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ROBOTISATION AND SERVICE AUTOMATION IN THE TOURISM AND HOSPITALITY SECTOR: A META-STUDY (1993-2024)

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Abstract: The aim of this study was to illustrate the expansion of the volume of articles based on robotisation and automation in the hospitality and tourism industry, investigate different research designs and research directions, and explain their change from 1993 until 2024. Analyses 310 publications published in the last 32 years processed using Google Scholar search engine. The data sets used for the observations consist primarily of key research works, predominantly appearing in peer-reviewed international journals. Additional sources include conference proceedings, books, reports, and theses spanning the past three decades, from November 1993 to June 2024. The rising number of publications on the social aspects of robotisation and automation mirrors changing lifestyles, with recent research shifting from descriptive studies to empirical ones to evaluate the impacts of these technologies in the hospitality sector. This meta-analysis of 310 publications on robotisation and automation in tourism and hospitality shows a significant rise in research over the past five years, with a shift from promoting automated businesses to addressing workplace problems and guest services. Despite this growth, gaps remain in experimental robotics research and studies on data privacy, human-robot interactions, and financial viability.

Keywords: robotisation, service automation, tourism, hospitality, meta-study

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INTRODUCTION

In recent years, the field of tourism and hospitality has been intensely exploring opportunities to enhance service quality and guest experiences. Authors such as Peng et al. (2014) and Crouch (1995) have particularly emphasised trends in tourism demand, identifying key factors impacting tourism demand. Through the systematic analysis of available research, these authors provide a necessary framework for understanding effective strategies and practices that lead to achieving high-quality standards. Moreover, noteworthy meta-analyses, such as those conducted by Afshardoost and Eshaghi (2020) and Zhang et al. (2014) have shed light on the critical relationship between destination image, tourist behavior, and loyalty. Through a comprehensive review of existing studies, these analyses not only amalgamate valuable insights into the perceptual aspects that shape a destination's image but also uncover the intricate connections between these images, tourists' behavioral patterns, and subsequent loyalty. Through carefully conducted meta-analyses, researchers such as Yousafzai et al. (2007) and Wu et al. (2011) have successfully synthesised significant amounts of data, providing valuable insights into key factors influencing the acceptance of the technology by users.

Robotisation and service automation are gaining in importance with the advent of the fourth industrial revolution. The modern age is characterised by an ever-expanding range of robot activities. They are used to produce industrial robots, in transport as autonomous vehicles, in medicine for diagnostics and surgical procedures, in education, warehousing, agriculture, to help the elderly and children with special needs in the form of social robots, for entertainment and military purposes (Ivanov et al., 2017). Robots can be classified as autonomous or quasi-autonomous depending on whether decisions are made by the robot itself or are managed by humans (Murphy et al., 2017).

Automation can be explained as a process in which machines are used to perform predetermined tasks (Ivanov et al., 2017). The main reasons for using automation in production and service delivery processes are saving resources (such as time and money) and creating identical product. Originally, automation was utilised almost entirely in production processes. Nowadays, automation plays an important role in our everyday lives, for example, in automatically adjustable lights, autonomous vehicles, self-service check-outs, electronic toll booths, air conditioners, etc.

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The field of robotisation and service automation in the tourism and hospitality industry is garnering significant interest due to its expanding presence in this sector. Artificial Intelligence (AI) and Machine Learning (ML) have significantly enhanced the capabilities of robots and automated systems, enabling predictive analysis of customer preferences, automated responses, and improved personalised services (Ivanov and Webster, 2019a). The Internet of Things (IoT) interconnects devices and systems, creating smart environments in hotels and resorts where IoT-enabled devices control and automate lighting, climate control, and security systems, thereby increasing efficiency and enhancing the guest experience (Kuo et al., 2017). Robotic Process Automation (RPA) automates repetitive, time-consuming tasks such as check-ins, check-outs, and concierge services, reducing human error and operational costs (Murphy et al., 2017). Cloud-based solutions offer scalable and flexible infrastructure for data storage and management, facilitating real-time analytics and seamless integration of various automated systems (Buhalis and Leung, 2018).

Additionally, Virtual Reality (VR) and Augmented Reality (AR) elevate the customer experience by providing virtual tours, interactive displays, and immersive environments, accessible both remotely and on-site (Tussyadiah and Park, 2018). Even though it is at first glance completely the opposite of the warm, welcoming hospitality we are used to, robotisation and service automation have found some appropriate areas in this sector. This is because hoteliers and other tourism service providers face a real challenge: they must find a way to do business faster, cheaper, better, and in a different way from their competitors, as well as find a path to strategically position in the tourism market. We already meet examples at airports where it is possible to check in and get a ticket based on reservations using digital kiosks. Moreover, robots now greet guests upon entering hotels, they prepare food in restaurants, serve guests, maintain hygiene in hotel rooms and hallways and provide information about the services offered by the hotel and local tourist attractions etc. (Ivanov, 2019).

For the guest, service automation is being used in every phase of the trip: before arrival at the hotel, during arrival at the hotel, during the stay at the hotel, during departure from the hotel and after departure from the hotel (Lukanova and Ilieva, 2019). Before arrival at the hotel, we now use different mobile applications, Virtual Reality, and chatbots to acquire information about the destination and accommodation. During arrival, guests already use mobile applications to inform the hotel about our check-in time or even do a remote check-in (Lukanova and Ilieva, 2019). During the stay, there are plenty of automatised options for adjusting the room, so it completely meets guests' needs like temperature, light, extra pillows etc (Lei et al., 2019). Guests can scan QR codes for any information about the hotel, and can use a mobile application in the restaurant to order food (with an option for choosing a specific amount of ingredients) or to settle their account, etc. Automation can save guests time during departure from the hotel (check out using a mobile application, choosing the best route to avoid traffic jams, gathering information about flight, weather, etc). After departure, the guest is able to remotely leave a comment and appraise their stay using these modern technologies, providing data to help service providers to improve.

Scientific papers have already started examining literature in the field of robotisation and automation in tourism and hospitality. They take the form of bibliometric analyse focusing on guest experience (Yörük et al., 2023), comprehensive analyse of robotisation and automation specifically in hospitality (Wu et al., 2023) and studies examining emotional experiences during interactions between robots and humans (Seyitoğlu and Ivanov, 2024). What distinguishes this meta-study from previous works is the period covered, the number of analysed papers encompassing the entire tourism industry including hospitality, an analysis of research directions and designs, and inclusion of six different types of scholarly works to provide a clearer picture of research in this area. The aims of this study were to conduct the first meta-analysis of research publications focused on robotisation and automation in tourism and hospitality, covering the period from 1993 to 2024. It analyses 310 papers to identify trends over time, explore the expansion of research in this field, assess the predominant types of publications, and highlight shifts in research focus from technological promotion to addressing practical issues such as workplace dynamics, guest services, and sociological impact. The study also identifies gaps and outlines future research trends in automation and robotics within the tourism and hospitality industry.

