

The Effect of Service Robots and Other Technology on Job Profiles in The Hospitality Industry

Detlev Remy, Gerry E. S. Koh, Michael A. Kruesi, Juhi N. Singh, Deborah W. L. Liew,
Glenda M. Y. Lum, Rachel L. W. Xuan and Xing Xing,

Abstract—The adoption of service robots has reshaped the hotel industry. Fueled by the prevailing manpower crunch and the recent COVID-19 pandemic, the industry was propelled to integrate technology into their operations and service robots were introduced as a complement to the human workforce. Even though the perceptions and impacts of service robots have been widely discussed, research pertaining to the impact of service robots from a human resource perspective is currently lacking in the literature. This qualitative study explores service robots in relation to the effect that this technology has on job profiles within the hotel industry, through semi-structured interviews with industry experts and academics. The key findings highlight that the acceptance of this technology is dependent on the tier of the hotel and the resistance arising from the cost and the technological disruption to the hotel. Moreover, job redesign was also found to be an effective strategy to complement the adoption of service robots. Finally, it was found that there is an impact on the level of service expectations from the guests as well as the productivity and efficiency of the staff upon the integration of service robots.

Keywords—Service robots, automation, acceptance, job redesign, service perception.

I. INTRODUCTION

The COVID-19 pandemic has undoubtedly been detrimental for the hospitality industry, which depends heavily on interpersonal interactions and operates in a high-touch environment (Baum et al., 2020). To address this, hoteliers have consequently introduced a myriad of technological solutions, such as service robots, to improve operational efficiency and to manage labor costs during this time of economic uncertainty (Chen et al., 2015). However, due to the novelty of service robots, further research is required to fully comprehend the complexity that goes into the application of such technology in the context of the hospitality industry.

To combat the effects of the pandemic, hoteliers started to place additional emphasis on technological innovations that could potentially boost short-term recovery (Xiang et al., 2015). Moreover, due to lower occupancy driven by the travel restrictions, hoteliers had to resort to cost-cutting measures to address the manpower crunch that resulted due to the pandemic, as reliance on contracted staff and outsourced activities were also reduced (Majumdar, 2021).

Employees often cite poor working conditions, low salaries and labor-intensive workloads amongst the main reasons that contribute to the high staff turnover rates in hotels (Marco-Lajara & Úbeda-García, 2013). The pandemic exacerbated this, further highlighting the pertinent issue of job insecurity that has long plagued the hospitality industry (Aguilar-Quintana, 2021).

With various drivers stemming from both macro and microenvironments, hoteliers have been forced to adopt technological novelties to adapt to the currently volatile market. This is particularly pertinent in times of economic uncertainty and as a measure to prepare for the surge of inbound tourists once border restrictions are eased. Although there is existing research being conducted on service robots, in-depth studies done on the assessment of their impact on job profiles in the service industry is lacking. Therefore, the present study qualitatively analyzes the influence of service robots with an emphasis on human resource (HR) aspects to address the prevailing research gap.

A. Research Questions and Research Objectives

This exploratory research aims to answer the following question:

“In which way will service robots and other technology affect job profiles in the hospitality industry?”

Extant literature mostly addresses considerations of service robots from the perspective of customers, however research on managers’ and HR professionals’ perceptions of outcomes resulting from the adoption of service robot technology is still lacking (Xu et al., 2020). Thus, this study seeks to examine how robotic technology can influence the future workplace and serve to bridge the prevailing knowledge gap related to the impact of service robots in relation to the job profiles in the hospitality industry.

Researchers have proposed that businesses can expect considerably higher returns on investments (ROI) from robotic technologies (Finch et al., 2018). Furthermore, service robots may be the answer to combat the prevalent manpower crunch issue in the hospitality industry (Decker et al., 2017). The present study builds on these considerations and examines the impacts of the adoption of service robots based on the following two research objectives:

1. To analyze the factors that contribute to the development of job profiles in the hotel industry.

2. To investigate the impact of service robots and automation technology on future job profiles in the hospitality industry.

II. LITERATURE REVIEW

A. Background

The COVID-19 pandemic has accelerated the adoption of technology in various industries (Rosete et al., 2020). The convergence of technologies has led to the creation of new products and services but has also resulted in technological obsolescence. The emergence of 5G, artificial intelligence, machine learning, virtual and augmented reality as well as other enabling technologies, has been shown to have a positive general effect on the quality of life (Khan, 2020). Moreover, new business models and revenue generating centers have been formed as a result of the implementation of digital transformation strategies. Blockchain technology for example is expected to generate more than USD23 billion by 2023 (Aoun et al., 2021). The incorporation of service robotics and other technologies could therefore also be beneficial in addressing the prevalent issues faced in the hospitality industry (Lu et al., 2019; Wirtz et al., 2018).

B. Technology in the Hospitality Industry

The last decade has spurred unprecedented growth in the adoption of smart technologies in the hospitality industry. The application of technology is apparent in a broad range of service sectors (Rosete et al., 2020), resulting in increased efficiency and service quality (Barras, 1990) through the automation of many laborious tasks (Bindi et al., 2008). The development has further created opportunities for businesses to interact with customers via touchpoints and to provide services that are more personalized in nature (Buhalis & Sinarta, 2019).

