Effects of Robots Development on Employees Perception of Human-Robots Collaboration in Hospitality Industry

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ABSTRACT

Robotics technology has transformed the work environment toward automation and affects employees' assessment of robots. Therefore, this dissertation aims to examine whether the introduction of robots influences employees' behavioral intentions to use robots and awareness of robots to promote human-robot collaboration (HRC). Besides, the role of strategic human resource management (HRM) involvement as a moderator in the perception of robots as a team member was investigated.

This thesis followed a quantitative method to examine employees' behavioral intentions to use robots and awareness of robots in promoting human-robot collaboration (HRC), and 500 data were collected from hospitality employees via the Amazon Mechanical Turk platform in the USA. After data cleaning, 329 valid responses were analyzed. Partial least squares structural equation modeling was applied using Smart PLS Ver. 3.0 to test the study's measurement and proposed research model.

The dissertation results show that robots' perceived usefulness and ease of use positively increase employees' behavioral intentions to use robots. In addition, the advantages and disadvantages of robots have a positive impact on robot awareness. Employees' behavioral intentions and awareness contribute positively to human-robot collaboration. On the other hand, the moderating role of strategic HR's involvement in the relationships was insignificant.

Based on the literature review, to the best of the authors' knowledge, this study is one of the first on this topic. It extends TAM with new antecedents related to robot use, robot awareness, and HRC in the travel, tourism, and hospitality (TTH) industry. In addition, this model attempts to determine the factors that favor HRC in the industry. The study results reveal important implications for strengthening human-robot cooperation in the tourism and hospitality industry.

Keywords: Service Robot, Robot Adoption, Robot Awareness, Human-Robot Collaboration, Strategic HRM, Hospitality Industry

ÖZ

Robot teknolojisi çalışma ortamını otomasyon bağlamında dönüştürmüş ve çalışanların robot algısını etkilemiştir. Bu tez, çalışanların robot kullanmaya yönelik davranışsal niyetlerini ve insan-robot iş birliğini teşvik etmek için robot farkındalığını etkileyip etkilemediğini incelemeyi amaçlamıştır. Ayrıca, robotların bir ekip üyesi olarak algılanmasında stratejik insan kaynakları yönetiminin (İKY) düzenleyici rolü incelenmiştir.

Bu tez, çalışanların robot kullanmaya yönelik davranışsal niyetlerini ve insan-robot iş birliğini teşvik etmede robotlara yönelik farkındalığı analiz etme kapsamında nicel bir yöntem izlemiştir. Amazon Mechanical Turk platformu aracılığıyla ABD'deki ağırlama endüstrisi çalışanlarından 500 veri toplanmıştır. Veri ayıklanması işlemi sonunda, 329 geçerli anket analize dahil edilmiştir. Önerilen etkileri ve araştırma modelini test etmek için kısmi en küçük kareler yapısal eşitlik modellemesi (PLS-SEM) Smart PLS Ver 3.0 kullanılarak yapılmıştır.

Araştırma sonuçları, robotların algılanan kullanışlılığının ve kullanım kolaylığının, çalışanların robot kullanmaya yönelik davranışsal niyetlerini olumlu yönde etkilediğini göstermektedir. Ayrıca robotların avantaj ve dezavantajları robot farkındalığını olumlu yönde etkilemektedir. Çalışanların davranışsal niyetleri ve farkındalıkları, insan-robot iş birliğine olumlu olarak katkıda bulunmaktadır. Öte yandan, insan kaynakları yönetiminin düzenleyici rolü istatistiksel olarak anlamlı çıkmamıştır.

Mevcut literatür taraması ve bulgular, bu çalışmanın bu konudaki ilk çalışmalardan biri olduğunu ve turizm endüstrisinde robot kullanımı, robot farkındalığı ve insan-robot iş birliği ile ilgili yeni öncüllerle Teknoloji Kabul Modelini genişlettiğini yansıtmaktadır. Ayrıca bu model, endüstride insan-robot iş birliğini destekleyen faktörleri belirlemiştir. Çalışmanın sonuçları, turizm ve konaklama endüstrisinde insan-robot iş birliğinin güçlendirilmesi kapsamında önemli çıkarımlar ortaya koymaktadır.

