ІНСТРУМЕНТИ «ТУРИЗМ 4.0» ДЛЯ СПРИЯННЯ ПОРІВНЯННЮ ДАНИХ ПРО СТАЛИЙ ТУРИЗМ (НА ПРИКЛАДІ ВИЛКОВЕ ТА СФАНТУ ГЕОРГЕ В ДЕЛЬТІ ДУНАЮ)

Актуальність. Сьогодні туризм визнаний одним з найважливіших видів комерційної діяльності. У 2019 році він створив 10% робочих місць і становив 10,4% світового ВВП. Слідуючи за прикладом мегаполісів, все більша кількість міст і сіл праґнуть отримати вигоду від туризму на основі своїх місцевих культурних та природних надбань. Цю тенденцію можна спостерігати в транскордонному біосферному заповіднику дельти Дунаю в Румунії та Україні, де багато раніше віддалених поселень почали приймати все більшу кількість відвідувачів. Однак туризм може також спричинити низку негативних економічних, соціальних та екологічних впливів на місце призначення та його регіон, що може підірвати саму привабливість інших напрямків.

Мета та завдання. Особливою проблемою для органів влади, відповідальних за розробку регіональних стратегій та правил сільського туризму, є наявність стандартного методу оцінки та порівняння можливостей відвідувачів та стійкості різних напрямків. Нові технології Tourism 4.0, такі як високопродуктивна аналітика даних (HPDA), можуть підвищити ефективність та результативність стратегічного планування та екологічної стійкості. Загальною метою дослідження було порівняти поточну ситуацію двох подібних поселень у біосферному заповіднику дельти Дунаю: Вилкове в Україні та Сфанту Георге в Румунії. У співпраці з муніципальними радами, місцевими підприємствами та громадськими організаціями ми застосували модель впливу на туризм (TIM), розроблену словенською компанією Arctur, до даних, зібраніх за тією ж методологією в період з серпня 2020 року по травень 2021 року. Загалом було розглянуто 295 позицій. Дани можуть бути кількісними (кількість спожитої електроенергії чи води за добу) або більш суб’єктивними експертними висновками (чи населений пункт страждав від заторів чи
загалом показує, що обидва напрямки мають значний потенціал для покращення своєї ефективності. На жаль, зокрема з питань екології, соціальних та економічних аспектив, вони мають незначний вплив на відповідні громади. Однак, вони мають високий рівень співпраці між туристичним сектором та місцевою громадою.

Висновки. Результати першого застосування моделі впливу на туризму в Вилкове та Сфінту Георге показують, що обидва напрямки мають значний потенціал для покращення своєї ефективності. На жаль, зокрема з питань екології, соціальних та економічних аспектив, вони мають незначний вплив на відповідні громади. Однак, вони мають високий рівень співпраці між туристичним сектором та місцевою громадою.

Ключові слова: аналітика туристичних даних, модель впливу туризму, планування туризму

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TOURISM 4.0 TOOLS FOR FACILITATION OF SUSTAINABLE TOURISM DATA COMPARISON (USING A CASE STUDY FROM VYLKOVE AND SFÂNTU GHEORGHE IN THE DANUBE DELTA)

Topicality. Tourism is recognized as one of the most important commercial activities today. In 2019 it generated 10% of the total employment and represented a share of 10.4% of global GDP. Following the lead of cities, a growing number of towns and villages in rural areas are seeking to benefit from tourism, based on their local cultural and natural assets. This trend can be observed in the transboundary Danube Delta Biosphere Reserve of Romania and Ukraine where many formerly remote settlements have started to host increasing numbers of visitors. However, tourism
can also impose a number of negative economic, social and environmental impacts on the destination and its region that could undermine the very attractiveness of the destinations concerned.

Aims and tasks. A particular problem for authorities charged with developing regional rural tourism strategies and regulations is to have a standard method for assessing and comparing the visitor capacity and sustainability of different destinations. Emerging Tourism 4.0 technologies such as High-Performance Data Analytics (HPDA) can improve the efficiency and effectiveness of strategic planning and environmental sustainability. The general objective of the research reported here was to compare the current situation of two similar settlements in the Danube Delta Biosphere Reserve: Vylkove in Ukraine and Sfântu Gheorghe in Romania. In collaboration with the municipal councils, local businesses and civic organisations, we applied the Tourism Impact Model (TIM) developed by the Slovene company Arctur to data collected using the same methodology between August 2020 and May 2021. Overall, 295 questions were addressed. The data could be quantitative (amount of electricity or water used per day), or more subjective expert opinion (whether and when the settlement suffered from traffic congestion or satisfaction of residents with levels of incoming tourists). The data were also quality controlled and labelled according to their accuracy, type (digital or analogue) and frequency of collection.