MATERIALS AND METHODS

Meta-analysis as a statistical methodology began to gain popularity in the mid-20th century. While it's challenging to pinpoint who first used meta-analysis, one of the early contributors to its development was the statistician Karl Pearson in the context of his work on combining results from different studies (Egger et al., 2002).

Research papers focused on a specific subject are gathered and examined in terms of their data and methodology (Weichselbaumer and Winter-Ebmer, 2005). The reliability of meta-analysis depends on the quality of the included studies and the correct application of statistical methods. Properly conducted meta-analysis can provide a comprehensive overview of the literature, identify trends and effects, and offer stronger statistical support for conclusions (Cheung and Vijayakumar, 2016; Cohn and Becker, 2003; Hwang and Jeong, 2009; Peng et al., 2015).

The significance of meta-analysis lies in its ability to integrate results from various studies, reduce bias, and increase the precision of effect estimates. This approach allows researchers to see a broader picture of the topic under study while simultaneously identifying variations and inconsistencies among studies (Peng et al., 2015).

For this meta-analysis, data were collected from April to June 2024 (Figure 1). The goal was to gather a meta-analytical picture of academic research published in English in the field of robotisation and service automation in the travel, tourism, and hospitality industry. We used Google Scholar as the largest free search engine (Gusenbauer, 2019) for the convenience of searching, sorting, and filtering results. The database for the observations comprises the main studies, which were mostly published in peer-reviewed international journals, while others were in conference publications, books, reports, and theses, from the last 32 years (since November 1993 until June 2024). Google Scholar was utilised to search for any combination of at least two search terms from two distinct groups. The first group included the terms 'robot' and 'automation,' while the

second group comprised 'tourism,' 'hospitality,' 'industry,' and 'travel.' Alongside keyword searches, Google Scholar was used to filter results by year, yielding a total of 310 records. After removing duplicates, 297 unique scientific papers remained. The relevance of each paper was assessed based on its title and abstract. Authors were contacted via email and ResearchGate to obtain access to papers that were initially inaccessible; ultimately, 35 papers remained inaccessible.

Eligible publications relevant to the research, totaling 262 papers, were accessed. Each paper's full text was evaluated using a triple-checking mechanism. Sixty-three studies were excluded from the analysis due to inadequate methodological standards or insufficient focus on the application of robotisation and automation in tourism and hospitality, ensuring the reliability and relevance of the meta-analysis findings. Additionally, six non-academic papers were excluded due to their limited relevance. Software, specifically Zotero version 6.0.37, was employed to sort scientific papers by year, remove duplicates, cite them in the text, and facilitate database sharing among authors.

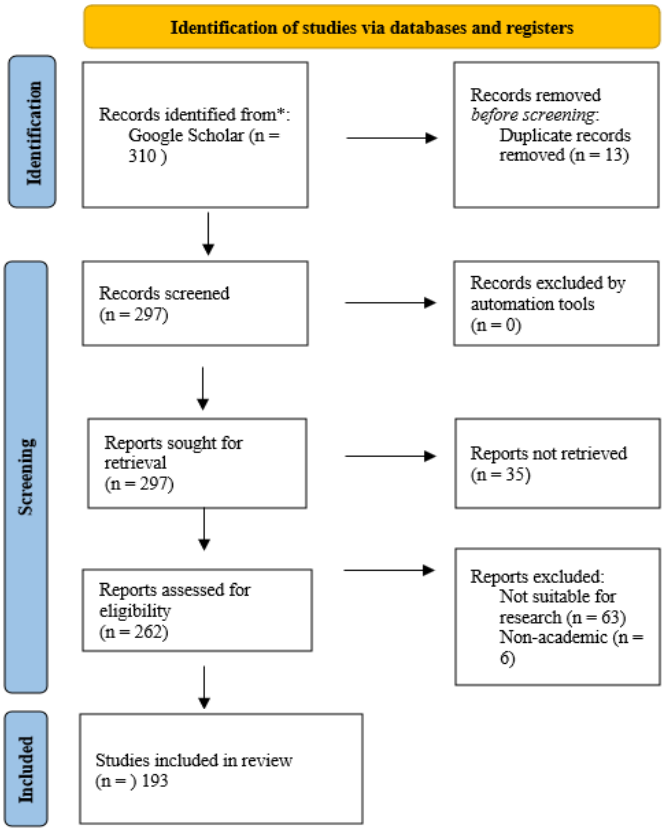


Figure 1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only (Source: Authors' analysis)

RESULTS

Altogether, 310 publications resulted from the Google Scholar search, but only 193 were judged as relevant for our study. The main reason for excluding 117 publications was that the content was unsuitable for our research (63), thirty-five of them were not possible to retrieve (35), thirteen of them were duplicates (13), while six of them were non-academic publications (6). The number of publications referring to robotisation and automation in tourism and hospitality is increasing (Figure 2). If we compare the period of 27 years from 1993 until 2019 with the last 5 years (from 2020 until 2024), it is clear this research field has become very much more interesting and important. We found that 121 relevant papers were published in the last 5 years, which is a considerable increase compared to the 72 papers published from 1993 until 2019.