Anahtar Kelimeler: Hizmet Robotu, Robot Benimseme, Robot Farkındalığı, İnsan-Robot İş Birliği, Stratejik İnsan Kaynakları Yönetimi, Ağırlama Endüstrisi

DEDICATION

TO MY MOTHER

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
HRC	Human-Robot Collaboration
HRM	Human Resource Management
LBS	Location-Based Services
ML	Machine Learning
MTurk	Amazon Mechanical Turk
SME	Small and Medium-Sized Enterprise
TAM	Technology Acceptance Model
TTH	Travel Tourism and Hospitality

Chapter 1

INTRODUCTION

1.1 Background

Technology development and establishment are speeding up a stage in human history. The history of technology development begins with the innovation of essential tools and techniques in ancient human civilization (Derry, & Williams, 1960; Grinin, Grinin, & Korotayev, 2020). According to Headrick (2009), the modification of primary hunting or household tools to the modern technological device has been passed million years, periodically Stone age, Hydraulic (4000 – 1500 BCE), Iron, horses, and empires (1500BCE – 500 CE), Postclassical and Medieval revaluation (500 - 1400), Age of global interactions (1300 - 1800).

Michelangeli, Di Rita, Lirer, Lubritto, Bellucci, Cascella, and Magri (2022) explained that, first industrial revaluation (1750 - 1869), The acceleration of change (1869 - 1939), Postindustrial world (1939 - 2007). With time human mindset adopted these changes as advancing the world. Saffo (1992) categorized macro-myopia to estimate the impact of new technologies. This argument is strengthened by the timeline between first visibility of a new technology's impact and its real structural impact after the first industrial revolution (1750 - 1869) but from the last three decades' technological revolution has been increasing incredibly (Haupert, 2019). At present, automation, AI, robotics are the game changes; this technological advanced device enhances the quality of personal and professional life.

The history of technology informed that this rapid growing revives dominate employment's negative side (Halteh, Arrowsmith, Parker, Zorn, & Bentley, 2018). Similarly, Ford (2015, P-7) mentioned that “the overall stock of jobs could diminish as machines develop into fully-fledged workers rather than simply tools that complement human skills, as well as what work remains might be polarized into a small number of elites, knowledge-based.” Artificial intelligence (AI) is omnipresent in the human lifestyle using technological devices. Organizations in advanced and emerging countries are willing to adopt robotic devices to be one step further in the competitive market (Kressmann, 2017).

Digital technologies include the internet of things, big data, virtual reality, cloud computing, blockchain, Chatbots, deep learning, machine learning, and robots (Ammar, Haleem, Javaid, Bahl, & Verma, 2021). These technologies are individually or combined to allow digital progress for specific verticals in different service sectors (Crafts, 2021). Scholars also showed that new technologies would support the economic growth and speed up by interaction to capability through risk decrease by normalization and increase profits that revolutionize investment frameworks (Wallis, Colson, & Chilosi, 2018).

This new investment strategy has a direct impact on new technology adoption. In this case, the travel, tourism, and hospitality (TTH) industry have been updating the segment of procedures (autonomy, easy reconfiguration, robust perception systems) in different areas of the services by robot expertise (Ivanov, Gretzel, Berezina, Sigala, & Webster, 2019). In addition, technological adoption gradually increases to full automation or semi-automation and super robotic machinery in different

hospitality sectors. According to Martynovich and Lundquist (2016), technological advancement qualified businesses to be disposed to exhibit several altitudinal circulations that change over time. Therefore, the hospitality industry may perceive higher infiltration of technologies in the future.

Roos and Shroff (2017) stated that how rapidly technology development brings digitization into our regular lives will significantly affect current employment and generate new skilled work. Some scholars called this as fourth industrial revolution 'Industry 4.0'. As a result, scholars concerned about the use of robotic technology may occupy the current existing employment by service robots and offer advanced skill levels for condensed labor costs and turnover, likewise amplified effectiveness of TTH operations (Ivanov et al., 2019; Yang, Henthorne, & George, 2020).

Accordingly, human work replacement impacts job requirements, like advanced skills to adjust and analytical knowledge of using big data, machine learning, and robot control (Arslan, Cooper, Khan, Golgeci, and Ali, 2021). These replacements may receive benefits laterally for the organization in decision bias and provide a better quality of service. According to Ribes, Jackson, Geiger, Burton, and Finholt (2013), in an organization where robotic devices will replace human employees, it will not be an easy task to maintain robots and human labor resources side by side, in addition to continuously upgrading new technology by HRM of the organization and adjust or collaborate with the human resource is quite complicated to accomplish an organizational goal.

In context, Krammer (2021) points out that organizations are under more pressure than ever to innovate, and the HRM function is in a fantastic position to support these ambitions. In the same way, Brockbank (1999) stated that to accomplish competitive improvement in an energetic environment, handling HR strategically is the only approach. In addition, this culture of imagination also revolution across internal-external attach procedures besides organizations' ongoing changes environment by technology. Liu (2021) clarified that strategy development in HR participates fashions a culture of ingenuity and innovation across the organization and connects internal-external processes besides administrations continuing improvement by technology.

