

Analysis of scientific literature on robotics-based services and processes in tourism and hospitality – contribution of Central and Eastern European Countries

Analiza naučne literature o uslugama i procesima zasnovanim na robotici u turizmu i ugostiteljstvu – doprinos zemalja Centralne i Istočne Evrope

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Abstract

The purpose of this paper is to analyse the scientific contribution of authors from Central and Eastern European countries to the scientific literature on services and processes based on robotics in tourism and hospitality. The research included an analysis of journals in the field of tourism and hospitality indexed on the Journal Citation Reports within the Web of Science. Results showed that starting from 2019 six authors from the Central and Eastern European countries (Bulgaria, Romania, Czech Republic, and Russia) published a total of 13 papers on the application of robots in tourism and hospitality. The total number of citations of papers by authors from Central and Eastern European countries is 1.214, and the average number is 93.38. Regarding collaboration, more than 60% of papers by authors from Central and Eastern European countries have authors from a total of two countries.

Keywords: robot, services, tourism, hospitality, bibliometric analysis

Sažetak

Svrha ovog rada je analiza naučnog doprinosa autora iz zemalja Centralne i Istočne Evrope naučnoj literaturi o uslugama i procesima zasnovanim na robotici u turizmu i ugostiteljstvu. Istraživanje je obuhvatilo analizu časopisa iz oblasti turizma i ugostiteljstva koji su indeksirani u Journal Citation Reports u okviru Web of Science. Rezultati su pokazali da je od 2019. godine šest autora iz zemalja Centralne i Istočne Evrope (Bugarske, Rumunije, Češke i Rusije) objavilo ukupno 13 radova o primeni robota u turizmu i ugostiteljstvu. Ukupan broj citata za radove koje su objavili autori iz zemalja Centralne i Istočne Evrope je 1.214, dok je prosečan broj 93,38. U pogledu saradnje, na više od 60% radova autora iz zemalja Centralne i Istočne Evrope su prisutni autori iz ukupno dve zemlje.

Ključne reči: roboti, usluge, turizam, ugostiteljstvo, bibliometrijska analiza


1. Introduction

Technological innovations have always had an impact on the overall growth of civilization, leaving a mark in every industry sector. During the fifth industrial revolution, tourism and hospitality started implementing various robots and robotics systems (Drexler & Lapré, 2019). Robots represent “system-based autonomous and adaptable interfaces that interact, communicate and deliver service” (Wirtz et al., 2018, p. 909). The use of robots provides several benefits to organizations, including lower costs, increased productivity, and profits

(Kim et al., 2023; Madhan et al., 2023), as well as attracting customer interest and improving customer experience while reducing employee workload and stress (Song et al., 2022; Xu et al., 2023). Service robots in tourism and hospitality may be used as support for routine and simple tasks, substitute for humans in a sequence of service encounters, differentiation factor in the market used to attract customer interest, means for improving efficiency, resource utilization, service quality, and means for upskilling employees to new skillsets required for successful functioning (Tuomi et al., 2021). In addition, special types of social robots have the ability to follow

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behavioural norms and interact and communicate with humans (Chi et al., 2020), potentially improving the guest/tourist experience and service quality (Fusté-Forné & Jamal, 2021). The perfect humanoid robot follows social conventions, exhibits empathy and comprehension, and showcases the precision and speed of an automated system (Murphy et al., 2017).

Robots are becoming more popular in hotels, with the first robot hotel, Henn-na, opening in Japan in 2015. Since then, various types of robots have been used in major hotels, including a smart concierge robot Connie at the Hilton Hotel, robot attendants Leo and Cleo at the Marriott International, service robot Pepper at the Mandarin Oriental Hotel (Chen et al., 2023), Botlrs as the first autonomous robot for hotel delivery services in Aloft hotels (Luo et al., 2021), as well as autonomous delivery robots Relay and Wally at the Holiday Inn Express hotels, Redisence Inn by Marriott and Aloft, and robots Jeni and Jena at the Hotel Jen in Singapore (Reis et al., 2020). Various robotics solutions are used for programmable housekeeping, in assisting lobby participants, concierges, as well as waiters in restaurants (Drexler & Lapré, 2019). All these changes announce the arrival of Hospitality 5.0, which stands for the cooperative efforts of people and technology to create a society that is resilient, sustainable, and centered on people (Xu et al., 2023).