Technology has also reshaped the hotel industry, playing a significant role in providing hotels with a competitive advantage. It is shown in the literature that a significant positive relationship exists between the adoption of information technology (IT) and the drive to construct a competitive advantage (Cho & Olsen, 1998). The emergence of 5G for example, has improved service innovation for firms, such as the delivery of online marketing content and supporting the Internet of Things (IoT) connectivity (Gomez & Paradells, 2015). Hotel technology applications can also improve guest experience, as the sophistication of technology adopted can have a direct influence on future hotel visitor ship experience (Lukanova & Ilieva, 2019).

Digital innovations and technological novelties have moreover changed the framework of business operations in the hospitality and tourism industry, through the property-wide use of smartphones, coupled with high-speed internet connections, improving departmental operational processes and marketing strategies (Kim et al., 2014). The incorporation of smart technology also opened new horizons for the interconnectivity between multiple stakeholders that support prompt information exchange to make comprehensive business decisions (Buhalis & Amaranggana, 2015). IoT also offers data capabilities and

technological solutions that enhance current business models in the hotel industry (Buhalis & Leung, 2018).

However, researchers have pointed out that the hotel sector has been lagging in readily purchasing and adopting technological solutions, citing reasons such as high costs and a hesitancy to adopt new systems (Siguaw et al., 2000). When considering external factors such as the COVID-19 pandemic, the hotel industry now has to be agile and embrace new technologies in order to remain competitive. Self-service technology such as service robots and self-service kiosks have gained increased attention, particularly during the pandemic, as these innovative solutions have offered solace in a time where physical interaction may be detrimental (Gursoy & Chi, 2020). Service robots are also becoming increasingly useful in both back-of-house and customer facing roles (Murphy et al., 2016) as an answer to address manpower crunch issues. Service robots are therefore expected to radically change the service and management strategies in the hospitality industry (Tuomi, et al., 2020).

C. Application of Service Robots in Hotels

The adoption of service robots can bring about implications to the hotel organization. Hackman and Oldham's (1980) job characteristic model serves as a theoretical foundation to examine job design, job redesign, and general workplace improvements. Based on this model, technology can impact job scope and employee's job satisfaction. Moreover, new roles have been introduced and reformed through digitization such as the electronic environment, social media and technological advancement (McMullen & Yeh, 2013). However, technological implementation can also result in the de-skilling of employees (Morris et al., 2004). In fact, jobs previously performed by human employees may be replaced by service robots or other technologies (Liu & Wang, 2018).

The World Economic Forum (2020) published the Future of Jobs report, which suggests the surge in digital technologies and automation will transform tasks, jobs and skills within the next five years. In line with these developments, researchers have emphasized the importance of role readiness for employees to adapt to the new service environment (Larivière et al., 2017). This requires an entirely new set of skills, as well as a proactive attitude on the part of the public sector, to assist employees in reskilling and upskilling (Huang & Rust, 2018). According to earlier studies on the use of technology in service encounters (Bowen, 2016), technology plays two main roles: supporting automation (Support) and substitutive automation (Substitute). Furthermore, Bowen (2016) suggests that the increased use of technology in service encounters may shift the role of employees. Employees have previously been focused on more sophisticated jobs that require critical thinking or emotional intelligence, while technology performed better with repetitive chores. Automation technologies have modified job profiles in hospitality service engagements, in addition to boosting service offerings (Buhalis & Sinarta, 2019). As a result of the adoption of technology, there has been a rising requirement in the upskilling of employees, and there has also been a rise in new job opportunities for service staff as well as an increase in operational efficiency (Tuomi et al., 2021).

Rapid technological development, coupled with the external environmental threat brought about by the COVID-19 pandemic has driven the redefinition of HR practices in hotel management. The industry suffered an employment shock as employees were put on furlough to cope with the severe losses due to the decrease in inbound tourists. Job insecurity amongst employees also surfaced as organizations were conducting layoffs or downsizing operations (Jung et al., 2021).. Undoubtedly, the crisis altered the industry, forcing stakeholders to reinvent and innovate in order to survive. According to Waschull et al., (2017) as technological advancements continue, management has become more reliant on employees who are more tech-savvy as opposed to practically skilled. Employees are also expected to possess higher skill levels to keep up with the rapid technological development (Waschull et al., 2017).

III. METHODOLOGY

The present study has adopted the interpretivist paradigm to gather deeper insights from the participants, due to the novelty of the developments outlined above. This exploratory approach enabled the researchers to investigate the perspective, experiences, meanings, thoughts, and beliefs of industry stakeholders on the effects of service robots and other technology on job profiles. With a distinct lack of research pertaining to the present topic, the study explores the insights existing under different levels of depth (Boru, 2018) establishing the foundation for potential extensive future research.

The researchers adopted the use of semi structured interviews as the method of data collection. Interviews are seen as the study of diversity of the topic of interest within a population, creating relevant dimensions and values within a population (Jansen, 2010), and analyzing the findings to explore meanings and experiences (Fink, 2003).

The advantage of adopting an interview method is that it is an efficient, flexible, and cost-effective way of investigating the perspectives of participants.

A. Time Scales

Cross sectional studies are conducted within a short period, investigating an ongoing situation within a population for that given point in time (Zheng, 2015). Such analyses offer researchers a time frame in the present to conduct the research and provide them with a guideline and perimeter on data collection, focusing on individual attributes and features of exposures of individual participants and outcomes (Levin, 2006).

In the present study, cross sectional studies apply to investigating the perceptions of the interviewed participants,

based on their exposure to service robots and their effects on job profiles. The researchers were therefore more likely to estimate the prevalence and ratios to analyze the relationship between the exposure and the outcome (Setia, 2016).