Consequently, to adopt new technological advancements in the TTH industry, strategic HRM involvement needs to establish a positive appraisal of redeeming humans as physical labor sources. Robots will maintain automation tasks besides (LaGrandeur & Hughes, 2017). Conclusively, the challenge to deal with hospitality employment and robot use is a more significant complication for HRM to play a role in current circumstances. In 1993 Schraft and Wanner published the first research on tourism and robot, but in 1920, Karel Capek invented the concept of the robot in the drama of “Rossum’s Universal Robots” (cited in Ivanov et al., 2019).

1.2 Problem Statement

Recently service robots have been deployed in various revolutionary airports, hotels, and restaurants to offer an exclusive experience for their guests, such as Hotel Jen in Singapore, Hotel Icon in Hong Kong, and Henn-na Hotel in Japan, which have used robots to take control of the amenities of human employees in the form of anthropomorphous and remnants facts (e.g., front desk, butler, housekeeping, and

concierge) (Choi, Choi, Oh, & Kim, 2020). In addition, robots can provide room service at Shangri-la Group's Hotel Jen and perform concierge service at Hilton Hotels (Reis, Melão, Salvadorinho, Soares, & Rosete, 2020). Thus, companies need to technologically and strategically be prepared for future challenges (Qureshi & Syed, 2014).

According to the literature, some contributions of technological impact on unemployment and robots' usage in the TTH industry are evident. However, it seems that shortage of proper evidence and study gap in the responsibility of strategic HRM on the effect of robots' advancement in the hospitality employment system. Because existing robotics research in the TTH field shows that researchers generally focus on the definition, classification, involvement, and impact of robots (Dautenhahn, Woods, Kaouri, Walters, Koay, & Werry, 2005; Brougham & Haar, 2018; Wirtz, Patterson, Kunz, Gruber, Lu, Paluch, & Martins., 2018; Van Pinxteren, Wetzels, Rüger, Pluymaekers, & Wetzels, 2019; Berezina, Ciftci, & Cobanoglu, 2019; Turja, Aaltonen, Taipale, & Oksanen, 2020; Sinha, Singh, Gupta, & Singh, 2020; Zhu & Chang, 2020; Reis et al., 2020; Samala, Katkam, Bellamkonda, & Rodriguez, 2020; Lee, Ahn, Shin, Kwon, & Back, 2019; Choi et al., 2020; Parvez, Ozturen, & Cobanoglu, 2021). In addition, some researchers focus on customers' perceptions of robots (Tussyadiah & Park, 2018; Chan & Tung, 2019; Christou, Simillidou & Stylianou, 2020).

Employees' experiences of interaction and working with robots (Qureshi & Syed, 2014; Ivanov, Webster, and Garenko, 2018; Yu, 2020; Vatan & Dogan, 2021; Bhargava, Bester, & Bolton, 2021; Del Giudice, Scuotto, Ballestra, & Pironti, 2021a,

b), and human-robot collaboration (Djuric, Urbanic, & Rickli, 2016; Tung & Law, 2017; Hoffman, 2019; Molitor, 2020; Henschel, Hortensius, & Cross, 2020; Libert, Mosconi, & Cadieux, 2020; Wiese, Weis, Bigman, Kapsaskis, & Gray, 2021).

The results of these human-robot studies mentioned above indicate diverse feelings toward using robots. Some researchers suggest that employees' experiences with robots are self-motivated (Przegalinska, Grippa, & Gloor, 2020; Liao & Sundar, 2021). Weber (2018) and Vatan & Dogan (2021) have shown that morality, empathy, trust, dependency, economic and social impact, management actions, and strategic development are underway for robot adoption. However, many questions are unanswered, and there is a need for more scientific studies addressing these issues.

1.3 Research questions and Objectives

In the hospitality industry, the technological association was little before the 1970s, and point-of-sale (POS) systems were the first familiarized computer technology in the hotel around 1970 (Voigt, Buliga, & Michl, 2017; Ahmad, & Scott, 2019). According to the ILO report 2018, "At the global level, the estimated effect of the stock of robots has a coefficient of -0.032, statistically significant at the 5% level" this means a one percent increase in the stock of robots decreases employment by 0.054%. To quantify the impact, if the average number of robots increases by more than 20% as it has happened between 2005 and 2014, employment fell by 0.8%" (cited in Carbonero, Ernst, & Weber, 2018).

Even though TTH has conventionally depended on labor-intensive procedures and HRM has faced difficulties in maintaining employees, technological implementation

proposes a new direction to solving this problem and abridged costs (Crafts, 2021). This new pathway will bring changes in the hospitality industry through technological advancements and reduce the cost of travel (Muller, 2010). Z generations are excited by the improvement of technical use in tourism. They are willing to be part of this technological advancement and would like to enjoy hi-tech service in lodging and dining experience (DiPietro & Wang, 2010; Ahmad & Scott, 2019).