The use of robots and robotic systems in tourism and hospitality has been positioned as important and valuable in developed economies such as the United States, the United Kingdom, China, Japan, and Taiwan (Ivanov et al., 2019). In contrast, research on transitioning and developing economies is much rarer and has only recently appeared. This research aims to assess the scientific contribution of researchers from Central and Eastern European (CEE) nations to the scientific literature on robotics-based services and processes in tourism and hospitality. The value of this study is in identifying the most notable and referenced authors and articles from CEE nations, as well as the most important subjects in published papers.

This paper's theoretical contribution derives from a review of earlier studies on the application of robots in tourism and hospitality conducted by authors from CEE countries. These studies were published in some of the most prestigious international publications in the field.

This focuses attention on a group of countries that hold a prominent geostrategic position in Europe, but whose significance may be overlooked because of the emphasis on the countries of Western Europe or the European Union. It was established how many publications were from the CEE countries and how much of a contribution they made to earlier studies on the use of robotics in tourism and hospitality. Additionally, the distribution of papers among journals, countries, authors, international collaboration, and citations are highlighted. Additionally, a summary of all the publications was provided, and their content was examined in order to emphasize the individual contributions that each one made to science and the field. The most essential and up-to-date research areas are highlighted, laying the groundwork for future theoretical concerns. Based on this, it is emphasized that the authors from CEE countries identified the most important factors in the development of robotic-based services and processes in tourism and hospitality.

The paper is organized as follows. After an introduction in which the importance and role of robots in tourism and hospitality industry was pointed out, the methodology of the conducted research was presented, along with a detailed description of the bibliometric method. After that, the results of the research and discussion of the obtained results are presented. At the end of the paper, a conclusion is given with key theoretical and practical implications of the research findings, as well as the key limitations and suggestions for future research on this topic.

2. Research methodology

In this paper is applied bibliometric analysis which entails extracting data from publications and analysing it in order to answer questions about the research represented by those publications (Belter, 2015). Bibliometric analysis provides systematic research that point out qualitative and quantitative changes in a particular field of research. In this paper is applied bibliometric analysis procedure defined by Donthu et al. (2021). This procedure is presented in Table 1.

Bibliometric analysis is especially common among authors from tourism and hospitality, as demonstrated by the number of published papers that use this method (Koseoglu et al., 2016; Ülker et al., 2023).

Table 1. Bibliometric analysis procedure

Phase	Description	Used approach
1	The aims and scope of the research	The aim of this research is to identify the temporal frequency of scientific papers published by authors from CEE countries, as well as the most important journals, authors, countries, papers, and research topics.
2	Selection of techniques for bibliometric analysis	Techniques used for bibliometric analysis are: <ul style="list-style-type: none"> – Performance analysis (number of published papers on a yearly basis, journals, countries, authors); – Science mapping (co-word analysis, co-authorship analysis, network metrics, clustering, visualization).

Table 1. (continued)

Phase	Description	Used approach
3	Collection of data for bibliometric analysis	<p>Data were collected from Web of Science (WoS), an academic database that includes quality journals and at the same time separates tourism and hospitality as an independent category (Chen et al., 2023). The analysis included journals indexed on the Journal Citation Reports (JCR) within the WoS. Papers on tourism and hospitality are published in a variety of publications, depending on the perspective from which they are addressed. As a result, tourism and hospitality can be the primary or secondary focus of a paper. To choose the most relevant journals from the area of tourism and hospitality, with tourism and hospitality as the primary topic, those with titles that directly connect to the indicated field were selected. The same or similar method of journal selection is present in the previous literature in the domain of bibliometric analysis in tourism and hospitality (Anđelić et al., 2019; Dimitrovski et al., 2019; Garabinović et al., 2021; Garabinović et al., 2023; Lukić Nikolić & Garabinović, 2023; Leković et al., 2023; Papić et al., 2023). It was discovered that there are 27 journals with names that directly refer to the studied field (tourism/hospitality).</p> <p>The following publishers have been identified (number of journals): Elsevier/Science Direct (8); Taylor & Francis online (8); Sage journals (6); Emerald Insight/Emerald Publishing (3); Wiley Online Library (1); and Springer/Springer Nature (1).</p> <p>The search was conducted at the end of August 2023 and there was no time limit regarding the year of publication of the papers. Paper search options on the websites of the journal publishers were used. Parts of the papers included in the search were: title, abstract and keywords.</p> <p>The defined search terms were robot or robotics. Each paper was additionally read in order to confirm the justification of its inclusion in the further analysis.</p> <p>A total of 208 papers matched the aforementioned criteria.</p> <p>Additional criteria for final selection were the authors' affiliation in Central and Eastern European countries. The countries included in the analysis were chosen based on their geographical location in the CEE region (EU Vocabularies – Publication Office of the EU, n.d.).</p> <p>A total of 13 papers fulfilled these criteria.</p>
4	Conducting analysis	<p>For data processing and analysis were applied the following software:</p> <ul style="list-style-type: none"> – Microsoft® Excel® 2019; and – VOSviewer 1.6.19. – suitable for bibliometric analysis (van Eck & Waltman, 2010).

