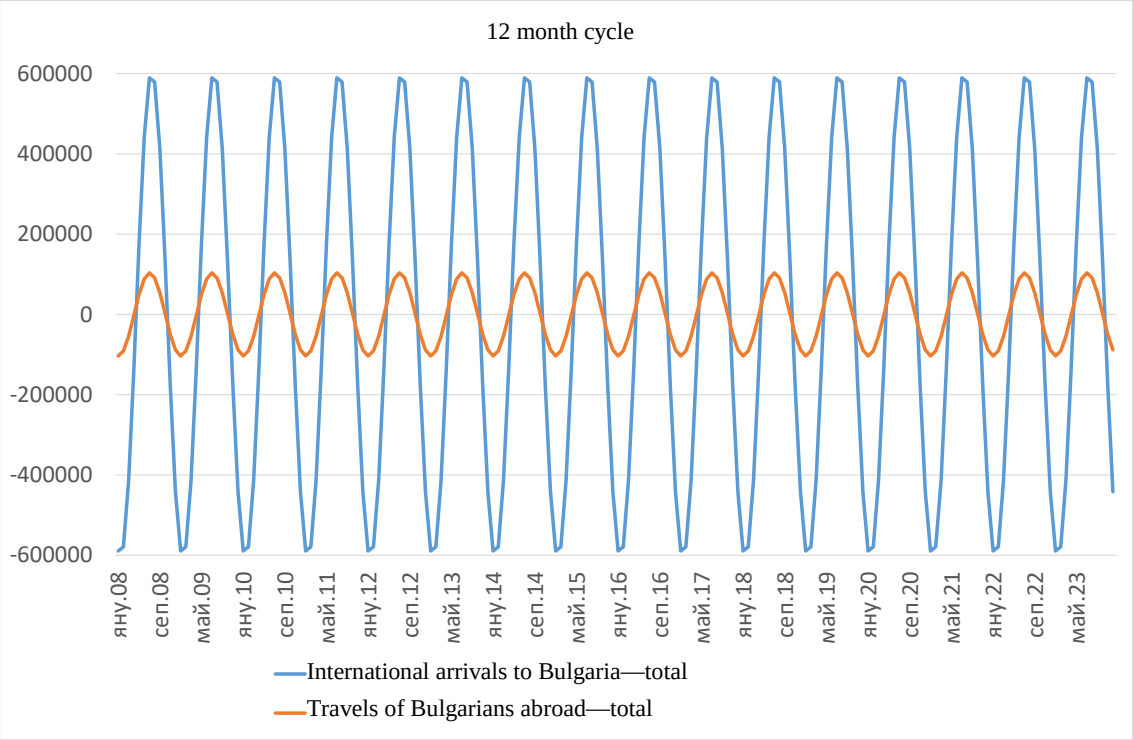

Figure 5. 12-month cycle for the number of International arrivals in Bulgaria, and travels abroad.

We can use the following formula for that purpose:

$$rn_i = \frac{nh_i . d_i}{tn_i}$$

It is required to prognose the number of the bed allotments for two years ahead. We chose “two years”, as the analyzed data are for the past nine years, i.e., the prognoses cover ¼ of that or two years.

Figure 6 shows the prognosis with a 95% probability. In this case, we combine the lower limit of the interval with the maximal times of the servicing.

$$rn_{optimistic\ ,i} = \frac{nh_{UL,i} . d_i}{tn_{min\ ,i}}$$

$$rn_{pessimistic\ ,i} = \frac{nh_{LL,i} . d_i}{tn_{max\ ,i}}$$

$$rn_{realistic\ ,i} = \frac{nh_{forecast\ ,i} . d_i}{tn_{average\ ,i}}$$

The result in Figure 7 points that the prognosis shows a recovery of the tourist destination’s potential much faster than the automatically generated results (BTA, 2021).