B. Data Collection and Sampling

Interviews are predominantly used to explore the views, experiences, beliefs, or motivations of participants, providing a deeper understanding of the social phenomenon (Gill et al., 2008; Silverman, 2000). Within the semi-structured approach, researchers use a set of open-ended questions to collect data, with planned and unplanned probes when compelling insights are seen during the process (Young et al., 2018). This provides the researchers the flexibility to discuss the topic in detail, gaining a deeper understanding of one's behaviours and attitudes (Christou, 2006; Fontana & Frey, 1994; Minichiello et al., 1995), in line with the study's exploratory and interpretive nature.

As iterated by other literature (Guest et al., 2006; Morse, 2000; Strauss & Corbin, 1998), the data collection process with an undefined sample size should conclude once it stops providing new insights or themes, achieving data saturation. Non-probability and convenience sampling methods were adopted during the span of the research. Convenience sampling methods typically lead to subjective methods to be adopted (Etikan et al., 2016), whereby participants were selected, or referred to the researchers to partake in the study based on criteria such as ease of access, availability or willingness to participate due to personal interest (Dörnyei, 2007). Although its implementation is faster and cheaper in contrast to probability sampling (Battaglia, 2008), this method of sampling may result in limiting the rigor of the data and hindering the empirical associations generalizable outside the participant group (Stratton, 2021).

In order to mitigate the issues outlined above and to ensure a higher quality of the responses, the following participant criteria were set: (a) professionals with experience in the hospitality or hotel industry, (b) hospitality professionals managing or working within the human resource department, (c) academics exposed or having researched service robots and other related technology, leading to the curation of participants with diversified backgrounds ranging from hotel leaders to university professors.

The Participants were generally within the age range of 30 to above 60, with respective education levels ranging from a diploma to a PhD. Participants were distinctively segregated into two main clusters: academia and industry professionals, with more than 5 years in the hotel or hospitality industry (see Fig. 1)

Respondent ID:	Current Position	Gender	Age Range	Level of Education	Years of Experience
00 (Pilot)	Professor	Female	50-59	PhD	8 Years
01	Strategic Advisor, ex-CEO	Male	60 and above	PhD	45 Years
02	Learning and Talent Development Manager	Male	30-39	Masters	More than 10 years
03	Independent Consultant, Hospitality, Revenue, Strategy	Male	60 and above	-	More than 50 years
04	Head of Business Performance	Male	30-39	Bachelor's Degree	12 Years
05	Managing Director, Business Development	Male	40-49	Masters	5 Years
06	Professor	Male	40-49	PhD	More than 25 years
07	Professor	Male	60 and above	PhD	10 years
08	Human Resource Application Developer	Male	30-39	Bachelor's Degree	More than 12 years
09	General Manager	Male	50-59	Diploma	32 Years
10	Professor	Male	30-39	PhD	21 Years
11	Professor	Male	30-39	PhD	10 Years
12	Corporate Director, Marketing and Sales	Male	60 and above	Master's Degree	35 Years
13	Professor	Male	40-49	PhD	21 Years
14	Professor	Male	60 and above	PhD	35 Years

Fig. 1. Participant Profile.

C. Data Analysis

Open coding was used within this study, attempting to make order and sense of the data, as well as allowing researchers to identify concepts and thematic areas (Williams & Moser, 2019). Color coding was also adopted as recommended by Linneberg and Kosgaard (2019), highlighting its suitability for projects with limited data, using one color for each code.

The analysis process for the present study was adopted from Watkins (2012) who suggest that after revisiting the research questions, researchers should familiarize themselves with the documents involved before developing individual open codes, phrases, and ideas. Moreover, researchers are to look across transcripts, highlighting text in-line with each open code and subsequently, results are to be reviewed, where finalized codes are classified as themes that are presented. Considering this, codes were curated and finalized based on the literature review as well as the research questions and objectives. Upon concluding the data collection and analytical process through Microsoft Excel, the finalized codes were classified as themes, of which findings will be presented below.

IV. FINDINGS AND DISCUSSION

The current study aims to explore how service robots and other technology affect future job profiles through a blended approach with 14 participants of two clusters: academia and industry professionals. The findings suggest that participants generally reflect a consensus with the literature, broadly concurring that service robots may have significant effects on job profiles (Oderken et al., 2022; Yoganthan et al., 2021; Wirtz et al., 2018). However, it should be noted that some respondents remain resistant to the idea of normalization of service robots within the hotel industry.

The findings reveal that the acceptance of service robots is largely dependent on the tier of the hotel. Participants generalized that guests at a luxury-tier hotel would not be receptive as service robots would degrade their hospitality experience. In contrast, guests at a limited-service hotel would perceive robots as a cost-saving measure, thus they would be more accepting of the experience. This finding echoes Tasci and Semrad (2016) and the results of Walker (2012) that service robots may jeopardize customers' feeling of hospitableness in a hospitality experience.

Findings also reveal that hoteliers would be hesitant to adopt service robots due to the factors of cost and possibility of

technological breakdown involved. However, the findings also suggest that cooperative robotics would complement current employees through the removal of menial tasks. This is supported by Choi et al (2020), Odekerken et al (2022), Yoganathan et al (2021) and Yoon and Lee (2019) who found that the incorporation of service robots as part of the operational team would lead to an optimum form of collaboration. Despite the associated benefits, reservations are apparent in the consideration process. This finding echoes Siguaw et al (2020) and the identification by Alohalı et al (2020) and Chang et al (2019) that hoteliers are lagging in readily adopting technological solutions due to high costs and the risk of technology failure.