Source: Authors

3. Research results and discussion

in tourism and hospitality. The temporal dynamics of publication of papers is presented in Table 2.

Starting from 2019, authors from the CEE countries published a total of 13 papers on the application of robots

Table 2. Time distribution of papers whose authors are from institutions from CEE countries

Year	Number of papers	Percentage of total number of papers	Percentage of papers from CEE
2019	1	9.09	7.69
2020	4	10.00	30.77
2021	2	5.41	15.38
2022	2	3.92	15.38
2023	4	7.14	30.77

Source: Authors

Most articles by authors from CEE institutions were published in 2020 (30.77%), when they accounted for the greatest proportion of the overall yearly number of published papers (10.00%). The average annual number of published papers is 2.60. The average yearly involvement in the total number of published articles is 7.11 percent. The majority of the papers (seven in total) are from the second decade of the twenty-first century, accounting for 53.85%. CEE nations accounted for 12.07% of total published papers in the second decade of the twenty-first century and 4.17% of total articles published in the third decade of the twenty-first century.

The papers were published in eight journals (Figure 1). Most of the papers were published in the “Journal of Hospitality and Tourism Technology” – 3 papers, i.e., 23.08%.

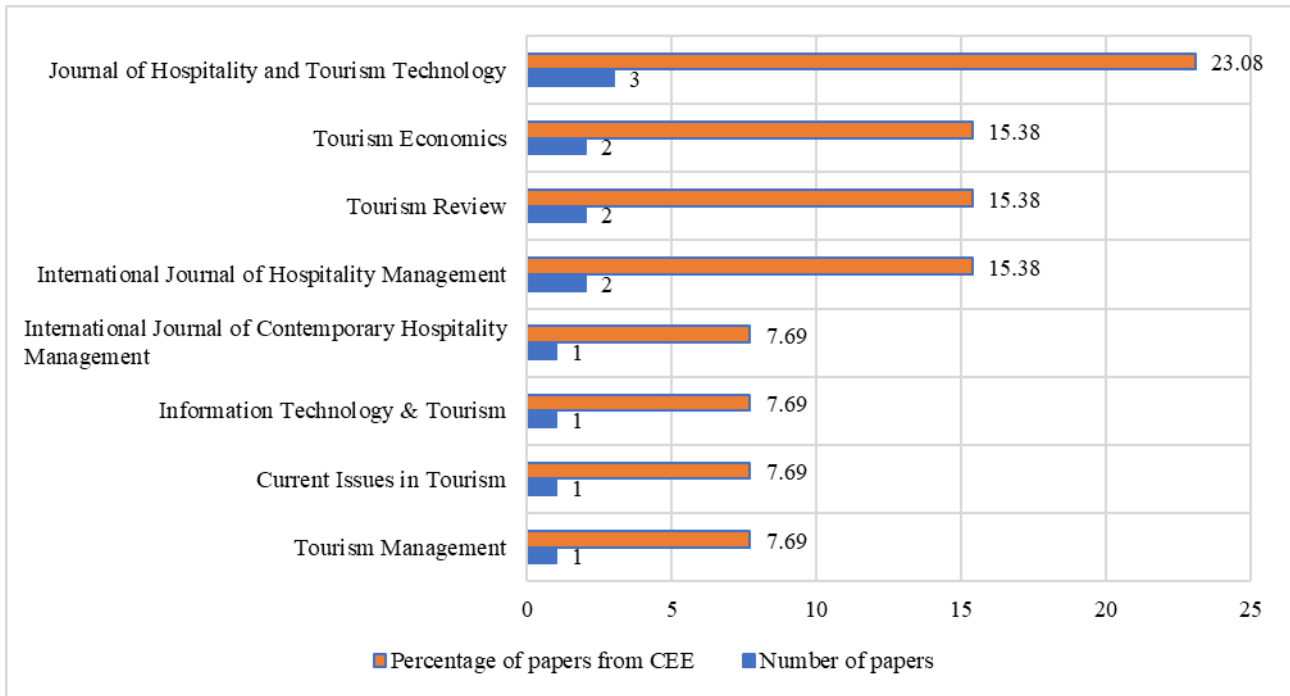
Six authors were from institutions located in CEE countries, which represents 1.30% of all authors. Of the stated number of authors, two authors have two or more papers. Author Stanislav Ivanov (Bulgaria) has published 10 papers, which is 76.92% of papers from CEE countries. The mentioned author also occupies the third position in terms of share in the total number of published papers on the application of robots in tourism and hospitality (4.81%). Another author who has two published papers is Olimpia State (Romania), which is 15.38% of papers from CEE countries.