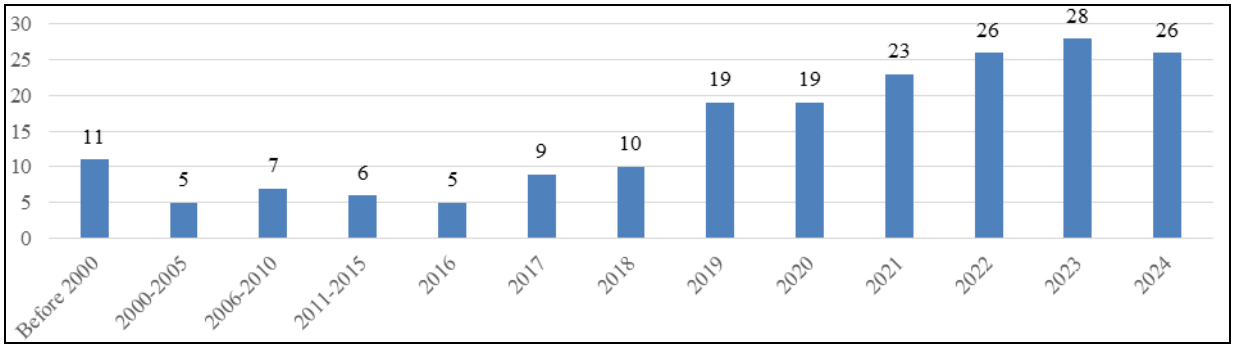


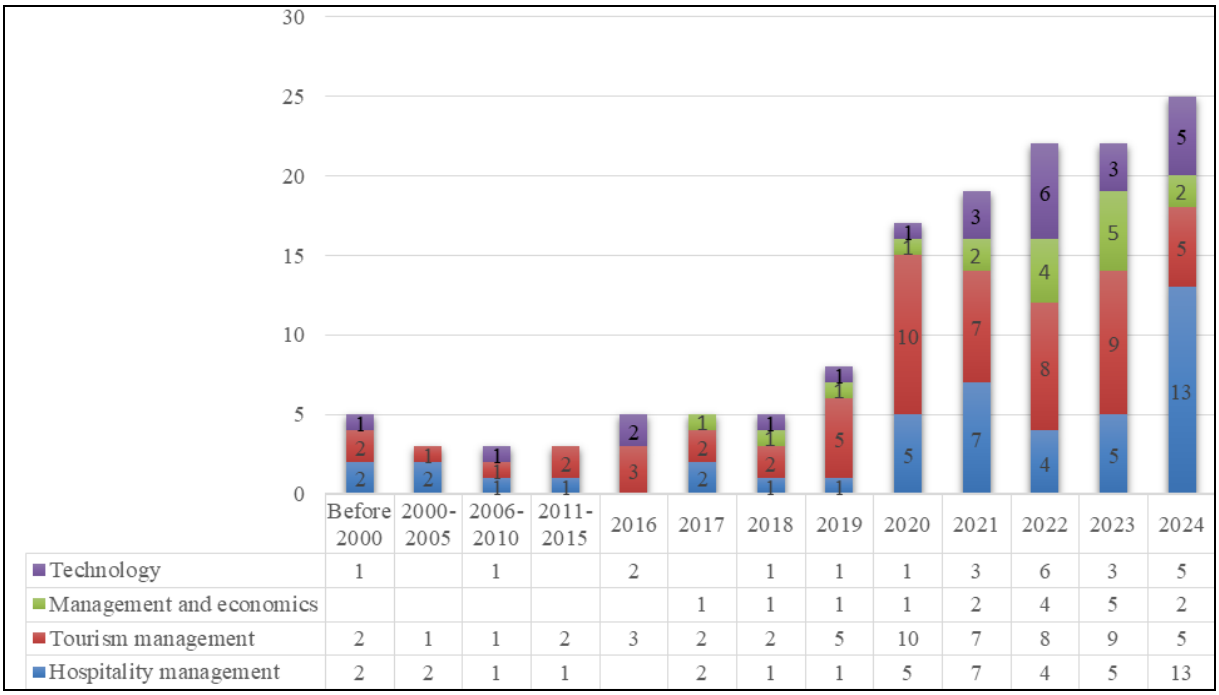
Figure 2. Number of relevant published papers in the field of robotisation and service automation in tourism and hospitality comparing different periods (Source: Authors' analysis)

One of the trends that can be observed is that most of the publications were journals, which numbered 142, accounting for 73.6% of the total. On the other side, book chapters and conference papers each had a share of 10.4% with 20 publications. Journal articles and conference papers dominated the scene up to 2019. However, driven by popular demand, there has been a significant increase in the number of book chapters on robotisation and automation in hospitality since 2019, with 18 chapters published, making this the second most prevalent type of publication.". This shift shows a growing recognition of these technologies as important technologies within the industry. The rest of the publications were books (7 or 3.6%), theses (3 or 1.6%) and report (1 or 0.5%). A summary of the publication types is available in Table 1.

Table 1. Type of publication in the field of robotisation and service automation in tourism and hospitality according to publication year (Source: Authors' analysis)

Type of publication	Before 2000	2000-2005	2006-2010	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Conference paper	2	/	1	/	/	3	4	1	/	1	4	4	/	20
Paper in journal	5	3	3	3	5	5	5	8	17	19	22	21	26	142
Book	2	2	1	1	/	/	/	/	1	/	/	/	/	7
Report	/	/	1	/	/	/	/	/	/	/	/	/	/	1
Thesis	2	/		1	/	/		/	/	/	/	/	/	3
Book chapter	/	/	1	1	/	1	1	10	1	2	/	3	/	20
Total	11	5	7	6	5	9	10	19	19	22	26	28	26	193

Journals that published research papers on robotisation and automation in tourism and hospitality were classified into four categories by their field type: hospitality management; tourism management; management and economics; and technology (Figure 3). The largest number of journals was connected to tourism management (57 or 40.1%) and hospitality management (44 or 31%). Fewer journals were more focused on technology (24 or 16.9%) or management and economics (17 or 12 %). In last five years (2020-2024), the number of journals that included papers on robotisation and automation in hospitality has significantly increased: over a 27-year period (1993-2019), there were ten journals in the field of hospitality management and 18 in the field of tourism management compared to the last 5-year period (2020-2024), when there were 34 journals in the field of hospitality management and 39 journals in the field of tourism management. In 2024 we anticipate more papers are yet to be published, perhaps encompassing more journals.



	Before 2000	2000-2005	2006-2010	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Technology	1		1		2		1	1	1	3	6	3	5
Management and economics						1	1	1	1	2	4	5	2
Tourism management	2	1	1	2	3	2	2	5	10	7	8	9	5
Hospitality management	2	2	1	1		2	1	1	5	7	4	5	13

Figure 3. Periods and articles published by type of journals (Source: Authors' analysis)

Important research directions have changed in the last 32 years (Table 2). At the beginning, research focused on marketing and promotion of automated business operations in the tourism and hospitality industry. Researchers discussed in their papers the implications of being different and strategically positioned on the market. However, before 2000, there were few automated business operations in the tourism and hospitality industry, so researchers generally did not have enough cases to investigate and present in their papers. It was clear that technological innovations were a key to success, but not many research groups had enough experience to give recommendations on how the industry should implement the innovations required.