The juxtaposed views from the participants' responses and the extant literature on the acceptance of service robots brought about two distinct emerging themes. Firstly, the perception of service from the viewpoint of guests has gone through an iterative evolution over the years. The findings reveal that the perception of what service is has transitioned, with the introduction of various technological additions in the progressing timeline of the hotel industry. Secondly, service robots only act as a short-term solution and do not improve productivity and efficiency in the workplace. This provides a contrasting perspective from the literature, as service robots are often regarded as a low operating cost solution to enhance work processes (Dadi et al., 2021; Solnet et al., 2016; Wirtz et al., 2018).

Although participants from both clusters generally reflect a common consensus on their views on service robots, the standpoint stemming from each individual's area of expertise can provide varying attitudes. The academics generally presented a more optimistic view of service robots through the common association of 'cost-reduction' and 'efficiency' but acknowledged the prevalent negative aspect of 'loss of human-interaction' as well. However, the industry professionals presented a perspective focused on practicality and competitive advantages, commonly associating terms such as 'differentiation'. It is important to note that the different backgrounds that participants possess can bring light to different viewpoints, which can provide valuable insights for current practice and future research.

One point that both clusters agreed on however is the importance of job redesign, changing current job profiles. With service robotics complementing the human workforce in the service equation, it releases the employees from repetitive and highly laborious tasks, allowing them to utilize the time and required cost to enhance their current level of skills (Dadi et al., 2021). The adoption of this technology has the potential to alter existing job profiles in the workforce and reveal opportunities for reskilling and upskilling (Odekerken et al., 2022). Participants were asked about their perspective on the change of future job profiles and reflected high consensus in the concept of complementary robotics, where they believe this solution will benefit the employees.

Participants agreed that service robots could free up existing employees from mundane and repetitive tasks, in exchange for higher skilled and higher compensated activities. This is in line with existing research that outlined the degree of effectiveness with complementary robotics (Choi et al., 2020). Longo et al

(2020) also noted the improvement in tasks and service delivery through opportunities to upskill the workforce and promote a higher degree of collaboration between employees and these technological tools

Participants further noted that it is not viable to completely replace human labour with robotics, noting that mainly lower level jobs would face the possibility of replacement. Concurring with current literature, employees with lower skill levels are most susceptible to being replaced, reducing the necessary employment cost (Solnet et al., 2016). Nevertheless, participants view this as an improvement to productivity and efficiency, in line with existing research where robots substitute employees at monotonous and repetitive jobs (Dadi et al., 2021). General consensus from the participants that reflects an enhancement in job profiles of hotel employees through the implementation of service robots. By improving poor work conditions and substandard employee benefits (Choi, 2006; Koo & Curtis, 2020), employees would be more inclined to stay, thus addressing the prevalent issue of manpower crunch in the industry.

V. CONCLUSION

A qualitative research study was conducted to examine the perspectives of management and academia specialising in the field of hospitality and service robots, answering the question of:

"In which way will service robots and other technology affect job profiles in the hospitality industry?"

It also addresses the knowledge gap in the literature and contributes to the field of study for hospitality management and academia. With two research objectives for this study, the first research objective was to analyze the factors that contribute to the development of job profiles. The second research objective of investigating the impact of service robots and technology on future job profiles in the hospitality industry.

The key findings of this study highlighted the acceptance of service robots being dependent on a hotel's tier. Hoteliers are reluctant to adopt technology due to financial and technological concerns, and service robots should be a cooperative robot that complements employees by reducing menial tasks during operations.

A. Implications for practitioners

Based on responses from academia, the team concluded that hospitality managers need to commit themselves to provide the resources and support needed for employees to adapt and effectively work with service robots and other technology. It was also highlighted to strike a balance between the use of service robots and humans, as service robots should be taking a cooperative standpoint to aid instead of replacing the human workforce (Xu et al., 2020). However, despite acknowledging this, participants chose to retain their stance of not adopting technology, potentially indicating a trend towards the future of the industry.

Taking luxury hotels into context, participants suggested that, as customers seek to experience high touch human

interactions, the adoption of technology can be a disruption that negatively affects customers. However, the findings of Boo and Chua (2022) state otherwise. It was found that respondents were neutral towards the implementation of technology within check-in and out processes within a five-star hotel, which indicates that management's perspective towards customers' expectations of service may not be accurate. Thus, it is essential for management to understand the viewpoints of customers before being resistant towards adoption of technology. Based on the literature review, the pandemic has placed a spotlight on the industry's unsustainable reliance on foreign workers, leading to larger emphasis towards the adoption of new manpower frameworks and technological solutions (Baum et al., 2020). With Singapore's ageing population, Tan et al. (2017) highlighted that 55% of employees will be over age 50 by 2030, suggesting rising concerns pertaining to a manpower crunch, and productivity loss from increased sickness and absenteeism. Therefore, this leads to the question of whether the hospitality industry is able to sustain itself in the event of another pandemic.

The adoption of service robots and other technology will be inevitable in the coming years, serving as a valuable resource for hospitality businesses to optimize performance (Bowen & Morosan, 2018). As highlighted by participants, this adoption opens opportunities for job redesign to upskill employees, leaving menial tasks to robots. Hoteliers should therefore meticulously plan their approach towards the adoption of technology with change management strategies that aids employees to accept and embrace change (Lee, 2008). This would not only ensure that the adoption provides short-term productivity and efficiency benefits, but it would also allow hoteliers to work towards an avenue that can serve as a sustainable measure. If this process is neglected, it may potentially impact employees negatively, ultimately not advocating for these changes.