Five authors from CEE countries (83.33%) have papers that have been cited. According to the criterion of the total number of citations (1,177), the most important author from CEE countries is Stanislav Ivanov (Bulgaria). The mentioned author has 96.95% of all citations of papers by authors from CEE countries. The mentioned author has 338.13 total annual average number of citations and

according to this criterion he ranks first among authors from CEE countries. The first place according to the criterion of the average number of citations per paper is taken by Martina Markova (Bulgaria) – 152.

The total number of citations of papers by authors from CEE countries is 1,214, and the average number is 93.38. The most cited paper with 299 citations is Ivanov et al. (2019). The paper with the highest average annual citations (73.67) is Seyitoğlu & Ivanov (2021).

Figure 1. Distribution of papers from CEE countries by journals



Source: Authors

Regarding the CEE countries, authors from four countries participated in the writing of papers: Bulgaria, Romania, Czech Republic, and Russia. The mentioned countries make up 10.53% of all countries whose authors have papers on the application of robots in tourism and hospitality. There was a total of 13 papers from the mentioned group of countries. Most papers were from Bulgaria (10 papers, i.e., 76.92%), followed by Romania (2 papers, i.e., 15.38%), and the Czech Republic and

Russia each have one paper, i.e., 7.69% each participation. Half of the authors are from Bulgaria (0.65% of all authors), and one author each comes from institutions from Romania, the Czech Republic and Russia (each has a 0.22% share in the total number of authors).

The collaboration of authors from CEE countries with authors from other countries is shown in Figure 2.

Figure 2. Collaboration between authors from CEE countries with authors from other countries



Source: Authors

All papers from Bulgaria were written in collaboration with authors from other countries. Cooperation with six countries was achieved. Half of the papers (5 papers) were written in collaboration with authors from the USA. Then follow: Turkey (4 papers, i.e., 40.00%), Portugal (1 paper, i.e., 10.00%), Italy (1 paper, i.e., 10.00%), Czech Republic (1 paper, i.e., 10.00%). All papers from Romania were

written in collaboration with authors from other countries. In both papers by authors from Romania, collaboration was achieved with five countries – USA, Spain, UK, Israel, and India. The paper from the Czech Republic was written in collaboration with authors from two countries – Bulgaria and the USA. The author of the paper from Russia also mentioned an institution from another country

Table 3. (continued)

Authors (year)	Topics/Contributions
Seyitoğlu & Ivanov (2020)	The health crisis caused by <i>COVID19</i> caused a focus on distancing between supply and demand. The paper presents the service delivery system design framework for hospitality companies.
Webster & Ivanov (2020)	An attempt was made to answer the question of what tourism will be like in a robonomic society. The perspectives of robonomic society and tourism in that society were analysed.
Ivanov & Webster (2021)	Willingness to pay potential customers for robot-delivered services (respondents from 99 countries). Key findings: – Expectation to pay less for robotic services (almost the same price or big discounts); – Correlation: positive (“attitudes towards robots in tourism, robotic service experience expectations, men and household size”), negative (“travel frequency, age and education”).
Seyitoğlu & Ivanov (2021)	Service robots are seen as a way to achieve physical distance during the pandemic. Their application creates physical, but also emotional distance (employees-tourists), which needs to be replaced by the application of appropriate technological solutions.
Ivanov et al. (2022)	The situation caused by <i>COVID19</i> has shown the importance of biosecurity of customers. It was analysed how automation technologies can reduce the negative economic effects of biosecurity threats.
Pizam et al. (2022)	The intention to adopt robots among hotel managers is influenced by: – Positive impacts: relative advantage; competitive pressure; top management support; – Negative impact: complexity; – Moderating impact: innovativeness.
Helal (2023)	The effects of digital transformation of fast-food restaurant customers (Egypt) were analysed. The following significant impacts were identified: Technical readiness → Technology acceptance → Perceived (hedonic and utilitarian) values → Well-being.
Ivanov et al. (2023)	The contribution of robots to sustainable development was examined. It was established that robots can have both a positive and a negative impact, depending on the observed goal of sustainable development.
Ozturk et al. (2023)	The intention to use robots by hotel customers (11 countries) was examined. The utilitarian and hedonistic perception of value had a positive influence on it. The perception of ease of use and compatibility had a positive impact on the aforementioned perceptions.
Seyitoğlu & Ivanov (2023)	The relationship between robot-based services and perceived discrimination was examined. The focus was on two groups – employees and tourists. The conclusion is that robotic systems can contribute to reducing, but also increasing perceived discrimination within each of the two groups separately, as well as between groups.