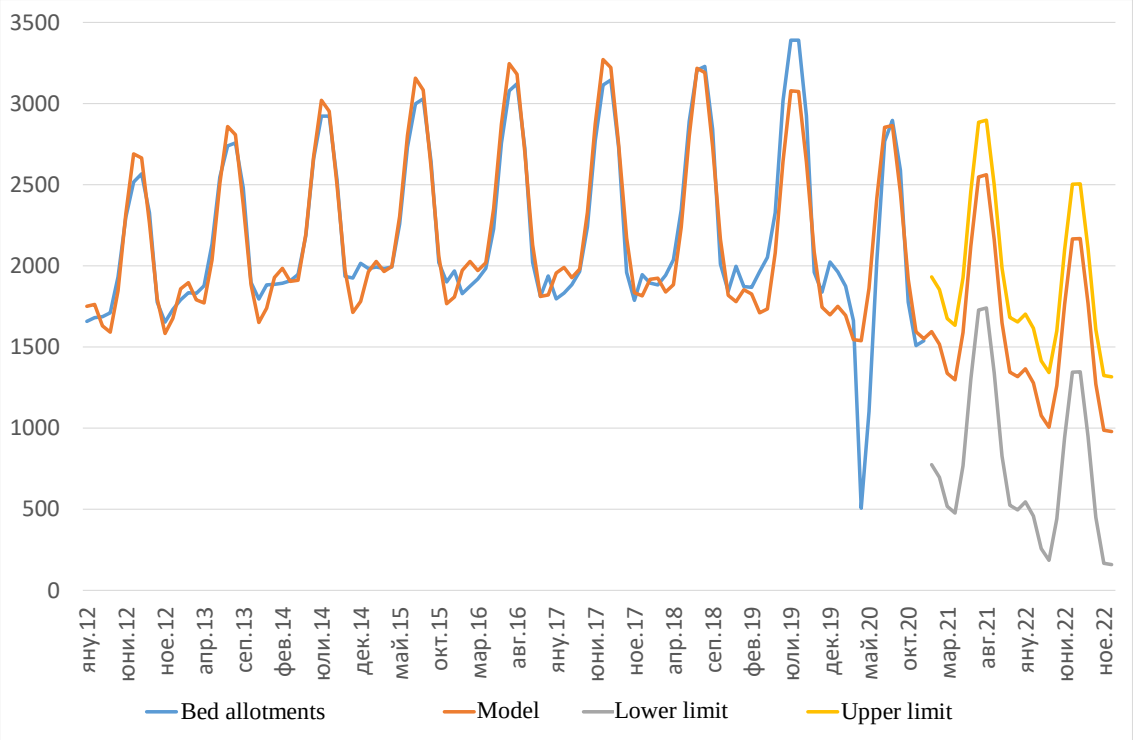

Figure 6. The prognosis with 95% probability.