B. Limitations and Future Research

As highlighted within the methodology, undertaking a cross-sectional time scale approach has led to the lack of viewpoints from other stakeholders, be it from a local or international standpoint. Therefore, future research areas can focus on these aspects. Gathering the perspective of other industry stakeholders from various backgrounds such as management from different types and sizes of hotels, employees from other departments, service robot suppliers, and customers, the data collected can contribute to the existing body of research.

A longitudinal mixed-method study could be adopted within this context, using both qualitative and quantitative data collection and analysis approaches to capture the changes over time (Plano-Clark et al., 2015). This would allow researchers to gain an in-depth understanding of the phenomenon with qualitative aspects, and the utilization of quantitative statistical analysis to combine, link and integrate both findings (Creswell, 1999).

Participants highlighted that it is natural for employees to be resistant to change due to uncertainty and fear, and job redesign is a strategy that will become apparent during the technological adoption process. Therefore, the role of HR is emphasized to

aid organizations in training employees. As mentioned by Tafvelin et al. (2019), aligning training with job redesign can be a favorable strategy to achieve positive organizational outcomes.

Future researcher may consider studying the implementation of service robots and other technologies, with aspects of job redesign to study the impacts revolving employees, revealing what can be done within a HR perspective to aid the process. This would not only allow for an in-depth understanding of employees during the process of change, but it may also potentially develop findings that influence other hoteliers to adopt similar processes.

REFERENCES

- [1] Aguiar-Quintana, Teresa, Thi Hong Hai Nguyen, Yasmina Araujo-Cabrera, and José M. Sanabria-Díaz. "Do job insecurity, anxiety and depression caused by the COVID-19 pandemic influence hotel employees' self-rated task performance? The moderating role of employee resilience." *International Journal of Hospitality Management* 94 (2021): 102868. <https://doi.org/10.1016/j.ijhm.2021.102868>
- [2] Ahammad, Shamim. "Importance of Training in Hotel industry." (2013). <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A651957&swid=-7931>
- [3] Alohal, Mansor, Fergal Carton, and Yvonne O'Connor. "Investigating the antecedents of perceived threats and user resistance to health information technology: a case study of a public hospital." *Journal of Decision Systems* 29, no. 1 (2020): 27-52. <https://doi.org/10.1080/12460125.2020.1728988>
- [4] Aoun, Alain, Adrian Ilinca, Mazen Ghandour, and Hussein Ibrahim. "A review of Industry 4.0 characteristics and challenges, with potential improvements using blockchain technology." *Computers & Industrial Engineering* 162 (2021): 107746. <https://doi.org/10.1016/j.cie.2021.107746>
- [5] Baum, Tom, Shelagh KK Mooney, Richard NS Robinson, and David Solnet. "COVID-19's impact on the hospitality workforce—new crisis or amplification of the norm?." *International Journal of Contemporary Hospitality Management* (2020). <https://doi.org/10.1108/IJCHM-04-2020-0314>
- [6] Barras, Richard. "Interactive innovation in financial and business services: the vanguard of the service revolution." *Research policy* 19, no. 3 (1990): 215-237. [https://doi.org/10.1016/0048-7333\(90\)90037-7](https://doi.org/10.1016/0048-7333(90)90037-7)
- [7] Battaglia, Michael, N. Sampling, and P. J. Lavrakas. "Encyclopedia of survey research methods." *Publication date* (2008).
- [8] Boru, T. (2018). Chapter 5: Research Design And Methodology. <https://doi.org/10.13140/RG.2.2.21467.62242>
- [9] Bindi, Filippo, Riccardo Manzini, Arrigo Pareschi, and Alberto Regattieri. "Similarity-based storage allocation rules in an order picking system: an application to the food service industry." *International Journal of Logistics: Research and Applications* 12, no. 4 (2009): 233-247. <https://doi.org/10.1080/13675560903075943>
- [10] Bowen, David E. "The changing role of employees in service theory and practice: An interdisciplinary view." *Human Resource Management Review* 26, no. 1 (2016): 4-13. <https://doi.org/10.1016/j.hrmr.2015.09.002>
- [11] Bowen, John, and Cristian Morosan. "Beware hospitality industry: the robots are coming." *Worldwide Hospitality and Tourism Themes* (2018). <https://doi.org/10.1108/WHATT-07-2018-0045>
- [12] Buhalis, Dimitrios, and Aditya Amaranggana. "Smart tourism destinations enhancing tourism experience through personalisation of services." In *Information and communication technologies in tourism 2015*, pp. 377-389. Springer, Cham, 2015. https://doi.org/10.1007/978-3-319-14343-9_28
- [13] Buhalis, D., & Leung, R. (2018). Smart hospitality—Interconnectivity and interoperability towards an ecosystem. *International Journal of Hospitality Management*, 71, 41-50.
- [14] <https://doi.org/10.1016/j.ijhm.2017.11.011>