Research results. With respect to Vylkove and Sfântu Gheorghe, in both cases the tourism data collected were not sufficient to produce a full analysis for an overall DCC assessment. However, it was possible to examine the data for each of the main TIM pillars individually (Environment, Economy, Social / Cultural and Collaboration) and make a comparison between the destinations. From these data, it is clear that while both destinations are generally managing tourism poorly (as Sleepers), Sfântu Gheorghe has a better overall condition than Vylkove across the four pillars since it scores higher in the Champion character. Vylkove suffers from having a large amount of missing data, probably because the town council derives little direct benefit from tourism (it is a receiver of impacts but most of the revenue goes to external parties) so it does not collect information. On the other hand, compared with Sfântu Gheorghe, it does not misuse or exploit its environment. Both destinations have a good level of collaboration between the tourism sector and the local community.

Conclusion. The results from the first application of the Tourism Impact Model in Vylkove and Sfântu Gheorghe show that both destinations have considerable potential for improving their performance and the sustainability of their tourism offers. At present, the lead is mostly taken by private initiative and investment, with little involvement of the local authorities. In particular, environmental, social and economic data are largely unavailable for planning sustainable tourism development, gaining benefits or mitigating impacts. These aspects merit further action and research as a matter of urgency.

Keywords: tourism data analytics, tourism impact model, tourism planning

Problem statement and its connection with important scientific and practical tasks. The tourism sector has been steadily growing in the Black Sea basin but still faces significant challenges affecting the sustainability of the sector in the longer-term (environmental pressures, peak visits in limited areas, poor overall visibility). These challenges could be addressed through better insights of current trends, in order to boost new services and introduce effective policy measures.

In recent years, there has been a marked increase in the number of visitors coming to the coastal zone of Odessa oblast in Ukraine, and Tulcea county in Romania, which together include the Danube delta. Most of the visitors are from the home country or their neighbours, with a certain amount of cross-border tourism (mainly to visit relatives). As a result, there has been increasing development of beach resorts, cottages, cabins and villas all along the foreshore, much of it unregulated. This has led to significant coastal pollution (plastic, effluents), human health issues from untreated sewage, erosion and landslides, as well as loss of habitats and protection for biodiversity. There is an urgent need to monitor and model tourist flows more accurately, put in place more strategic planning [1], and attract investment to develop better sustainable tourism facilities and services inland to relieve the pressure on the coast.

Analysis of recent publications on the problem. A recent analysis of the prospects of the marine and coastal tourism development in Ukraine [2] identified a range of problems for the sector, most of which are of a systemic political and economic nature. The authors used a structural analysis and design technique to build a qualitative functional flow chart model to explore the interaction of different positive and negative factors for marine and coastal tourism in Ukraine. In particular the current state is characterised by lack of government support for private actors and the poor state of the underlying infrastructure. The model can be used to describe the current and desired states of marine and coastal tourism.

Similarly, a new study has been made of the norms, rules, institutions, methods, activities and tools that together create equal opportunities in the use of socially significant recreational resources, harmonize the interests of the subjects of recreational nature management and contribute to the implementation of the goals of inclusive development [3]. It showed that institutional support for the inclusive development of tourism and recreational nature management should be built using a systematic approach, especially regulation of
property relations, ensuring environmental protection, providing social security, and building an effective system of information management and investment support.

The foregoing analysis shows that researchers, regulators and operators in the tourism sphere are largely unaware of the rapidly emerging technologies that can improve economic efficiency and environmental sustainability. To address this issue, in 2018 the government of Slovenia funded a research and development project under the term Tourism 4.0 [4]. This term reflects the ongoing industrial revolution known as Industry 4.0 [4, 5], which aims to achieve higher added-value products and services though operational efficiency and the automation of the production process by utilising modern digital technologies [6].

