

## **Towards the future of tourism: A bibliometric analysis of the fourth industrial revolution in the tourism industry**

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**Objectives** | Technology has been changing the travel and tourism industry since its beginning. After World War II, there was a noteworthy global rise in journeys. Among the factors that contributed to this growth are geopolitical stability, the development of commercial aviation, higher wages and changes in cultural attitudes toward travel. Additionally, the introduction of computerized systems in airlines made travel logistics simpler. More recently, the sector has been going through new changes, specifically caused by the digital paradigm, with technology playing a very influential role on tourism destination management and traveller's experience. This is primarily due to the 4th industrial revolution and its technologies, such as AR/VR, artificial intelligence, robots and blockchain. Although there are countless examples of the application of these technologies (e.g., Pencarelli, 2019; Stankov & Gretzel, 2020; Osei et al., 2020), few studies discuss the part played by this industrial revolution in the tourism sector. This study follows a holistic perspective of the tourism sector, considering all of its subsectors, while trying to answer two research questions: (1) What technologies from industry 4.0 are being implemented in the tourism sector? and (2) Which tourism fields and areas are embracing the industry 4.0 technologies? Within its five sections, it is possible to find a literature review centred on the relation between tourism and industry 4.0, followed by a description of how the study was conducted and the results that arose from the performed analysis. Finally, conclusions are displayed and analysed, while some suggestions for future research are given.

**Methodology** | This study followed a bibliometric analysis to explore current literature connecting tourism and industry 4.0. This method employs quantitative techniques to measure specific features of academic studies on a particular topic. The bibliography was selected based on a research protocol, that used the following terms: "4.0 technologies", "cyber-physical systems", "fourth industrial revolution", "industrie 4.0", "smart manufacturing" or "smart factory". This search string was applied in both SCOPUS and Web of Science and no period limitation was defined. The search resulted in a combined amount of 1120 publications, of which the duplicates were removed and some filters were applied, namely, language (English, Portuguese and Spanish), and type of

document (papers, conference papers, book chapters). On the remaining documents, an individual analysis was conducted, to ensure their alignment with the research topic. This resulted in a total of 103 documents for analysis.

After ensuring the validity of the information and verifying that there were no inconsistencies among the items, the analysis was conducted. The aim was to understand the evolution of publications per year and the most influential studies, authors, journals and research areas. A keyword network was created with the assistance of the VOSviewer software. A clustering technique was then applied and different clusters were identified.

**Main Results and Contributions** | The number of publications on the digital transformation of the tourism industry have been increasing, with the first one being in 2016. Between 2018 and 2019, the number of publications grew by 180%. The study by Bodkhe et al. (2020) stands out as the most cited document, with 389 citations, followed by Pencarelli (2020) with 211 citations and Lee and Lee (2019) with 168 citations. The most cited papers focus mostly on blockchain, the digital revolution, tourism 4.0 and robots.

As for the number of publications per journal, it was found that the great majority (83%) of source titles with publications in this domain had only one publication. Out of the remaining, Sustainability had the highest number of documents (40), followed by 'Procedia Computer Science', 'Information Technology and Tourism', 'Technology Application in Tourism in Asia: Innovations, Theories and Practices', 'Impact of Industry 4.0 on Sustainable Tourism' and 'African Journal of Hospitality, Tourism and Leisure', with three publications each. This showed that there are no sources specifically focused on this topic while also showing how versatile the topic is.

The keyword network analysis shows a total of 274 keywords grouped into 20 clusters. Among these, the most representative ones were related to topics such as (i) I4.0 technologies implementation in the hospitality industry, (ii) advantages and disadvantages of the fourth industrial revolution in the tourism panorama; (iii) smart tourism and tourism 4.0; and (iv) adoption of mixed reality in both destination and businesses settings.

**Limitations** | Considering that this was a bibliometric analysis, a more detailed analysis of the selected documents could have been conducted. Second, other bibliometric analyses could have been considered and carried out, such as the distribution/cooperation of authors per affiliation country and co-citation analysis. A third limitation is related to the technical constraints of the VOSviewer software. The fact that two databases were used caused the software to only allow for some of its features, excluding the possibility of conducting some relevant analysis.

**Conclusions** | The present research on the current state of the digital transformation in the tourism industry demonstrate that the principal areas of concern are hospitality and destination

marketing, while the most frequently mentioned technologies are blockchain, AI, robots, the IoT, mixed reality, and big data.

Regarding the contributions of this study, the identification of the industry 4.0 technologies currently used in the tourism industry is the most relevant theoretical provision. However, the literature has been mostly focused on the hospitality and restaurant areas hence future research should concern other sub-sectors. Additionally, out of the analysed studies, only three were concerned with the digital skills and digital literacy of tourism managers, workers and students. This identifies a literature gap that should be taken into consideration by future studies. Finally, cybersecurity and legislation have also been neglected in these studies. This is a very sensitive subject that all stakeholders should pay attention to due to the growing number of cyber-attacks hence more academic studies are essential.

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