- [15] Buhalis, D., & Sinarta, Y. (2019). Real-time co-creation and oneness service: lessons from tourism and hospitality. *Journal of Travel & Tourism Marketing*, 36(5), 563-582.
<https://doi.org/10.1016/j.tourman.2018.08.026>
- [16] Chang, Yu-Wei, Ping-Yu Hsu, and Yi-Chen Lan. "Cooperation and competition between online travel agencies and hotels." *Tourism Management* 71 (2019): 187-196.
<https://doi.org/10.1016/j.tourman.2018.08.026>
- [17] Chen, James KC, Amrita Batchuluun, and Javkhuu Batnasan. "Services innovation impact to customer satisfaction and customer value enhancement in airport." *Technology in Society* 43 (2015): 219-230.
<https://doi.org/10.1016/j.techsoc.2015.05.010>
- [18] Cho, Wonae, and Michael D. Olsen. "A case study approach to understanding the impact of information technology on competitive advantage in the lodging industry." *Journal of Hospitality & Tourism Research* 22, no. 4 (1998): 376-394.
<https://doi.org/10.1177/109634809802200404>
- [19] Choi, Kyuhwan. "A structural relationship analysis of hotel employees' turnover intention." *Asia Pacific Journal of Tourism Research* 11, no. 4 (2006): 321-337.
<https://doi.org/10.1080/10941660600931150>
- [20] Choi, Youngjoon, Miju Choi, Munhyang Oh, and Seongseop Kim. "Service robots in hotels: understanding the service quality perceptions of human-robot interaction." *Journal of Hospitality Marketing & Management* 29, no. 6 (2020): 613-635.
<https://doi.org/10.1080/19368623.2020.1703871>
- [21] Chuah, Stephanie Hui-Wen, Eugene Cheng-Xi Aw, and Cheng-Feng Cheng. "A silver lining in the COVID-19 cloud: Examining customers' value perceptions, willingness to use and pay more for robotic restaurants." *Journal of Hospitality Marketing & Management* 31, no. 1 (2022): 49-76.
<https://doi.org/10.1080/19368623.2021.1926038>
- [22] Creswell, John W. "Mixed-method research: Introduction and application." In *Handbook of educational policy*, pp. 455-472. Academic press, 1999.
<https://doi.org/10.1016/B978-012174698-8/50045-X>
- [23] Dadi, Hussain, Mubarak Al-Haidous, Nayef Radwi, and Loay Ismail. "Service Robots in Hospitals To Reduce Spreading of COVID-19." In *2021 Fifth World Conference on Smart Trends in Systems Security and Sustainability (WorldS4)*, pp. 212-217. IEEE, 2021.
<https://doi.org/10.1109/WorldS451998.2021.9514018>
- [24] Decker, Michael, Martin Fischer, and Ingrid Ott. "Service Robotics and Human Labor: A first technology assessment of substitution and cooperation." *Robotics and Autonomous Systems* 87 (2017): 348-354.
<https://doi.org/10.1016/j.robot.2016.09.017>
- [25] Dörnyei, Z. (2007). *Research methods in applied linguistics*. New York: Oxford University Press.
- [26] Etikan, Ilker, Sulaiman Abubakar Musa, and Rukayya Sunusi Alkassim. "Comparison of convenience sampling and purposive sampling." *American journal of theoretical and applied statistics* 5, no. 1 (2016): 1-4.
<https://doi.org/10.11648/j.ajtas.20160501.11>
- [27] Finch, Glenn, Brian Goehring, and Anthony Marshall. "Cognitive innovation: top performers share their best practices." *Strategy & Leadership* (2018).
<https://doi.org/10.1108/SL-10-2017-0095>
- [28] Fink, Arlene. *The survey handbook*. sage, 2003.
<https://doi.org/10.4135/9781412986328>
- [29] Gomez, Carles, and Josep Paradells. "Urban automation networks: Current and emerging solutions for sensed data collection and actuation in smart cities." *Sensors* 15, no. 9 (2015): 22874-22898.
<https://doi.org/10.3390/s150922874>
- [30] Guest, Greg, Arwen Bunce, and Laura Johnson. "How many interviews are enough? An experiment with data saturation and variability." *Field methods* 18, no. 1 (2006): 59-82.
<https://doi.org/10.1177/1525822X05279903>
- [31] Gursoy, Dogan, and Christina G. Chi. "Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda." *Journal of Hospitality Marketing & Management* 29, no. 5 (2020): 527-529.
<https://doi.org/10.1080/19368623.2020.1788231>
- [32] Hackman, J. Richard. "Work redesign and motivation." *Professional psychology* 11, no. 3 (1980): 445.
<https://doi.org/10.1037/0735-7028.11.3.445>