In addition, few studies address the motivation of service workers to use robots or collaborate with robots at work and the role of management/leadership in the decision-making process. This study assumed that service robots could bring a different level of attention to service quality. Therefore, this dissertation aims to deliver a new dimension to initially establish a new strategy of collaboration in HRM strategy to resolve the unemployed problem. Subsequently, research questions are presented: How does technological advancement replace human employment in entry-level jobs, and how useful is this robotic notion in the hospitality industry to resolve turnover? Besides, the research focus on the role of HRM in the hospitality industry on these specific issues. The aims of this research are double:

1) To investigate the factors that lead to human-robot collaboration. In this sense, this study seeks to understand human employees' attitudes, intentions, motivation, and willingness to collaborate with robots. And
2) Despite the increasing use of robots in the TTH industry, it is essential to address the awareness, willingness, and capabilities of HRM in the decision-making of robots' adoption and management.

1.4 Research Contribution

Many latest researchers are discussing robotics, but maximum of those research is in the engineering area. Even though there are some studies in the social science area but is not sufficient and just covers a specific location. Therefore, there is a vast gap in social science robotic research, particularly in the concept of employees' perceptions of human-robot collaboration and embodiment in strategic HRM in typical TTH research. In this concern, this dissertation contributes to TTH research and opens a new door for future researchers. The subject of this dissertation is also appropriate for the current circumstance and enlightening for TTH specialists, stockholders, and academics.

Throughout this dissertation, in the context of TTH, numerous current service robotic applications examples were provided (e.g., CoBot', online assistant, front ask robots, cooking robots, server robots, butler, housekeeping, and concierge). Besides, robotic service available at the airport (e.g., Josei Pepper, Munich Airport in Germany, KLM's robot spencer at Amsterdam, LG's robots at Seoul airport, air New Zealand robots in Sydney, SITA's baggage robots at Geneva airport) and during the COVID-19 many airports adopt robots for COVID safety purpose.

In the hotel (e.g., Hotel Sheraton in Los Angeles, Hilton Hotels in the USA, Hotel Jen in Singapore, Hotel Icon in Hong Kong, and Henn-na Hotel in Japan). In addition, service robots have been used in restaurants to deliver food to customers. Therefore, this dissertation indicated robots for interpreted and projected changes in the TTH industry in the upcoming years.

This dissertation indicates that TTH scholars undertake employee perception in adopting robots to collaborate humans and robots in an organization. This thematic and research approach is developed based on the TAM framework and is applicable in this dissertation to classify the perceptions into main flows of theoretical extension. This extension has explored the strategic HRM opportunities to involve in decision-making to motivate and help human employees to consider the human-robot collaboration at work.

Finally, this dissertation contributes to the literature on two ways: technology management, strategic HRM, and TTH management. First, this study extends the technology acceptance model (TAM) theory by including additional critical determinants of human-robot collaboration. Second, this study provides important insights for TTH industry stakeholders (entrepreneurs, managers, customers, and employees) to plan and apply better strategies for the future.

1.5 Summary

Many robotics issues are still limited in research, like service robots' appreciation, position recognition of robots in TTH industry, management's perceptions on robots' adoption, robotics prospects and challenges in TTH, organization's strategy to adopt robots, plan to motivate and train employees to collaborate with robots. This issue evolves from the service industry's development of service robotic performance. Hospitality is one of the leading industries in using service robots. Hence several technological devices are considered in the service delivery. Besides the technological development, labor shortage and the skilled labor force are among the reasons for adopting robots in the hospitality industry.

Robot adoption is becoming a significant issue in hospitality research because of technological unemployment; researchers have different concerns. However, with the time of digitalization service industry will change and modify toward digital services. In this sense, the hospitality industry will offer automated robotic services to customers, improving the quality of service and saving valuable time. With the advanced service system in innovative hospitality, the industry needs skilled, trained, and educated employees. Although robots may perform heavy and repeated tasks, employees act as controllers and program planners.

1.6 Outline of the Dissertation

This dissertation is designed on five chapters; each chapter introduces its distinctive pieces of information. Accordingly, chapters are followed:

Chapter 1: This chapter describes the introduction of the dissertation through research background, problem statement, research question and objective, research contribution, and summary

Chapter 2: This chapter describes the relevant literature, theoretical framework, and hypothesis development through an introduction, technology acceptance model (TAM), description of the technology, history of technological development, technology, and modern life, technology, and TTH, and technological trend of TTH. The technical trend has eight sub-sections (*e.g., service automation through AI robots, set out touchless service, cloud migration, integrated guest applications, location-based services, technology lounges, self-service meeting spaces, and predictive analytics*). After those effects of AI and robots in the hospitality industry, technological effects on unemployment, human resource, and robots, strategic HRM. Finally, hypothesis development is based on behavioral Intentions in the use of robots, perceived usefulness, perceived ease of use, robot awareness, advantages of

robots, the disadvantage of robots, robots' user motivation, human-robot collaboration (HRC), strategic HRM involvement.