Source: Authors

After reviewing the papers of authors from CEE countries, the following conclusions can be made. A special emphasis is made on analysing current or potential service consumers. Also, the manager's attitude regarding the usage of robots is vital. Hotels were the most extensively studied of the supply-side hospitality enterprises. Robots' ability to create distance between service providers and users, particularly during times of health crisis (such as *COVID19*) was also important factor. The emotional element of service provision is significant, and it requires the participation of human resources, as well as the further development of technology in order to bridge social distance. Economic aspects of the application of robots in tourism and hospitality are also one of the significant topics.

There are only a few authors from CEE countries who have papers on the topic of robotics application in tourism and hospitality that were published in the analysed journals. Furthermore, a small number of authors from institutions located in CEE countries wrote the mentioned papers. For the above reasons, it is necessary to promote the application of robotics in tourism and hospitality. Some of the guidelines are:

- Improving the technical-technological competences of tourism and hospitality students by introducing new subjects/courses in the field of application of new technologies or greater representation of technological competences in already existing subjects. Actualization of robotics applications in tourism and hospitality through the establishment of new multidisciplinary higher education study

- programs at both technical-technological institutions and social-humanistic research institutions.
- Initiation of new and inclusion in existing international projects in the field of application of new technologies, especially robots, with a special focus on tourism and hospitality.
- Changing existing and adopting new regulations regarding the application of contemporary technologies in the economy, with special emphasis on robotics and artificial intelligence.
- Establishing and fostering inter-institutional collaboration, not only between individual researchers.
- Strengthen cooperation among CEE countries through new or existing regional economic initiatives.
- Strengthen the cooperation between CEE countries and leading countries in the development of robotics and artificial intelligence.
- Initiate collaboration between scientific-research organizations in technical-technological sciences and tourism-hospitality industry.
- Encourage the development of startup companies in the field of information technology and the development of innovations in robotics applicable in tourism and hospitality.

4. Conclusions

Results of conducted bibliometric analysis point out several main conclusions that indicate the present state of research in CEE countries regarding the application of

robots in tourism and hospitality industry. Results showed that papers from all countries on the mentioned topic were published in a period of 40 years (1984-2023), in most of the analysed journals, with a growing number of papers in the 21st century (most of the papers are from the 3rd decade of the 21st century), written by the authors from 38 countries. Regarding CEE countries, authors of the paper were from four countries (Bulgaria, Romania, Czech Republic and Russia). Starting from 2019, six authors from these countries published 13 papers on the application of robots in tourism and hospitality industry. The total number of citations of papers by authors from CEE countries is 1,214, and the average number is 93.38. Regarding collaboration, more than 60% of papers by authors from CEE countries have authors from two countries, while average number of countries per paper is 2.85. Stanislav Ivanov from Bulgaria is the author with highest number of papers (10 papers) and highest number of citations (1,177).

This research has significant implications for both theory and practice. From theoretical perspective, the focus of this paper is on the position of CEE countries, providing in that way the unique knowledge of the most important countries, authors, and papers from this region. On that way, scholars and practitioners can easily identify the most influential authors and papers from CEE countries and their orientation and influence in this field. This research also has some valuable implications for practitioners, especially leaders and managers of tourism and hospitality objects aiming to implement robotic solutions. They may find the most valuable (cited) papers in this field, especially from CEE countries and become better informed before making decision regarding implementation of robotic solutions.

This research is accompanied by certain limitations that should be taken into account. First, all of the articles included in the dataset for bibliometric analysis were collected between August 23rd and August 31st, 2023, and more relevant studies may have emerged during the writing and publishing of this paper. Second, the analysis was limited to papers from one database – *Web of Science* (more precisely – *Journal Citation Reports*) with the aim of preventing unnecessary redundancy and duplication, but that may lead to missing out the papers from other databases that could be important. Furthermore, papers on the application of robotics in tourism and hospitality that have already been published in other journals were omitted from the list of journals whose titles directly relate to these topics.

Given the ongoing technological development, as well as the massive digitalization of entire society, it is almost inevitable that there will be many new papers in the topic of robot appliance in the tourism and hospitality industry. As a result, the proposal is to perform an ongoing bibliometric analysis study in order to examine the most recent trends and opportunities of robot application in these two industries.

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