- [33] Huang, Ming-Hui, and Roland T. Rust. "Artificial intelligence in service." *Journal of Service Research* 21, no. 2 (2018): 155-172.
- [34] Jansen, Harrie. "The logic of qualitative survey research and its position in the field of social research methods." In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, vol. 11, no. 2. 2010.
- [35] Jung, Hyo Sun, Yoon Sik Jung, and Hye Hyun Yoon. "COVID-19: The effects of job insecurity on the job engagement and turnover intent of deluxe hotel employees and the moderating role of generational characteristics." *International Journal of Hospitality Management* 92 (2021): 102703.
<https://doi.org/10.1016/j.ijhm.2020.102703>
- [36] Khan, Muhammad Khurram. "Technological advancements and 2020." *Telecommunication Systems* 73, no. 1 (2020): 1-2.
<https://doi.org/10.1080/15256480.2014.961795>
- [37] Kim, Jungsun, Daniel J. Connolly, and Shane Blum. "Mobile technology: An exploratory study of hotel managers." *International Journal of Hospitality & Tourism Administration* 15, no. 4 (2014): 417-446.
<https://doi.org/10.1080/15256480.2014.961795>
- [38] Koo, Bonhak, Catherine Curtis, and Bill Ryan. "Examining the impact of artificial intelligence on hotel employees through job insecurity perspectives." *International Journal of Hospitality Management* 95 (2021): 102763.
<https://doi.org/10.1016/j.ijhm.2020.102763>
- [39] Larivière, Bart, David Bowen, Tor W. Andreassen, Werner Kunz, Nancy J. Sirianni, Chris Voss, Nancy V. Wunderlich, and Arne De Keyser. "'Service Encounter 2.0': An investigation into the roles of technology, employees and customers." *Journal of business research* 79 (2017): 238-246.
<https://doi.org/10.1016/j.jbusres.2017.03.008>
- [40] Lee, Wen-Hwa, Ching-Wen Lin, and Kuang-Heng Shih. "A technology acceptance model for the perception of restaurant service robots for trust, interactivity, and output quality." *International Journal of Mobile Communications* 16, no. 4 (2018): 361-376.
<https://doi.org/10.1504/IJMC.2018.092666>
- [41] Levin, Kate Ann. "Study design III: Cross-sectional studies." *Evidence-based dentistry* 7, no. 1 (2006): 24-25.
<https://doi.org/10.1038/sj.ebd.6400375>
- [42] Linneberg, Mai Skjott, and Steffen Korsgaard. "Coding qualitative data: A synthesis guiding the novice." *Qualitative research journal* (2019).
- [43] Liu, Hongyi, and Lihui Wang. "Gesture recognition for human-robot collaboration: A review." *International Journal of Industrial Ergonomics* 68 (2018): 355-367.
<https://doi.org/10.1016/j.ergon.2017.02.004>
- [44] Longo, Francesco, Antonio Padovano, and Steven Umbrello. "Value-oriented and ethical technology engineering in industry 5.0: A human-centric perspective for the design of the factory of the future." *Applied Sciences* 10, no. 12 (2020): 4182.
<https://doi.org/10.3390/app10124182>
- [45] Lu, Lu, Ruiying Cai, and Dogan Gursoy. "Developing and validating a service robot integration willingness scale." *International Journal of Hospitality Management* 80 (2019): 36-51.
<https://doi.org/10.1016/j.ijhm.2019.01.005>
- [46] Lukanova, Georgina, and Galina Ilieva. "Robots, artificial intelligence, and service automation in hotels." In *Robots, artificial intelligence, and service automation in travel, tourism and hospitality*. Emerald Publishing Limited, 2019.
<https://doi.org/10.1108/978-1-78756-687-320191009>
- [47] McMullen, Karen D., and Felicia Yeh. "Adapting to change: A survey of evolving job descriptions in medical librarianship." *Journal of Hospital Librarianship* 13, no. 3 (2013): 246-257.
<https://doi.org/10.1080/15323269.2013.798772>
- [48] Majumdar, Raju. "Surviving and growing in the post-Covid world: the case of Indian hotels." *Worldwide Hospitality and Tourism Themes* (2021).
<https://doi.org/10.1108/WHATT-05-2021-0064>
- [49] Marco-Lajara, Bartolomé, and Mercedes Úbeda-García. "Human resource management approaches in Spanish hotels: An introductory analysis." *International Journal of Hospitality Management* 35 (2013): 339-347.
<https://doi.org/10.1016/j.ijhm.2013.07.006>