Chapter 3: This chapter presents the methodological components of the dissertation, accordingly chapter introduction, methodological consideration, research objectives, research philosophy, research approach, and finally research design and sample.

Chapter 4: This chapter demonstrates and defines the dissertation's results and discussion through chapter introduction, findings, evaluation for model assessment**,** discriminant validity**,** multicollinearity statistics (VIF)**,** evaluation of path model**,** testing model adequacy, relevancy, and discussion.

Chapter 5: This is the last chapter of the dissertation. It presents the conclusion of the dissertation through chapter introduction, dissertation contributions, theoretical contribution, managerial contribution, limitations, and future study.

Chapter 2

THEORETICAL FRAMEWORK

2.1 Introduction

Technological development has produced many approaches, and currently, the concept of Industry 4.0 describes innovative digitalization (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014; Molitor, 2020; Cobanoglu, Doğan, & Güngör, 2021b). Although industry 4.0 is a relatively new term, many experts are already predicting a fifth industrial revolution (Industry 5.0) that will lead to a new paradigm of human-machine cooperation and interaction (Haldorai, Seo, & Kim, 2021). The goal of Industry 5.0 is to "combine human creativity and craftsmanship with the speed, productivity, and consistency of robots" (European Economic and Social Committee, 2018). Therefore, the use of robots in daily life is becoming more prevalent and creating new research areas (Tung & Law, 2017; Henschel et al., 2020; Wiese et al., 2021). Nowadays, space, industrial, social, medical, and service robots assist humans in complex and repetitive tasks. Bartneck and Forlizzi (2004, p. 592) describe a service robot as "an autonomous or semi-autonomous robot that interacts and communicates with humans by following behavioral norms expected of the humans with whom the robot is to interact." Djuric et al. (2016) and Jocelyn, Burlet-Vienney, & Giraud (2017) stated that approaches to human-robot collaboration are evolving. In the collaboration strategy, robots are referred to as 'CoBot' due to their flexibility, strength, and persistence in human decision-making. Consequently, human-robot collaboration is a driving force for success and essential

for offering intelligent services in the hospitality industry (Basuki, Tarigan, Siagian, Limanta, Setiawan, & Mochtar, 2022). Although robots can polarize work and replace or enhance human labor, customers still rely more on human assistance than technological support (Samala et al., 2020).

Frankiewicz and Chamorro-Premuzic (2020) noted that digital transformation is more about human talent than technological diversification because technology can be easily purchased and installed. However, human skills pose a challenge to the scientific capabilities of the next generation in adapting to this progress. The philosophy of building human talent combines soft skills with hard skills and encourages intellectual curiosity to find a more accurate and appropriate solution. Human-technical interaction is effective only when the right team skills accompany it (Rasoolimanesh, Law, Buhalis, & Cobanoglu, 2019).

Grosz and Kraus (1999) believed that the best teamwork could be achieved when team members understand each other well. In this context, Wiese et al. (2021) and Del Giudice et al. (2021a, b) noted that we need to disclose how workers rely on machine agents in collective events, while robots have become more prevalent as work partners. Therefore, ensuring human-robot collaboration and convincing employees to work with robots is a unique challenge for organizations (Bröhl, Nelles, Brandl, Mertens, & Nitsch, 2019).

2.2 Technology Acceptance Model (TAM)

Davis (1986) established TAM to theorize why people accept or reject information technology or computer technology usage. The theory of reasoned action in the field of social psychology was based on TAM concept adoption, which describes

individuals' behavior beyond their intentions (Davis, 1989). Rauniar, Rawski, Yang, and Johnson (2014) stated purpose is based on two concepts: social customs or trust and personal attitudes toward the performance. The original TAM defended the connection between users' opinions, mindsets, intents, and "genuine behavior of technology adoption (Szajna, 1996). According to Manis and Choi (2019), TAM has originally named perceived ease of use and perceived usefulness as those affect technological devices usage by beliefs and approaches.

According to Davis (1989), both paradigms impact people's prospects to accept and take advantage of technology in the TAM. Venkatesh and Bala (2008) mentioned perceived usefulness is the faith in receiving assistance to improve the task or job performance. As well as perceived ease of use is the belief of possible users that technical assistance will reduce the effort that is generally required (Francom, Schwan, & Nuatomue, 2021).