Since 2011, the sociological aspect of developing robotisation and automation tourism and hospitality was analysed more frequently. Taking this into account, 81 publications have focused on sociological aspects of developing robotisation and automation in tourism and hospitality in last five years only. Additionally, since 2011, 14 more papers equally presented marketing and social aspects. That means over 60% of the papers published from 2011 onwards were focused on sociological and/or marketing aspects. We hypothesise that financial aspects (5%) are not yet well researched because relatively few hotels have started developing robotisation and automation their business or because many hotels are not interested in it yet. Because of that, there is not enough evidence about long-term robotised business in the tourism and hospitality sector. Furthermore, few publications researched the productivity and efficiency of robotised and automated business operations compared to traditional ones. Since these financial aspects (productivity and efficiency) of robotised and automated businesses are less studied than other research directions, future research in this field is expected.

Table 2. Research directions (Soc. – sociological; tech. – technological; fin. – financial; mktg. – marketing)

Papers	Before 2000	2000-2005	2006-2010	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Total Number	11	5	7	6	5	9	10	19	19	22	26	28	26	193
Percent	5.7	2.6	3.6	3.1	2.6	4.7	5.2	9.8	9.8	11.4	13.5	14.5	13.5	100.0
Papers by research direction (nr. and %)														
Sociological aspects	2 (1.0%)	1 (0.5%)	1 (0.5%)	4 (2.1%)	1 (0.5%)	6 (3.1%)	8 (4.1%)	4 (2.1%)	13 (6.7%)	16 (8.3%)	20 (10.4%)	15 (7.8%)	17 (8.8%)	108 (56.0%)
Marketing aspects	6 (3.1%)	3 (1.6%)	3 (1.6%)	/	1 (0.5%)	/	/	3 (1.6%)	1 (0.5%)	/	/	/	/	17 (8.8%)
Financial aspect	1 (0.5%)	/	1 (0.5%)	1 (0.5%)	/	1 (0.5%)	/	1 (0.5%)	2 (1.0%)	/	/	/	/	7 (3.6%)
Technological aspect	1 (0.5%)	/	2 (1.0%)	1 (0.5%)	/	1 (0.5%)	1 (0.5%)	1 (0.5%)	1 (0.5%)	/	1 (0.5%)	/	2 (1.0%)	11 (5.7%)
Soc. + tech. Aspects	/	/	/	/	1 (0.5%)	/	/	1 (0.5%)	1 (0.5%)	/	1 (0.5%)	/	/	4 (2.1%)
Soc. + fin. Aspects	/	1 (0.5%)	/	/	1 (0.5%)	/	1 (0.5%)	/	1 (0.5%)	/	/	/	/	4 (2.1%)
Tech. + mktg. Aspects	/	/	/	/	/	/	/	1 (0.5%)	/	/	/	/	/	1 (0.5%)
Mktg. + soc. Aspects	/	/	/	/	/	/	/	7 (3.6%)	/	3 (1.6%)	3 (1.6%)	1 (0.5%)		14 (7.3%)
Fin. + tech. Aspects	/	/	/	/	1 (0.5%)	/	/	/	/	/	/	/	/	1 (0.5%)
Fin. + soc. + tech. Aspects	/	/	/	/	/	1 (0.5%)	/	/	/	/	/	/	/	1 (0.5%)
Mktg. + fin. Aspects	1 (0.5%)	/	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)
General	/	/	/	/	/	/	/	1 (0.5%)	/	3 (1.6%)	1 (0.5%)	12 (6.2%)	7 (3.6%)	24 (12.4%)
Total	11 (5.7%)	5 (2.6%)	7 (3.6%)	6 (3.1 %)	5 (2.6%)	9 (4.7%)	10 (5.2%)	19 (9.8%)	19 (9.8%)	22 (11.4%)	26 (13.5%)	28 (14.5%)	26 (13.5%)	193 (100%)

The research design of papers published since 1993 and included in our study has changed, which can be seen in Table 3. The following 5 research designs stood out: case study (8.3%), review (23.3%), survey (18.7%), description (20.7%) survey and different forms of interviews (9.3%). At first, researchers described a few business scenarios that could happen in the future. Among other things, they mentioned automatic luggage transfer and pressure sensitive menu (Borsenik, 1993), speech recognition integrated into systems (Cheyer and Julia, 1999) and the advantages of using existing technologies (Gee et al., 1997). Even though research designs based on describing and/or predicting possible future scenarios remain the most common research design (46 papers; 25%), it seems that review papers barely fall behind (about 24%). Furthermore, case studies and survey questionnaires are gaining in popularity, and we can expect their further expansion in the future when it comes to writing scientific papers in this field. Literature reviews are worth mentioning as they show publications are becoming more numerous, with different topics focused on robotisation and automation in hospitality. In this meta-analysis, there were 46 literature reviews and 57% of these reviews were published in the last five years.

Interestingly, the results further reveal that the articles that present surveys and case studies have become one of the most dominant research designs in recent years. Since 2020, 29 survey papers have been published, accounting for 76 % of their total number (including the article with survey and laboratory experiment). Some of the questionnaires were intended for managers and supervisors (Bennett, 1995; Sztorc, 2021; and others), others were designed for hotels employees (Li et al., 2019; Belias and Vasiliadis, 2021; Belias et al., 2022; Mingotto et al., 2021; Ivanov and Webster, 2024; and others) and rest of them were distributed to people of different occupations, demographic characteristics, etc. (Chung-En, 2018; Ivanov et al., 2018a; Ivanov et al., 2018b; Tussyadiah and Park, 2018; Kazandjieva and Filipova, 2018; Ivanov and Webster, 2019b; Ivanov and Webster, 2019c; Belanche et al., 2020; Zhong et al., 2020; Zhu and Chang, 2020; Huang et al., 2021; Lee et al., 2021; Seo and Lee, 2021; Romero and Lado, 2021; Fang et al., 2024; Pham, 2024; and others).

These studies showed that technology is gaining approval in particular segments of the tourism and hospitality industry. Most people agree with the introduction of robotised services such as carrying luggage, linen and towels delivery, information provision, housekeeping activities, and processing bookings, payments, and documents. Furthermore, all studies that considered demographic differences have shown that younger people are more willing to accept business changes due to robotisation. Also, it is important to note that men are more receptive to these changes than women.