- [50] Morse, Janice M. "Determining sample size." *Qualitative health research* 10, no. 1 (2000): 3-5.
- [51] Morris, Michael G., Monroe Hall, Viswanath Venkatesh, and Shreevardhan Lele. "TECHNOLOGY AS AN ORGANIZATIONAL CHANGE VEHICLE: IMPACTS ON JOB SCOPE AND AFFECTIVE JOB OUTCOMES." (2004).
- [52] Odekerken-Schröder, Gaby, Kars Mennens, Mark Steins, and Dominik Mahr. "The service triad: an empirical study of service robots, customers and frontline employees." *Journal of Service Management* (2021). <https://doi.org/10.1108/JOSM-10-2020-0372>
- [53] Plano Clark, Vicki L., Nancy Anderson, Jessica A. Wertz, Yuchun Zhou, Karen Schumacher, and Christine Miaskowski. "Conceptualizing longitudinal mixed methods designs: A methodological review of health sciences research." *Journal of Mixed Methods Research* 9, no. 4 (2015): 297-319. <https://doi.org/10.1177/1558689814543563>
- [54] Rosete, Ana, Barbara Soares, Juliana Salvadorinho, João Reis, and Marlene Amorim. "Service robots in the hospitality industry: An exploratory literature review." In *International Conference on Exploring Services Science*, pp. 174-186. Springer, Cham, 2020. https://doi.org/10.1007/978-3-030-38724-2_13
- [55] Setia, Maninder Singh. "Methodology series module 3: Cross-sectional studies." *Indian journal of dermatology* 61, no. 3 (2016): 261. <https://doi.org/10.4103/0019-5154.182410>
- [56] Siguwaw, Judy A., Cathy A. Enz, and Karthik Namasivayam. "Adoption of information technology in US hotels: strategically driven objectives." *Journal of Travel Research* 39, no. 2 (2000): 192-201. <https://doi.org/10.1177/004728750003900209>
- [57] Solnet, David, Tom Baum, Richard NS Robinson, and Leonie Lockstone-Binney. "What about the workers? Roles and skills for employees in hotels of the future." *Journal of Vacation Marketing* 22, no. 3 (2016): 212-226. <https://doi.org/10.1177/1356766715617403>
- [58] Stratton, S. J. (2021). Population research: convenience sampling strategies. *Prehospital and disaster Medicine*, 36(4), 373-374
- [59] Strauss, Anselm, and Juliet Corbin. *Basics of qualitative research*. Sage publications, 1990. <https://doi.org/10.1017/S1049023X21000649>
- [60] Tafvelin, Susanne, Andreas Stenling, Robert Lundmark, and Kristina Westerberg. "Aligning job redesign with leadership training to improve supervisor support: a quasi-experimental study of the integration of HR practices." *European Journal of Work and Organizational Psychology* 28, no. 1 (2019): 74-84. <https://doi.org/10.1080/1359432X.2018.1541887>
- [61] Tan, J., Phan H. Yulianti, and H. V. Phan. "Aging workforce: Cost and productivity challenges of ill health in Singapore." (2017).
- [62] Tasci, Asli DA, and Kelly J. Semrad. "Developing a scale of hospitableness: A tale of two worlds." *International Journal of Hospitality Management* 53 (2016): 30-41. <https://doi.org/10.1016/j.ijhm.2015.11.006>
- [63] Tuomi, Aarni, Iis P. Tussyadiah, and Jason Stienmetz. "Applications and implications of service robots in hospitality." *Cornell Hospitality Quarterly* 62, no. 2 (2021): 232-247. <https://doi.org/10.1177/1938965520923961>
- [64] Walker, John R. *Introduction to hospitality*. Prentice Hall, 2002.
- [65] Wang, Yi-Chieh, Ching-Ching Luo, and Yang-Fei Tai. "Implementation of delightful services: From the perspective of frontline service employees." *Journal of Hospitality and Tourism Management* 31 (2017): 90-104. <https://doi.org/10.1016/j.jhtm.2016.10.006>
- [66] Washull, S., Jos AC Bokhorst, and Johan C. Wortmann. "Impact of technology on work: Technical functionalities that give rise to new job designs in industry 4.0." In *IFIP International Conference on Advances in Production Management Systems*, pp. 274-281. Springer, Cham, 2017. https://doi.org/10.1007/978-3-319-66923-6_32
- [67] Watkins, Daphne C. "Qualitative research: The importance of conducting research that doesn't "count"." *Health promotion practice* 13, no. 2 (2012): 153-158.
- [68] Williams, Michael, and Tami Moser. "The art of coding and thematic exploration in qualitative research." *International Management Review* 15, no. 1 (2019): 45-55.
- [69] Williams M, & Hancock B (Eds.), *Research Approaches in Primary Care* (pp. 77–112). Radcliffe Medical Press / Trent Focus. https://www.researchgate.net/publication/270684903_Surveys_and_Questionnaires
- [70] Wirtz, Jochen, Paul G. Patterson, Werner H. Kunz, Thorsten Gruber, Vinh Nhat Lu, Stefanie Paluch, and Antje Martins. "Brave new world: service robots in the frontline." *Journal of Service Management* (2018). <https://doi.org/10.1108/JOSM-04-2018-0119>
- [71] World Economic Forum. (October, 2020). *The Future of Jobs Report*.
- [72] https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf
- [73] Xiang, Zheng, Zvi Schwartz, John H. Gerdes Jr, and Muzaffer Uysal. "What can big data and text analytics tell us about hotel guest experience and satisfaction?." *International journal of hospitality management* 44 (2015): 120-130. <https://doi.org/10.1016/j.ijhm.2014.10.013>
- [74] Xu, Shi, Jason Stienmetz, and Mark Ashton. "How will service robots redefine leadership in hotel management? A Delphi approach." *International Journal of Contemporary Hospitality Management* 32, no. 6 (2020): 2217-2237. <https://doi.org/10.1108/IJCHM-05-2019-0505>
- [75] Yoganathan, Vignesh, Victoria-Sophie Osburg, Werner H. Kunz, and Waldemar Toporowski. "Check-in at the Robo-desk: Effects of automated social presence on social cognition and service implications." *Tourism Management* 85 (2021): 104309. <https://doi.org/10.1016/j.tourman.2021.104309>
- [76] Yoon, Seong No, and DonHee Lee. "Artificial intelligence and robots in healthcare: What are the success factors for technology-based service encounters?." *International Journal of Healthcare Management* (2018). <https://doi.org/10.1080/20479700.2018.1498220>
- [77] Zheng, Mingyung. "Conceptualization of cross-sectional mixed methods studies in health science: a methodological review." *International Journal of Quantitative and Qualitative Research Methods* 3, no. 2 (2015): 66-87.



Assoc Prof Dr Detlev Remy was born in Bonn, Germany, 24/07/1961. Prof Remy obtained a doctorate from the University of Surrey, UK, 2014, and a master's in marketing, from University College Cork, Ireland, 2007. He works for the Singapore Institute of Technology, Singapore as Associate Professor, teaching Revenue Management, Data Analytics and Digital Marketing whilst researching on Pricing and Revenue Management related topics amongst other research areas. He started his career in the hospitality and tourism industry in 1986, working in various positions up to general management position. These positions included inter alia managing director of the Kurhaus Baden-Baden with banqueting facilities up to 6,000 people and project manager of the consultancy group Dr. Kaub Group, Munich. Additionally, he has started his own consultancy business, "Remy Consult", advising tourism, beverage, and hospitality businesses, and providing executive education to a variety of stakeholders. Prof. Remy runs several applied research projects for the tourism and hospitality industry, inter alia on productivity for attraction businesses, and on new performance metrics for the hotel industry.