**Allocation of previously unsolved parts of the general problem.** Vylkove and Sfântu Gheorghe are small settlements situated inside the Danube Delta Biosphere Reserve, which is a global centre for biodiversity [7]. However, although both are well publicised on tourism web sites as interesting places to visit, they have not received much attention from academic researchers. As such, they provide a good opportunity to compare and contrast their respective approaches for developing and managing tourism.

Vylkove occupies an area of 4.60 km² with about 8,500 residents. Founded about 250 years ago, Vylkove was once situated on the Danube delta coast. Since then, the delta has moved out another 40 km or so, leaving the town behind at its present location on the bank of the Danube’s northernmost branch, called the Kilia. The original settlers were “Lipovans”, or “Old Believers” who in the 17th century opposed changes in Russian Orthodox rituals. They were persecuted and fled to remote parts of the Russian empire including the Danube delta. They survived on fishing (especially for sturgeon) and growing market crops. To build their cottages of reed and wattle, they created islands of dry land by digging sediments from trenches, forming a characteristic grid of square plots and canals. Until this day, the old town can be accessed only by footbridges or boat.

The main types of tourism are for cultural features, fishing, hunting and wildlife watching in the surrounding Danube Biosphere Reserve. It receives an estimated 35,000 – 50,000 visitors a year. The majority of them come on day trips from the nearby coastal holiday camp at Prymorske, by organised bus tours from Odessa, or on board river cruisers originating in Germany. There are two main tourism companies providing boat tours to the mouth of the delta where visitors can visit the “zero kilometre” monument on the shore of the Black Sea. The town has two hotels and a number of small cafes. Many individuals provide accommodation, as well as serving as tour guides around the old town and local fishermen also offer boat trips to the coast.

Until 1991, the Danube region of Ukraine was a strictly controlled border area within the Soviet Union, and had little contact within the USSR let alone outside of it. After Ukrainian independence in 1991, however, the economic situation in rural areas rapidly declined leading to high levels of unemployment and low pay [8]. Soon, young people began to migrate to cities and then went abroad. The process was exacerbated by the low level of political influence and has been largely marginalised or even excluded in recent national and regional development strategies. For example, the National Institute for Strategic Studies notes that Resolution №428 of the Cabinet of Ministers of Ukraine (31 March 31 2004) approved a Programme of Integrated Development of the Ukrainian Danube Region for 2004-2010 [9]. This was aimed at solving a number of issues related to socio-economic, environmental and cultural development of the Ukrainian Danube Region. However, since 2005, funding for the programme has effectively been suspended. These trends were have created a certain “solidarity of isolation” among local people who have had little opportunity to benefit from tourism income streams.

Sfântu Gheorghe is one of the smallest communes in Romania. Unlike other communes, it consists of only one village. Historically, the village never had more than 1,800 inhabitants (in the middle of the 1970s), and now has less than 900 inhabitants. The population of the village is slowly and consistently decreasing, as the environmental conditions and economic opportunities are challenging [10]. This region of present day Romania was part of the Ottoman Empire until 1878. After the Romanian administration took over this area of the Dobruja, the name of the village was also changed from Kadarlez to Sfântu Gheorghe. As in Vylkove, the village was settled in the middle of the 18th century by Lipovans [11] although it is marked as San Giorgio on one 14th century Genoese maritime map (the “Vesconti” map). According to official records (2011 Census), the majority of the inhabitants now declare themselves Romanians.

The economic activities of the inhabitants rely primarily on fishing, and secondarily on tourism. In Sfântu Gheorghe there are 17 official accommodation providers, with a capacity of 880 beds. Official records from the National Statistics Institute show that in 2018 there were 38,000 tourists that spent at least one night in Sfântu Gheorghe. Unofficial data provided to the media by the Danube Delta destination
management organisation mentions close to 48,000 tourists before the pandemic, with a higher number of tourists in 2020 as Romanian citizens mostly visited their own country in 2020. Most of the tourists that visit Sântu Gheorghe come for fishing, seaside tourism and cultural tourism (the Anonimul Film Festival at the end of the summer is a very big event for this location). There are also some Danube Delta cruises that stop in Sântu Gheorghe, but they only stay for a few hours before returning to Tulcea. Ecotourism is slowly growing in demand, especially birdwatching, but it is still a small part of tourism.