Table 3. Research design (*E.P. and S.S.I - Expert panel and Semi-structured interview; SEM - Structural equation modelling; PLS - Partial Least Squares; PLS SEM -Partial Least Squares Structural Equation Modeling)

Papers	Before 2000	2000-2005	2006-2010	2011-2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Total Number	11	5	7	6	5	9	10	19	19	22	26	28	26	193
Percent	5.7%	2.6%	3.6%	3.1%	2.6%	4.7%	5.2%	9.8%	9.8%	11.4 %	13.5 %	14.5 %	13.5 %	100%
Papers by research design (nr. and %)														
Case study	/	/	3 (1.6%)	1 (0.5%)	2 (1.0%)	/	/	3 (1.6%)	1 (0.5%)	2 (1.0%)	/	1 (1.0%)	3 (1.6%)	16 (8.3%)
Review	1 (0.5%)	2 (1.0%)	4 (2.1%)	1 (0.5%)	/	3 (1.6%)	2 (1.0%)	7 (3.6%)	6 (3.1%)	5 (2.6%)	6 (3.1%)	6 (3.1%)	3 (1.6%)	46 (23.8%)
Survey	1 (0.5%)	/	/	/	/	/	4 (2.1%)	3 (1.6%)	3 (1.6%)	6 (3.1%)	8 (4.1%)	5 (2.6%)	6 (3.1%)	36 (18.7%)
Predictions	2 (1.0%)	1 (0.5%)	/	1 (0.5%)	/	/	/	1 (0.5%)	1 (0.5%)	/	/	/	/	6 (3.1%)
Description	6 (3.1%)	2 (1.0%)	/	2 (1.0%)	/	5 (2.6%)	2 (1.0%)	5 (2.6%)	5 (2.6%)	3 (1.6%)	4 (2.1%)	4 (2.1%)	2 (1.0%)	40 (20.7%)
Predictions + description	1 (0.5%)	/	/	/	/	/	/	/	1 (0.5%)	/	/	/	/	2 (1.0%)
E.P. + S.S.I*	/	/	/	/	/	1(0.5%)	/	/	/	/	/	/	/	1 (0.5%)
Survey + Laboratory experiment	/	/	/	/	/	/	1(0.5%)	/	/	/	1 (0.5%)	/	/	2 (1.0%)
Field study	/	/	/	1 (0.5%)	1 (0.5%)	/	1 (0.5%)	/	1 (0.5%)	1 (0.5%)	/	/	2 (1.0%)	7 (3.6%)
e-Delphi & Lego® Serious Play	/	/	/	/	1 (0.5%)	/	/	/	/	/	/	/	/	1 (0.5%)
Delphi	/	/	/	/	1 (0.5%)	/	/	/	/	/	/	/	/	1 (0.5%)
Interview	/	/	/	/	/	/	/	/	1 (0.5%)	5 (2.6%)	4 (2.1%)	5 (2.6%)	3 (1.6%)	18 (9.3%)
Multiple-group chi-square difference test	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	/	1 (0.5%)
SEM / PLS / PLS SEM*	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	1 (0.5%)	3 (1.6%)	5 (2.6%)
PLS SEM + survey	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	1(0.5%)
Word association technique and sen-tence completion	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	/	1 (0.5%)
Online reviews analysis + in-depth interview	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	1 (0.5%)	2 (1.0%)
Interview + survey	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	2 (1.0%)	3 (1.6%)
Case study + interview	/	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	1 (0.5%)
Video comments analysis	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	1 (0.5%)
Review + focus group	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	1 (0.5%)
Social listening	/	/	/	/	/	/	/	/	/	/	/	1 (0.5%)	/	1 (0.5%)
Total	11 (5.7%)	5 (2.6%)	7 (3.6%)	6 (3.1 %)	5 (2.6%)	9 (4.7%)	10 (5.2%)	19 (9.8%)	19 (9.8%)	22 (11.4%)	26 (13.5%)	28 (14.5%)	26 (13.5%)	193 (100%)

However, there is still significant resistance to robotising services such as massages, security guarding, babysitting (Ivanov and Webster, 2019b; Ivanov and Webster, 2019c), daycare for children and preparation of food and drinks,

travel organising, hairdressing (Kazandjieva and Filipova, 2018). Although there is a study that presents the fact that people prefer to be served by humanoid robots compared to nonhumanoid ones (Zhu and Chang, 2020), they still consider classic service as unrivalled. Furthermore, it is worth mentioning that all of the papers based on semi-structured interviews (10) were published since 2020. The increase in the number of case studies is most likely due to different solutions based on robotisation and automation being implemented in the tourism and hospitality industry. In the last three years, there were six publications of this type (50% of the total number of case studies).

Robotisation and automation of services in the hotel industry and further research

The situation in the tourism market can often be unpredictable, while on the other hand, adapting, changing, or creating a new tourism offer is usually a long process. Given these points, marketing orientations have also changed. Thus, it has become necessary to adapt business products and processes to meet customer needs. That means, the main goal of the companies that adopt the latest marketing concepts is to make gains, not based on profits/sales, but on satisfied customers.

Altogether, what particularly stands out is that if this trend continues, we can expect further personalisation of products and services in the tourism and hospitality sector. That means guests will request higher quality service, which is supported by the fact that they are, above all, much more experienced than in the past, when the industry was less developed (Buhalis, 1998).

The needs of tourists will continue to change. In the hotel industry, we can expect further development of service automation. Guests enjoy feeling at least as comfortable as in their homes, which also means they should have available technological solutions similar to those they already use (Bilgihan et al., 2016). Furthermore, lack of free time makes guests want as much as possible to spend it consuming products or services. Allowing guests to take more control over their traveling experience could be one of the key benefits in the tourism market. On the contrary, bureaucratic processes such as traditional check-in, check-out and payment can be considered as a waste of time, and therefore, guests might want to avoid them or speed them up as much as possible (Jones and Dent, 1994). In addition, people are interested in new technologies because they believe they will feel more satisfied or they are attracted by the way they use something new (Ivanov et al., 2018b). Keeping that in mind, technology innovation appears to be a logical solution.

In the near future, we can expect an increasing number of accommodation service providers to use robotisation and automation, primarily to provide personalised services to guests. This should lead to greater accessibility to tourism service providers, more efficient operations and numerous savings. Precisely because of these changes in business, it will be necessary to conduct training in appropriate time-frames to improve the skills of employees (Kuo et al., 2017). Likewise, tourism and hospitality entities must keep in mind the possibility that guests will need specific knowledge, and hospitality providers should plan their business activities accordingly (Bowen and Morosan, 2018).