The behavioral intention of technology use examines users' preference of using technology devices or sources in the offered option (Shroff, Deneen, & Ng, 2011). According to Davis (1989), the idea of TAM was to describe and calculate people's technology acceptance intention from actions needed after a concise phase of collaboration with the system. Also, the objective of TAM was to solve the earlier diverse and unsatisfying research outcomes combining different attitudes and mindsets with technology acceptance.

A succinct but vigorous structure of understanding the user intention of accepting technology is the diversity of the contexts, which have been adopted in different

business sectors, service industry, manufacturing industry, and healthcare (Ward, 2013). In TTH, the TAM has been confirmed from customers' perspective, travelers' and employees' acceptance of technological assistance. Current research has implemented and adapted the TAM to establish technology assessments in management settings concerning customer demand. Scholars apply this model differently to show different estimates, so several external variables are available. One of TAM's most familiar extensions is TAM2, which adds the content of social influence and cognitive to improve the analytical capacity of perceived usefulness (Katsoni, & Poulaki, 2021).

In this dissertation, TAM was applied as the base model. This study extends the TAM with new variables to identify whether the adoption of robots influences employees' behavioral intentions to use robots and awareness of robots to promote HRC (Basuki et al., 2022). Besides, strategic HRM involvement moderates the perception of robots as team members. A high level of robotic effectiveness is identified in a high probability of adopting robots in the TTH industry (Becker & Huselid, 2006). Consequently, this study constructed the extended version of TAM to precisely calculate strategic HRM involvement in employees' robotic acceptance and collaborate intention to achieve a superior understanding of robots' acceptance in diverse circumstances (Barney & Wright, 1998).

2.3 How to Study Technology?

Technology is the ultimate enabler for superior the life quality, values, cultures, and related components of our life, so what is technology? Or the academic asks how to study technology? Or technically ask how to make technology and how to use technology? Technology can be defined as the complexity of knowledge, methods,

and specific technical systems in creating or using additional resources to create a particular type of invention (Hannay & McGinn, 1980). Dias (1999) describes that technology considers automation a device and encourages the concept of automation as add-0n.

In the scientific literature, technology has been studied in two parts to be established the frame of their work. One aspect of the research concentrated on technology like hardware, including the apparatus, devices, and tools as the instruments of creative activities, whether manufacturing or informational machines (Zuboff 1988; Barley 1986). Another part of the research focuses on software technology. In the early sixties, “Beta” first started discussing and gradually expanding the approaches of knowledge collected through experiences and sharing of ideas (Orlikowski, 1992). Consequently, the substance of technology has been developed and researched in different areas, from life science to social science.

In advanced Western society, technology has adopted the appeal to address many challenges in modern society's development. Therefore, modern technology is noteworthy in a diversity of distinguishing strategies for social management (Basuki et al., 2022). Even though many people still think technology is the collection of innovative technics, technology is a specific action of humans (Hannay & McGinn, 1980). Authors also said the technology could be applied to refer to or mean human activities. In the service sector, technology means the assistance and support to enhance the service encounter, which differentiates three key roles: “(1) augmentation of service employees, (2) substitution of service employees, and (3)

network facilitation" (Larivière, Bowen, Andreassen, Kunz, Sirianni, Voss, & De Keyser, 2017).

2.4 History of Technological Development

Innovation is the process of mental implementation for problem-solving in life; around us exist all can differentiate as natural or artificial (Garbuio & Lin, 2021). According to Coeckelbergh (2011), gradually, human is developing their capability and knowledge in diverse sectors to discover new information for enlightening or updating current situations, in addition to technology has extended the helping hand to human determination historically. Likewise, Derry & Williams (1960) mentioned the history of innovation starts with the history of humanity; technology brings changes in human life from simple stone tools to presents automatic appliances.

In the book "*An encyclopedia of the history of technology,"* McNeil (2002) declared, from the technological point of view history of humanity perhaps differentiates seven corresponding ages: "1. The era of nomadic hunter-gatherers, using tools and weapons fashioned from easily available wood, bone, and stone and able to induce control fire; 2. When increasing specialization of tasks, the Metal ages of the archaeologist encouraged a change in social structures; 3. The first Machine Age, that of the first clocks and the printing press, was when knowledge was standardized and widely disseminated; 4. The beginnings of quality production when, with the early application of steam power, the factory system began irreversibly to displace craft-based manufacturers; 5. The full flowering of the Steam Age, affecting all areas of economy and social life; 6. The rapid speed of the internal combustion engine, which within 50 years had an ousted system as a primary source of power; 7. Present

Electrical and Electronic Age, which promises to change human life more swiftly and rapidly."

