Enhancing tourism sustainability: A data-driven approach to carrying capacity analysis and soft policy implementation

The research on tourism carrying capacity (TCC) seeks to comprehend the adverse effects exerted by overwhelming tourist pressure on a destination's resources. Contemporary tourism scenarios increasingly denote an intrinsic complexity of dynamics layered in contexts that are often not exclusively tourism-oriented, generating significant impacts on the surrounding environment and the perception of it, both by visitors and residents, often with a negative connotation. Simultaneously, the concept of overtourism has been widely debated in recent years. Conversely, TCC is very important for planning and management that aims to identify the acceptable level of intensity of anthropogenic changes caused by tourists in a specific area, while its application indicates the ideal conditions for development (Bertocchi et al, 2020). When it comes to intend a heterogeneous group of physical, social, and economic effects, the considerations arising from the interrelation of these dimensions of a destination's sustainability have prompted studies of carrying capacity and overtourism to be associated with the concept of “excess,” often attempting to determine a maximum number of visitors. This allows to maintain a balance between both the physical-social environment and the quality of the experience for the visitor, conceiving a dynamic management solution used to improve tourist visitation, implement sustainable management and cope with the issue of overtourism (Coccossis and Mexa, 2004).

Thus, the primary goal is to foster the development of effective response strategies to support more sustainable tourism. However, the implementation of these strategies often faces challenges, leading to the frequent imposition of difficult-to-enforce limits on tourist flows. For instance, some tourist destinations when related to seasonal tourism face a huge pressure of these flows in specific areas. Applying too strict or overgeneralized limits to the whole destination has the potential to penalize areas that are not directly affected and fail to solve congestion points. Also decreeing the difficulty and failure of these policies is the responsibility that arises for administrations to implement policies that are suitable for a heterogeneous system. There are no one-size-fits-all solutions to solve the problems (Koens et al., 2018), on the contrary, each destination requires a more detailed and specific analysis of tourism subsystems in order to avoid generic and sketchy restriction policies on the entire

destination. Limitations should therefore be based on targeted policies, detailed analysis, and concrete data at the subsystem level, which is the reason that drives the search for new, more consistent approaches to specific problems (Coccossis and Mexa, 2017).

This study aims to underscore the significance of a data-driven approach in identifying crucial pressure points. If the maximum stress thresholds of the system were evaluated, the outcomes would be associated with an imposition of a maximum limit on the number of visitors, broken down by tourist type, applied to the entire tourist destination. The calculation of the tourism carrying capacity through a linear programming is based on a computational model of the TCC which seeks to maximize the daily profit within the maximum stress thresholds that the subsystems can withstand, without being overcome by the entire system (Costa and Canestrelli, 1991). The computation of the TCC is conceptualized as an optimization challenge geared towards maximizing the benefits derived from tourism for a destination. These benefits are quantified in terms of monetary revenues, determined by the expenditures of tourists across various types of visits (H, NH and E). The model is designed to operate within specific constraints, ensuring that the increasing number of visitors does not surpass the maximum stress levels that each tourist subsystem within a destination can endure. This requires the following steps: 1) identify the tourism subsystems of a destination, especially regarding tourism facilities and services; 2) classify the type of users who often utilize those subsystems; 3) determine the level of usage of these subsystems by user profile; 4) proceed with the analysis with the purpose of maximizing the revenue of the destination through understanding the daily expenditure per each profile. Our study aims to intervene in a phase where bottlenecks are systematically evaluated through the segmentation of the tourism subsystem (3) and the analysis of various visitor types. Through simulations in the change of ecosystem coefficients relating to the rates of use of tourist resources rather than limited changes in the stress capacity of each subsystem, it is possible to explore alternative and more adaptable approaches. The level of usage is fundamental to interpret the impacts of the profiles on the destination, having each of them a different behavior in using the services expressed with the subsystems. This has required the administration of stakeholder surveys from which it is possible to trace profiled responses. Each destination provided n=100 correctly completed stakeholder surveys.

This method provides a more precise and detailed understanding of tourist flows, guiding the formulation of intervention strategies that prioritize adaptability and optimization of tourist resources over rigid flow limitations. Three case studies are examined within their systemic context, utilizing a carrying capacity scenario simulator and a predefined set of indicators. Being heavily reliant on seasonal tourism, this results in a high concentration of visitors during summertime and a severe decrease during the off-season. The condition of seasonality leads to carrying capacity issues that affect the quality of tourists' experience and local needs. We argue these case studies are ideal to identify in advance the potential saturation point during the peak season and consequently defining strategic plans to avoid the creation of bottlenecks. Further operationalizations are pursued to conduct more simulations and/or solve the susceptibility grades of the subsystems, providing other scenarios as recommendations for future management implications. The simulations describe a range of possible scenarios and not a static reality, implying that working on other modifications may lead to different interpretations. The goal is resolving the critical subsystems within the indicated range by ensuring a heterogeneous presence of all three profiles.

The results highlight the effectiveness of adopting soft policies to address excessive tourism pressure, without the need for stringent measures and significant infrastructure investments. This study aims to highlight a complementary inference of the TCC model outlining sectorial and specific implications and not just an overall condition of the destination. This approach allows for a more targeted and comprehensive analysis of the issues and challenges facing a destination. By identifying sector-specific bottlenecks, tourism stakeholders can develop tailored strategies to address these challenges. Furthermore, by treating these issues as leverage for the enhancement of new strategies in sustainable destination management, this TCC model can help to promote profitable practices that balance economic, environmental, and social factors.

Finally, the progress of the study stands as important element for implementation, in-depth analysis, and future research development. Firstly, the model originally included the subsystem pertaining waste management. For the sake of the study this subsystem has not been considered due to the difficulty of collecting pertinent and consistent data. However, it becomes an opportunity for thorough research and a fundamental implementation in data

collection practices. Secondly, it would be interesting to further investigate the relationships among the various bottlenecks and identify the indices of influence among them. Understanding the interconnectedness of these elements will contribute to more effective destination planning. Additional insights can be even studied through the focus on the other subsystems, some of them having been subjected to modifications. This could lead to pivotal and inferential role when relating to the marketing effort and the digital management visitor flows, promoting the cultural urban network to overcome over-visiting and bottlenecks-related issues.

References

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