If a guest encounters a certain type of technology for the first time in a tourism and hospitality setting, fear and insufficient knowledge could create resistance to the technology. In addition, if a guest does not get the service they desire after their first usage of a technological solution, we can expect that they would avoid the technology in the future.

Along with the further development of automation in the hotel industry, the use of robots for various purposes and further automatic personalisation of services, it is reasonable to expect increased caution among guests regarding use of their personal data. Indeed, we believe that the threat of privacy breaches, deliberate or not, is going to be a weakness of modern, technologically innovative tourism and hospitality businesses. Therefore, hoteliers and other involved companies will have to work continuously, as they develop and apply technology, on protecting guests' data. It will be necessary to gain trust and take care of every step that technology brings to avoid creating dissatisfaction among guests (Drexler and Lapré, 2019). This is a key area to be explored further. Additional research should help to determine when and how tourist needs are going to change, since it is predictable that change will come. The consumers who engage in the tourism and hospitality industry generally live eventful lives, and so use different technologies during the whole day (e.g., sending e-mails, receiving offers, surfing on the Internet, comparing product prices, booking trips), even when they are on vacation. Taken together, one possible future scenario is that of guest oversaturation because of the amount of technology in their lives generally this could drive them to change their lifestyle and needs, including when using hospitality services. More research investigating this social aspect would be of great importance.

DISCUSION

As we have seen, the number of publications focusing on social aspects of robotisation and automation is continuously increasing. This is completely understandable because people's needs and lifestyles are changing. Those changes are happening on a daily basis and are the main reason why social aspects have become more popular in recent years. Mobile phones were a luxury 25 years ago, but nowadays nearly everyone in developed nations has at least one. In the past, we used to utilise travel agencies to get information about our destination, accommodation and transport. Now we can easily compare different destinations, transport alternatives, periods, prices and hotel services from the comfort of our homes. On the other hand, there is a clear difference between the number of publications focused on financial aspects and the three other dominant research topics. Because of that, it is highly likely that a significant increase in research focusing on financial aspects of the development of automated business in the hospitality field would be of great importance for service providers.

If we put ourselves in the position of a general manager of a hotel, many important questions would need to be answered before reorienting the business. How will this transformation affect employees? Are modern technologies suitable for most of our guests? Are these technologies easy to use or will training programmes need to be developed? Such dilemmas constitute the main reason for conducting surveys in the hospitality sector. Being aware of this, research groups have changed their research design in the last few years. Previously, they were more focused on describing specific

occurrences. Since 2018, research attention has clearly reoriented to empirical research, such as conducting surveys and interviews. By doing so, the authors have sought to identify advantages, disadvantages, costs, benefits and potential problems of robotised tourism and hospitality businesses in accordance with the views of guests, but also hotel management.

Furthermore, more review articles are being published nowadays to explain the knowledge so far and identify gaps in research. Among the research considered in our meta-analysis, 57% of review articles were published in the last five years. The greater number of reviews likely reflects the fact that this research field is growing in popularity, so the number of papers is increasing several times per year.

CONCLUSION

The strength of our work lies in the fact that this is the first meta-analysis of research publications studying robotisation and automation in tourism and hospitality. A total of 310 papers were analysed and 193 of them were considered relevant for our study using Google Scholar as the most wide-reaching search engine in this domain. In the last five years, the rapid growth of publications on this topic has been evident (63% of papers considered in this study were published in the last five years). The analysis showed that the most common type of publications were journal articles followed by book chapters and conference papers, and we can expect further expansion of these types of research publications.

Besides the technological aspect, which is still present in publications after 32 years, we stress that research directions have changed significantly over this time. In the beginning, research was focused on promotion of different automated business, and marketing was the predominant aspect. The main reason for that was the limited knowledge and lack of experience within robotised and automated hospitality companies. Research at that time highlighted that being innovative is one of the key benefits that can be achieved in the market compared to the competition.

Since 2011, there has been colossal interest in research into potential problems in the work environment and into the provision of services to guests. Authors have pointed out that market research is mandatory to have satisfied employees and guests, even in entities with financially viable business operations. The main reason research has focused very little on financial aspects is that there are not enough developed, appropriate technological solutions of this type which could be used in tourism and hospitality long-term businesses. Currently, most solutions are quite expensive and have limited capabilities, which means they are not good alternatives to traditional employees (Kuo et al., 2017).

Around 20% of studies in this meta-analysis contained descriptions of particular innovations in tourism and hospitality, but this percentage has not increased in the last five years. On the other hand, surveys targeting guests' and managers' attitudes toward developing robotised and automated business are growing in popularity. Nearly 80% (26) of these papers were published in the last five years. Additionally, there has been a rapid rise in the number of review articles and case studies, which was expected because of the growth of attractiveness of this research field. Our research has shown that all scientific papers using various types of interviews have been published in the last 5 years. These papers present the results of interviews with guests, hotel employees, and/or top management. As described technological solutions are increasingly being implemented in modern hotel operations, we can expect a further expansion of papers containing this or similar methodologies. On the other hand, there are still relatively few tourism service providers that use robots in the workplace, which also means there is lack of research focusing on experimental robotics. The current meta-analysis indicates that this is a research gap, which we predict will be addressed with time.

Data privacy, human-robot interactions, and costs and benefits are currently understudied topics that will require attention in the future. Given people's concerns about protecting their private data, resistance to adopting robots and automating hospitality services is likely. Therefore, service providers must invest resources in safeguarding guests' data and building their trust. Further research should also explore the influence of cultural differences on the decision to adopt robots in the hospitality sector. In addition to guest attitudes, understanding employee acceptance or resistance is crucial. This necessitates conducting appropriate market research and developing tailored training programs for employees.

Additionally, future research should include comprehensive cost-benefit analyses of integrating robotic technologies into hospitality operations. This analysis should evaluate financial implications alongside operational efficiencies and customer satisfaction metrics. Furthermore, it is essential to investigate the environmental impact of robotics in hospitality. This includes examining factors such as energy consumption, waste reduction, and overall sustainability benefits compared to traditional practices. Understanding how the presence of robots influences customer satisfaction and loyalty in hospitality settings is also critical. Future studies should delve deeper into the factors that contribute to positive or negative guest experiences with robotic services, aiming to enhance service quality and customer engagement.

Limitations

This meta-analysis is limited due to the fact that it was based on publications selected by the Google Scholar search engine only. We chose Google Scholar as the largest free academic search engine which suits and is available to the largest number of authors. The next important limitation lies in the fact that only publications in English were considered in the analysis. However, English language is used in most scientific papers, and we believe that our research properly reflects the progress of research published in English in this field. This gap is worth highlighting as additional research in other languages could be useful in the future.