Table 1: Summary of material age

Age	Approx. dating	Notes
Eolithic (Dawn Stone Age)	c.10 million ybp	Origins of tool making
Lower Palaeolithic (Old Stone Age)	5 to $1^{3/4}$ million ybp	Itinerant hunter tribes Hand axes widespread
Middle Palaeolithic (Old Stone Age)	400,000 to 35,000 ybp	
Upper Palaeolithic (Old Stone Age)	35,000 to 12,000 ybp	Origins of blade technology
Mesolithic (Middle Stone Age)	12,000 to 7,000 BC	
Neolithic (New Stone Age)	6.000 TO 3,000 BC	American revelation The beginning of towns
Aeneolithic or Chalcolithic (Bronze Age)	3,000 TO 1.500 BC	Writing knows in Near East Earliest copper articles in Egypt c.4,000 BC
Iron Age	Started c.15,000 BC	Tin (hance bronze) was discovered in Mesopotamia c.3000 BC.

Note: ybp indicates years before the present. The dates given are approximate: the same event took place in different countries at different times. Source: McNeil, I. (Ed.). (2002).

At first technologic impact on travel was during the wheel invention, and then build vehicles, construct the road and bridge (McNeil, (Ed.). (2002). Therefore, it is clear that technological change affects our lives more than anything. Nowadays, it is difficult to find any sector where technological advancement does not reveal and technology affects regular human life activities (Bijker, Hughes, & Pinch, 1989). The introduction of iron in human life rapidly changed the system of work profoundly transformed the abilities and possessions of human civilizations.

In modern times, scholars and social critics presented the technology to people in the 19th century as support for the coal miners and mill workers. According to Allenby (2019), the history of the USA technology development is related to the Age of Enlightenment (1685 to 1815). Furthermore, in the 18th century, the intelligent, scientific, and social life was emphasized when an expanding number of researchers started to grow further theoretical and sociologically encouraged issues (Bijker, 2010). Which divert to technological revolution besides paradigm of data science with a multifaceted of technical actions, information and material are the core elements which has transformed the fundamentals of the business environment and shaped qualifications for a novel financial and communal framework (Milivojevic, 2019).

2.5 Technology and Modern Life

Science and technology are essential elements in the excellence of modern life. In the change of situations and lifestyles, humans adapt to the changed situation, so the dimensions take over the predominant role (Coeckelbergh, 2011). With the intention of a better life, humans gradually depend on autonomous problem-solving and keep the focus on understanding the nature that is directly connected to the expertise and technologies (Ilić, Stojanović, & Pavićević, 2019). In the last two decades, technological solutions seem amenable to solving numerous problems, and modern understanding of technology has started to perceive requirements and nervousness over a selection (Hannay & McGinn, 1980).

In harmony with the desires of humans and nature, modern humanity has been facing the necessity of comprehensive examination collective accountability for improvement (Frankiewicz, & Chamorro-Premuzic, 2020). Additionally,

technological revolutions and other innovations and radical findings are the most significant elements in the industrial enhancement, which are documented each time in the development of civilization (Ilić et al., 2019). The history of the Industrial Revolution indicates a meaningful milestone, which has impacted nearly every facet of life.

There are several stages of the technological revolution. In the 1980s, the first revolution signifies the fundamental influence of microchips (Intel and Microsoft), computer motion, and telecommunications (Salih, Zeebaree, Abdulraheem, Zebari, Sadeeq, & Ahmed, 2020). In the 1990s, the second stage of a revolution went through technological networking (like Cisco Systems) for business, entertainment, and educational activities (Yigitcanlar, Corchado, Mehmood, Li, Mossberger, & Desouza, 2021). In the mid-1990s, the third stage of revolution occurred, and technology development was explored through the internet.

At the beginning of the 20th-century business model has changed the empathetic aptitudes of information by the internet and at the beginning of the 21st-century technological advancement stands on unique characteristics (Ilić et al., 2019; Ghadge, Kara, Moradlou, & Goswami, 2020). The fourth level of revolution progress indicates the global industrial movement known as Industry 4.0 (Ammar et al., 2021). Specialists prognosticate Industry 4.0 increased 30 % of technical-technological advancements (Farkas, 2018). This step of revolution enhanced digitalization and automation with consideration to robotization. Specifically, Industry 4.0 has a superior influence on economic growth, digitalization, management diversification, robotic production setup, logistics, and advanced

society, like innovative business, intelligent transport, smart cities, e-health structures, and intelligent tourism (Ghadge et al., 2020).

Table 2: Industrial revolution steps

Industrial revolution	Periods	Technology and capabilities
First	1784 – mid 19th century	Water and steam-powered mechanical manufacturing
Second	Late 19th century – 1970s	Electric-powered mass production based on the division of labor (assembly line)
Third	1970s – 2010	Electronics and information technology drives new levels of automation of complex tasks.
Fourth	Today	Sensor technology, interconnectivity, and data analysis allow mass customization, integration of value chain, and greater efficiency.
Fifth	Upcoming	Nanotechnology. Cognitive computing

Source: Farkas (2018, November).