The Danube Delta in Romania, as part of northern Dobruja, was a heavily disputed region between the Ottoman and Tzarist empires. During the Russo-Turkish war of 1877-1878, the Ottoman empire lost northern Dobruja and the Danube Delta to Romania, but the region did not lose its peripheral position in the new state either. Already poorly developed, as the Russians and Ottomans fought 4 wars in the larger region during the 19th century, the new Romanian administration delayed investments in this region as much as possible [12]. Dobruja and the Danube delta fell even further behind during the 20th century. Inhabitants such as those in Sântu Gheorghe had only fishing as a means of subsistence. Communism after 1947, and capitalism after 1989, did little to change the scarcity of economic opportunities. Sântu Gheorghe is still very isolated, reachable only by boat. From the middle of the 1970s until now, the village lost almost half of its population. Development plans and funds were implemented with the pre-accession funds of the EU (from 2004), but official EU funds were invested specifically for the Danube Delta only since 2015. Tourism seems to be an alternative to diversify the economy, but many scientists and the Danube Delta Biosphere Administration stress the need for careful development of tourism, as the ecosystem is poorly suited for mass tourism [13].

To investigate these issues, within and also as a comparison between Vylkove and Sântu Gheorghe, we applied one of the main tools of the Tourism 4.0 platform, namely the Tourism Impact Model (TIM). Developed by Arctur, a high performance computing and data management company based in Slovenia, TIM is designed to collect and process quality-controlled data from local residents, various levels of government, businesses and tourist service providers, as well as the tourists themselves [1]. Analysis is undertaken through the application of Multi-Attribute Decision Making (MADM) theory, using the open source DEXi visualization and analytical platform [14] to help optimise business processes, improve the tourist experience and minimise the negative impacts of tourism. Examples of TIM applications in the Black Sea region have been reported for Odessa city in Ukraine [15] and Constanţa city in Romania [16].

In contrast to descriptive analyses published to date, TIM provides a standardised quantitative and dynamic tool for one or more destinations not only to determine the threshold values of their carrying capacity in terms of basic key indicators, but also allows assessment of the outcomes from different investment and policy interventions over time. Thus, destinations can determine their comparative advantages, opportunities and risks from different development models, and act accordingly to become places that people want to visit as well as live in.

**Formulation of research objectives (problem statement).** The general objective of the research reported here was to assess the readiness of relatively small tourist destinations in the Danube delta to implement the TIM tool. In addition, a comparison of the TIM results from Vylkove and Sântu Gheorghe were to be compared for differences, similarities and potential synergies between them.

**An outline of the main results and their justification.** Data collection for the TIM took place between August 2020 and May 2021 for the baseline year of 2019, in the same way as in Odessa [15]. The data could be quantitative (amount of electricity or water used per day), or more subjective expert opinion (whether and when the city suffers from traffic congestion or satisfaction of residents with levels of incoming tourists). The data was also quality controlled and labelled according to its accuracy, type (digital or analogue) and frequency of collection. Data sources fell into three broad categories: (i) government agencies at regional or national level, including the State Statistics Service of Ukraine and Ministry of Justice; (ii) private enterprises; and (3) civil society organisations, the general public and individual experts.

The overall result of the TIM analysis at a location is represented in a Destination Character Chart (DCC). The DCC is a tool for visualisation of the destination character, summarising values of hundreds of indicators grouped into a 3-dimensional matrix (Figure 1). The positive impacts of tourism (Benefits) are plotted on the X axis, and the negative impacts of tourism (Resource consumption) on the Y axis, giving 16 (4x4 cells) possible positions (Figure 1A). There are 4 different groups of primary characters, each containing 4 positions (Figure 1B), namely:

- Champions (high benefits, low resource consumption)
- Sleepers (low benefits, low resource consumption)
- Exploitors (high benefits, high resource consumption)
• Misusers (low benefits, high resource consumption)

The third dimension, representing the general condition (environmental, economic and societal situation) of the destination, is the colour of the position (Figure 1C): it can be green (excellent), yellow (mediocre) or red (bad). The final result (Figure 1D) is a combination of a position in 3-dimensional matrix (X, Y and colour) and direction of travel, showing the past position (if available from a previous assessment) and the current trend (estimations for the future). The final name of the destination character is a combination of past and present positions, as well as potential trend (indicated by the arrows). For example, in Figure 1D, the destination is categorised as a significant exploiter (gaining many benefits but using a lot of resources) with a mediocre condition. Future trends could move the destination to a better status (moving up or to the right) or to a worse condition (moving down or to the left).