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REFERENCES

Afshardoost, M., & Eshaghi, M. S. (2020). Destination image and tourist behavioural intentions: A meta-analysis. *Tourism Management*, 81(5). https://doi.org/10.1016/j.tourman.2020.104154

Belanche, D., Casaló, L. V., & Flavián, C. (2020). Frontline robots in tourism and hospitality: service enhancement or cost reduction?. *Electronic Markets*, 31(3), 1-16. https://doi.org/10.1007/s12525-020-00432-5;

Belias, D., & Vasiliadis, L. (2021). Pilot study for two questionnaires assessing intentions of use and quality of service of robots in the hotel industry. In *Culture and Tourism in a Smart, Globalized, and Sustainable World: 7th International Conference of IACuDiT, Hydra, Greece, 2020*, 539-558, Cham: Springer International Publishing.

Belias, D., Vasiliadis, L., & Rossidis, I. (2022). The intention and expectations of modern robotic technologies in the hotel industry. *Journal of Quality Assurance in Hospitality & Tourism*, 23(6), 1451-1479. https://doi.org/10.1080/1528008X.2021.1995566

Bennett, D. M. T. (1995). *A feasibility study on the automation of domestic airline passenger customer service check-in procedures for FAR Part 121 carriers*. Embry-Riddle Aeronautical University.

Bilgihan, A., Smith, S., Ricci, P., & Bujisic, M. (2016). Hotel guest preferences of in-room technology amenities. *Journal of Hospitality and Tourism Technology*, 7(2), 118–134. https://doi.org/10.1108/jhtt-02-2016-0008

Borsenik, F. D. (1993). Hospitality technology in the 21 St Century. *Hospitality Research Journal*, 17 (1), 259–269. https://doi.org/10.1177/109634809301700121

Bowen, J., & Morosan, C. (2018). Beware hospitality industry: The robots are coming. *Worldwide Hospitality and Tourism Themes*, 10 (6), 726–733. https://doi.org/10.1108/WHATT-07-2018-0045

Buhalis, D. (1998). Strategic use of information technologies in the tourism industry. *Tourism management*, 19(5), 409-421. https://doi.org/10.1016/S0261-5177(98)00038-7

Buhalis, D., & Leung, D. (2018). Smart hospitality—Interconnectivity and interoperability towards an ecosystem. *International Journal of Hospitality Management*, 71, 41-50. https://doi.org/10.1016/j.ijhm.2017.11.011

Cheung, M. W. L., & Vijayakumar, R. (2016). A guide to conducting a meta-analysis. *Neuropsychology review*, 26, 121-128. https://doi.org/10.1007/s11065-016-9319-z

Cheyer, A., & Julia, L. (1999). Spoken language and multimodal applications for electronic realities. *Virtual Reality*, 4(2), 114-128. https://doi.org/10.1007/BF01408590

Chung-En, Y. (2018). Humanlike robot and human staff in service: Age and gender differences in perceiving smiling behaviors. *2018 7th International Conference on Industrial Technology and Management (ICITM)*, 99-103. 10.1109/ICITM.2018.8333927

Cohn, L. D., & Becker, B. J. (2003). How meta-analysis increases statistical power. *Psychological methods*, 8(3), 243-253. https://doi.org/10.1037/1082-989X.8.3.243

Crouch, G. I. (1995). A meta-analysis of tourism demand. *Annals of tourism research*, 22(1), 103-118. https://doi.org/10.1016/0160-7383(94)00054-V

Drexler, N., & Beckman Lapré, V. (2019). For better or for worse: Shaping the hospitality industry through robotics and artificial intelligence. *Research in Hospitality Management*, 9(2), 117–120. https://doi.org/10.1080/22243534.2019.1689701

Egger, M., Ebrahim, S., & Smith, G. D. (2002). Where now for meta-analysis? *International journal of epidemiology*, 31(1), 1-5. https://doi.org/10.1093/ije/31.1.1

Fang, S., Han, X., & Chen, S. (2024). Hotel guest-robot interaction experience: a scale development and validation. *Journal of Hospitality and Tourism Management*, 58, 1-10. https://doi.org/10.1016/j.jhtm.2023.10.015

Gee, C. Y., Fayos Solá, E., World Tourism Organization, & WTO Education Network (1997). *International tourism: A global perspective.* World Tourism Organization. (Eds.).

Gusenbauer, M. (2019). Google Scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases. *Scientometrics*, 118(1), 177-214. https://doi.org/10.1007/s11192-018-2958-5

Huang, H. L., Cheng, L. K., Sun, P. C., & Chou, S. J. (2021). The effects of perceived identity threat and realistic threat on the negative attitudes and usage intentions toward hotel service robots: the moderating effect of the robot's anthropomorphism. *International Journal of Social Robotics*, 13, 1599-1611. https://doi.org/10.1007/s12369-021-00752-2

Hwang, Y., & Jeong, S. H. (2009). Revisiting the knowledge gap hypothesis: A meta-analysis of thirty-five years of research. *Journalism & Mass Communication Quarterly*, 86(3), 513-532. https://doi.org/10.1177/1077699009086003

Ivanov, S. (2019). Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries? *Zeitschrift Für Tourismuswissenschaft*, 11(1), 25–43. https://doi.org/10.1515/tw-2019-0003

Ivanov, S. H., Webster, C., & Berezina, K. (2017). Adoption of robots and service automation by tourism and hospitality companies. *Revista Turismo & Desenvolvimento*, 27(28), 1501-1517. https://doi.org/10.34624/rtd.v1i27/28.10019

Ivanov, S., & Webster, C. (2019a). Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies – a cost-benefit analysis. In *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, 11-34, Emerald Publishing Limited.