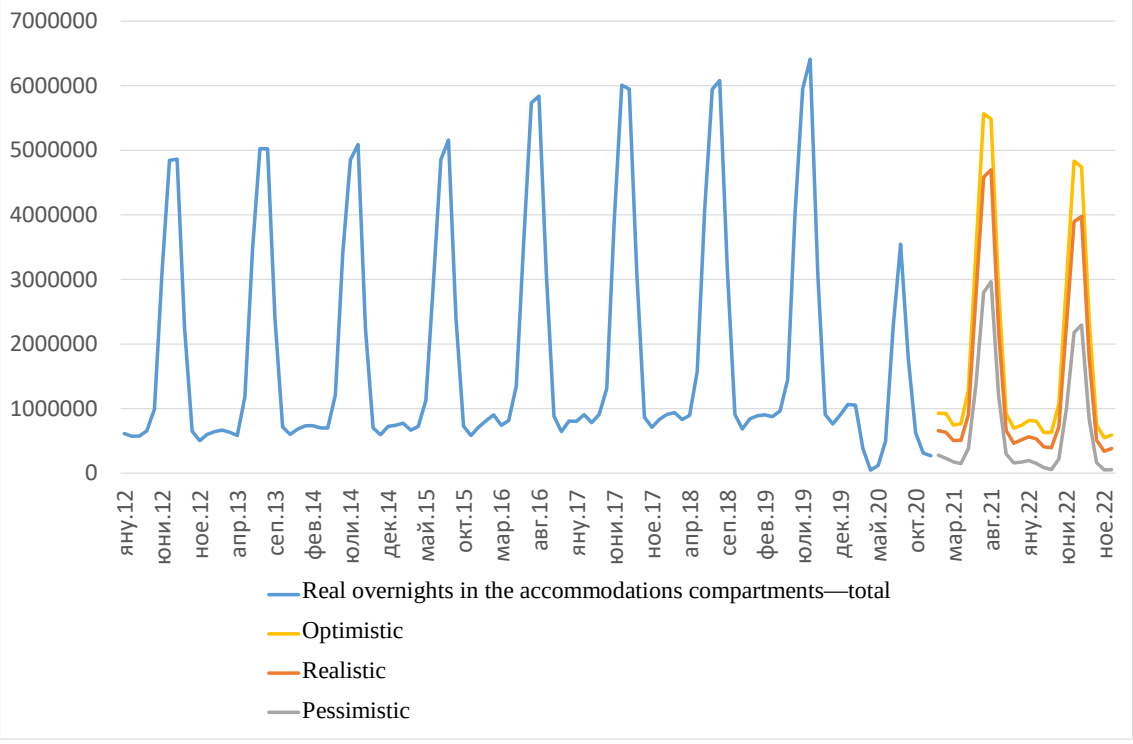

Figure 7. Combining the lower limits of the probability interval with the maximal service times.

Methodology of the Study

The base of the study's methodology is on the comprehensive research, review, observation, analysis, and synthesis of the statistical information available through the National Statistical Institute. Data are of Euro stat and The Institute for Analysis and Prognosis of the Information Tourist Environment at The University of Library Studies and Information Technology, Sofia, and the long-time experience of the authors in the scientific research on the modeling of the processes. When modeling the methods, we resolve various research tasks most commonly grouped in the following three groups: (1) analyses the stability of the disperse compared to industrialized tourism (FAKTI, n.d.); (2) the support given by the business strategies to the development of tourism; (3) degree of adoption of the informational recourses in the industrialized and disperse tourisms.

Results

The study shows that depending on the season, the tourist destination works under heavy load in specific periods. In crises, that illustrates its elasticity in contracting and expansion, similar to the mechanical spring. These dynamics show the system's characteristics analogous to the behavior of the spring. The tourist destination has its potential expressed in its superstructure and infrastructure. Therefore, it can be analyzed using the suggested model to give the system's parameters and observe its reaction in future periods, especially in crises.

Findings

We can conclude that the tourist destination works under cyclic loads during the season, and it demonstrates its elasticity that corresponds entirely to the elastic parameters of the mechanical spring. Furthermore, the experiment indicates the fluctuations of the tourist destination are similar to the mechanical spring. That is to say that the elasticity of the tourist destination has a cyclical character and can function under bigger or smaller loads.

Conclusions

The model of the imaginary tourist mechanical spring applied to the tourist destination has a meaning to foresee the potential of every tourist destination and can be used to prognose the results in future periods and the stress tests of the destination in random parameters of the system. However, the "industrialized" (FAKTI, n.d.) form of tourism will be substantially changed under Covid-19 and is not applicable in a pandemic environment because of the risk of immediate termination of charter chains and losses. On the other hand, "dispersed" mass tourism can thrive and demonstrate stability in such crises conditions. Therefore, it is essential that the tourist destination that functioned before the pandemic as a conveyer mass tourist destination reorganizes as a disperse tourist destination for individual tourists to retain the necessary stability of the offered tourist services.

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