With respect to Vylkove and Sfântu Gheorghe, in both cases unfortunately the tourism data collected were not sufficient to produce a full analysis for an overall DCC assessment. However, it was possible to examine the data for each of the main TIM pillars individually (Environment, Economy, Social / Cultural and Collaboration) and make a comparison between the destinations (Table 1 and Figure 2). From these data,
it is clear that while both destinations are generally managing tourism poorly (as Sleepers), Sfântu Gheorghe has a better overall condition than Vylkove across the four pillars since it scores higher in the Champion character. Vylkove suffers from having a large amount of missing data, probably because the town council derives little direct benefit from tourism (it is a receiver of impacts but most of the revenue goes to external parties) so it does not collect information. On the other hand, compared with Sfântu Gheorghe, it does not misuse or exploit its environment. Both destinations have a good level of collaboration between the tourism sector and the local community.

Table 1

<table>
<thead>
<tr>
<th>TIM Pillar</th>
<th>Misuser</th>
<th>Exploiter</th>
<th>Sleeper</th>
<th>Champion</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vylkove</td>
<td>0</td>
<td>0</td>
<td>64</td>
<td>0</td>
<td>36</td>
</tr>
<tr>
<td>Sf. Gheorghe</td>
<td>27</td>
<td>9</td>
<td>27</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>Environment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Economy</td>
<td>0</td>
<td>0</td>
<td>57</td>
<td>86</td>
<td>0</td>
</tr>
<tr>
<td>Social / Cultural</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>86</td>
<td>13</td>
</tr>
<tr>
<td>Collaboration</td>
<td>0</td>
<td>0</td>
<td>80</td>
<td>80</td>
<td>0</td>
</tr>
</tbody>
</table>

Figures are the percentage of data fitting a destination character for each TIM pillar.

Fig. 2 TIM Destination Character Charts for Vylkove (upper) and Sfântu Gheorghe (lower)
Source: Arctur d.o.o.
Conclusions and perspectives of further research. The Tourism 4.0 approach seeks to combine technological infrastructure with collaborative dialogue and data sharing among all relevant stakeholders in order to spur innovation potential in the local tourism industry. It provides a standard quantitative baseline for individual destinations, as well as a common method for comparisons between them. Unfortunately, it could not be fully implemented in Vylkove or Sfântu Gheorghe. Too much of the required data from these localities are infrequently or not collected, incomplete, inaccessible, or not measured in line with international standards. As a result, only partial results could be obtained and no overall assessment of status could be obtained. This also meant that the modelling aspect of TIM was not tested and the underlying thresholds and interactions that would define positioning in different quadrants of the Destination Chart remained unclear.

Nevertheless, the results that were obtained from the first application of the Tourism Impact Model in Vylkove and Sfântu Gheorghe show that both destinations have considerable potential for improving their performance and the sustainability of their tourism offers. Local stakeholders were broadly engaged with the study and appreciated the significance of Tourism 4.0 approaches in achieving more sustainable tourism outcomes. However, there was a severe lack of knowledge and capacity for effective (i.e. useful and appropriate) data collection and analysis, and a need for engagement by the government bodies that have overall responsibility and power for the region where the destinations lie. At present, the lead is mostly taken by private initiative and investment, with little involvement of the local authorities. In particular, environmental, social and economic data are largely unavailable for planning sustainable tourism development, gaining benefits or mitigating impacts. These aspects merit further action and research as a matter of urgency.

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REFERENCES


13. Strategia Integrată de Dezvoltare Durabilă a Deltei Dunării (SIDDD, 2016), accessed at: http://assets.itideltadunarii.com/PortalAssets/Fisiere/Strategia%20Integrata%C4%83%20Dezvoltare%20Durabil%C4%83%20a%20Deltei%20Dun%C4%83rii/SIDDDD%20HG%202016.pdf