Ivanov, S., & Webster, C. (2019b). Perceived appropriateness and intention to use service robots in tourism. *Information and communication technologies in tourism 2019*, 237–248. https://doi.org/10.1007/978-3-030-05940-8_19

Ivanov, S., & Webster, C. (2019c). What should robots do? A comparative analysis of industry professionals, educators and tourists. *Information and communication technologies in tourism 2019*, 249-262. https://doi.org/10.1007/978-3-030-05940-8_20

Ivanov, S., Webster, C., & Garenko, A. (2018). Young Russian adults' attitudes towards the potential use of robots in hotels. *Technology in Society*, 55, 24–32. https://doi.org/10.1016/j.techsoc.2018.06.004

Ivanov, S., Webster, C., & Seyyedi, P. (2018b). Consumers' attitudes towards the introduction of robots in accommodation establishments. *Tourism: An International Interdisciplinary Journal*, 66(3), 302-317. https://doi.org/10.1007/978-3-030-05940-8_19

Ivanov, S., & Webster, C. (2024). Automated decision-making: Hoteliers' perceptions. *Technology in Society*, 76, 102430. https://doi.org/10.1016/j.techsoc.2023.102430

Jones, P., & Dent, M. (1994). Improving service: Managing response time in hospitality operations. *International Journal of Operations & Production Management*, 14(5), 52–58. https://doi.org/10.1108/01443579410056795

Kazandjieva, V. I., & Filipova, H. P. (2018). Customer's perception assessment of tech-related innovations in tourism. *Izvestiya*, 62(1), 5-20.

Kuo, C. M., Chen, L. C., & Tseng, C. Y. (2017). Investigating an innovative service with hospitality robots. *International Journal of Contemporary Hospitality Management*, 29(5), 1305-1321. https://doi.org/10.1108/ijchm-08-2015-0414

Lee, Y., Lee, S., & Kim, D. Y. (2021). Exploring hotel guests' perceptions of using robot assistants. *Tourism Management Perspectives*, 37, 100781. https://doi.org/10.1016/j.tmp.2020.100781

Lei, S. I., Wang, D., & Law, R. (2019). Hoteliers' service design for mobile-based value co-creation. *International Journal of Contemporary Hospitality Management*, 31(11), 4338-4356. https://doi.org/10.1108/IJCHM-03-2018-0249

Li, J. J., Bonn, M. A., & Ye, B. H. (2019). Hotel employee's artificial intelligence and robotics awareness and its impact on turnover intention: The moderating roles of perceived organizational support and competitive psychological climate. *Tourism Management*, Vol. 73, 172-181. https://doi.org/10.1016/j.tourman.2019.02.006

Lukanova, G., & Ilieva, G. (2019). Robots, Artificial Intelligence, and Service Automation in Hotels. *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, 157–183. https://doi.org/10.1108/978-1-78756-687-320191009

Mingotto, E., Montaguti, F., & Tamma, M. (2021). Challenges in re-designing operations and jobs to embody AI and robotics in services. Findings from a case in the hospitality industry. *Electronic Markets*, 31(3), 493-510. https://doi.org/10.1007/s12525-020-00439-y

Murphy, J., Hofacker, C. & Gretzel, U. (2017). Dawning of the age of robots in hospitality and tourism: Challenges for teaching and research. *European Journal of Tourism Research*, 15, 104-111. https://doi.org/10.54055/ejtr.v15i.265

Peng, B., Song, H., & Crouch, G. I. (2014). A meta-analysis of international tourism demand forecasting and implications for practice. *Tourism Management*, 45, 181-193. https://doi.org/10.1016/j.tourman.2014.04.005

Pham, T. N. (2024). Determinants of Consumer'preferences for Robot Service Hotel: An Experiment Among Vietnamese Young Travellers. *Geojournal of Tourism and Geosites*, 53(2), 638-646. https://doi.org/10.30892/gtg.53227-1239

Romero, J., & Lado, N. (2021). Service robots and COVID-19: exploring perceptions of prevention efficacy at hotels in generation Z. *International Journal of Contemporary Hospitality Management*, 33(11), 4057-4078. https://doi.org/10.1108/IJCHM-10-2020-1214

Seo, K. H., & Lee, J. H. (2021). The emergence of service robots at restaurants: Integrating trust, perceived risk, and satisfaction. *Sustainability*, 13(8), 4431. https://doi.org/10.3390/su13084431

Seyitoğlu, F., & Ivanov, S. (2024). Robots and emotional intelligence: A thematic analysis. *Technology in Society*, 77, 102512. https://doi.org/10.1016/j.techsoc.2024.102512

Sztorc, M. (2021). Autonomous Enterprise as a model of hotel operation in the aftermath of the COVID-19 pandemic. *Sustainability*, 14(1), 97. https://doi.org/10.3390/su14010097

Tussyadiah, I. P., & Park, S. (2018). Consumer evaluation of hotel service robots. *Information and communication technologies in tourism 2018*, 308-320. https://doi.org/0.1007/978-3-319-72923-7_24

Weichselbaumer, D., & Winter-Ebmer, R. (2005). A meta-analysis of the international gender wage gap. *Journal of economic surveys*, 19(3), 479-511. https://doi.org/10.1111/j.0950-0804.2005.00256.x

Wu, F., Sorokina, N., & Putra, E. D. (2023). Customers satisfaction on robots, artificial intelligence and service automation (RAISA) in the Hotel Industry: A comprehensive review. *Open Journal of Business and Management*, 11(3), 1227-1247. https://doi.org/10.4236/ojbm.2023.113069

Wu, K., Zhao, Y., Zhu, Q., Tan, X., & Zheng, H. (2011). A meta-analysis of the impact of trust on technology acceptance model: Investigation of moderating influence of subject and context type. *International Journal of Information Management*, 31(6), 572-581. https://doi.org/10.1016/j.ijinfomgt.2011.03.004

Yörük, T., Akar, N., & Özmen, N. V. (2023). Research trends on guest experience with service robots in the hospitality industry: A bibliometric analysis. *European Journal of Innovation Management*. https://doi.org/10.1108/EJIM-09-2022-0530

Yousafzai, S. Y., Foxall, G. R., & Pallister, J. G. (2007). Technology acceptance: a meta-analysis of the TAM: Part 1. *Journal of modelling in management*, 2(3), 251-280. https://doi.org/10.1108/17465660710834453

Zhang, H., Fu, X., Cai, L. A., & Lu, L. (2014). Destination image and tourist loyalty: A meta-analysis. *Tourism management*, 40, 213-223. https://doi.org/10.1016/j.tourman.2013.06.006

Zhong, L., Sun, S., Law, R., & Zhang, X. (2020). Impact of robot hotel service on consumers' purchase intention: a control experiment. *Asia Pacific Journal of Tourism Research*, 25(7), 780-798. https://doi.org/10.1080/10941665.2020.1726421

Zhu, D. H., & Chang, Y. P. (2020). Robot with humanoid hands cooks food better? Effect of robotic chef anthropomorphism on food quality prediction, *International Journal of Contemporary Hospitality Management*, 32(3), 1367-1383. https://doi.org/10.1108/ijchm-10-2019-0904

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