

# Chapter 3

## Towards a New Analytical Framework for Tourism Sustainability Using Data Science

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### ABSTRACT

*The duality of tourism in the context of sustainability represents one of the sector's greatest contemporary challenges. This phenomenon acts as an engine of socioeconomic development, generating employment opportunities and improving people's quality of life. However, its development also entails adverse environmental impacts, including intensive use of natural resources, high levels of pollution, large accumulation of waste, among others. The purpose of this theoretical review is to highlight the importance of sustainability in the tourism sector, applying data science as a methodological framework for its analysis. In this way, we explore sustainability and data science, two growing and constantly evolving topics, providing a conceptual basis for understanding how they are related and integrated in the field of tourism research.*

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### 3.1 INTRODUCTION

The sustainable development paradigm, established in the 1987 Brundtland Report (WCED, 1987), marked a milestone by positioning sustainability as one of the fundamental pillars of global development. This approach seeks to comprehensively address environmental, social and economic challenges (Chaminade, 2020; Fernandes et al., 2022). Since then, the concept of “sustainable development” is understood as meeting the needs of the present without compromising the ability to meet the needs of future generations (WCED, 1987). Consequently, sustainability has become an essential strategy for future development, driving new models of economic growth that aim to diminish negative impacts over a longer time frame.

Over time, this paradigm has expanded and has involved various actors in society (governments, companies, individuals, etc.), generating new initiatives and concepts that lead to the sustainable development sought. One of these is the paradigm of sustainable tourism development, which refers to tourism activity that contemplates current and future impacts, meeting the needs of tourists, the industry and the environment (Lee & Xue, 2020). In addition, sustainability takes on particular relevance in tourism, due to the significant positive and negative impacts that this industry generates on the planet and society (Henderson, 2007).

Tourism research in sustainability has evolved from the development of theoretical principles to the implementation of practices that actively engage different stakeholders (Bramwell et al., 2017; Ruhanen et al., 2015; Sharpley, 2020). A holistic approach to sustainable tourism identifies four key stakeholder groups: residents, tourists, companies, and government (McIntosh et al., 1995; Salee et al., 2022). These stakeholders, with their diverse perspectives, needs and influences, form an integral and dynamic ecosystem that is crucial for the transition to a more responsible and balanced tourism model. Analysis of these key stakeholders and their interactions can provide a deeper and more detailed understanding of the challenges and opportunities in implementing sustainable practices in the tourism sector. Also, recent research, such as that of Alonso-Muñoz et al. (2023), points out that research on sustainability and tourism continues to be fragmented, as most studies are oriented to specific subsectors, particular destinations, or specific sustainability problems. Therefore, the current literature does not offer a comprehensive and updated view of the field.

Similarly, scientific advancement is increasingly driven by advanced computational capabilities that enable researchers to transform and analyze large volumes of data (Hey et al., 2009). Pennington et al. (2020) emphasize the urgent need to train future scientists with expertise in both their specific fields and in data science. The authors point out that no single discipline can address all of the current challenges associated with the dire situation of planetary unsustainability. Consequently, an integrative approach is required, where knowledge from different disciplines is combined to find more sustainable and effective solutions. However, Boyd & Crawford (2012) highlight that, although data science and big data approaches offer new opportunities for analysis and research, their use comes with significant ethical, social and methodological challenges that need to be critically addressed.

Data science has emerged as a key tool for analyzing and understanding large volumes of information in the tourism sector, especially as it relates to sustainability. However, despite the obvious benefits of big data analysis, tourism academics have yet to fully integrate these tools and methodologies into their research (Köseoglu et al., 2020; van der Zee et al., 2020). There are multiple data sources relevant to big data analytics in tourism, such as data from devices, transactions, and User Generated Content (UGC)

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