Even though we are in the fourth industrial revolution, researchers focus on the next revolution, which is identified as the fifth industrial revolution or industry 5.0. Industry 5.0 might change our world essentially what we cannot even think about now. According to the researchers, the next revolution is nanotechnology and cognitive computing. Nanotechnology, nanotech, and cognitive computing are science's revolutionary innovations (Aithal & Aithal, 2016; Ilić et al., 2019; Garbuio & Lin, 2021). According to Basuki et al. (2022), nanotech and cognitive computing are used in scientific analysis. However, it impacts all the industries (e.g., space exploration, medicine, AI, robotics, and manufacturing). Nanotechnologies innovation can design, produce, and produce raw materials and goods in a novel

procedure (Garbuio & Lin, 2021). Nanotechnology developments bring the opportunity to encase business through commercializing the goods profitably. Therefore, the corporate world observes the nano-tech development (Aithal & Aithal, 2016).

Table 3: Nanotechnology in the services industry

Kind of Services industry	Nanotechnology-based modernization
Specialized, scientific and technological services	Scientific analysis needs aa minimalamount of uniting to measure the most miniatureest items; in this case, nanotechnology is becoming a superior function of technological innovation and enhancing the excellence of various specialized services.
IT & ICT supported services.	Nanotechnology established the IT and ICT hardware elements to expand the excellence of ICT-assisted services.
Medical services	In life science, nanotechnology help to diagnose every nanometer to identify the base of the disease; this is a revolutionary innovation in medical service.
Defense Services	The defense industry gradually diverted to robotics and drone; therefore, several countries focus on nanotech for defense services.
Government services	To ensure the civilization facilities, nanotechnology can improve the food production and procedures, water management and waste recycling, energy and well-being supervision to increase the life satisfaction of the public.
Industry assistance services	In future business, nanotechnology will play an essential role in establishing a new production line. A nanotechnology-based control system will measure the impact of greenhouse gas emissions and recover the lack of feature in numerous industry establishments.
Community services	Life quality is directly connected with the environment, and nanotechnology-based eco-friendly systems will ensure sustainability and reduce environmental deprivation to expand the value of community services.
Public functionality services	Nature and human life are connected positively, so it awildlifeically impacts human life when nature gets disturbed. So, establishing natural life nanotechnology and its prospects increases the awareness among people through a different device to certify public utility services preservation like saving rainwater, recycling waste and reusing water, and generating

	green energy to reduce toxins in the environment.
Automatic Transmission services	Scientific innovation swiftly modifies life through different services at present, automation is one of the best practices to maintain social distance and related activities. However, the future will be more advanced through nanotechnology-based electrical and electronic devices.
Schooling and training Services	During the pandemic crisis, online communication and balancing daily life become more important; in this case, nanotechnology can facilitate an expansion of online services, which come together with online schooling services and online training to develop the performance feature.
Mass-media and communication	Social media to mass media each stage each moment generate qualities of data. To manage these data and speed up the connection, nanotech may improve to the next level to enjoy life with better quality.
Entertaining and Recreation	Nanotechnology will modify the recreation devices to improve the quality of entertainment, which includes vitality, automated equipment, performance equipment, and amusement procedures.
Marketing service	Current marketing is updated to the online base promotion, and the next level of marketing could be based on nanotech, which innovates new technical support and ensure benefits for all parties, where service and product provider and receiver can be listed and easy to identify.
Transport and shipping service	Nanotech-based transport and shipping would be more noticeable, and receiver may guide the products quickly and reduce the change of delay and lost communication and online tracking.
Trading service	A rapidly worldwide trading system is changing, and with support of technology, producers can trade anywhere in the world. In future, nanotechnology could improve productivity and introduce new items with superior speed in protected conditions.
Finance and banking service	Online banking and financing are some of the best technological improvements in modern life. Nowadays, mobile banking made life easier and more flexible. Future banking and financing through nanotechnology would be securer, speedy and instructive.
Insurance service	Insurance is an information-based business and ensures security of life and assets; current insurance companies collect data about customers and inform them about different facilities through websites, email, or online communication. Nanotechnology might support true information collection and storage.
Delivery service	The nanotechnology-based statement will guarantee service and products, besides tracking the products will be more flexible and

	earlier than ever.
Tourism transformation	Technological innovation directing the high-touch industry to high-tech industry, rapidly all the tourism and hospitality organizations adopting the technical supports to amplify the velocity of communication. Moreover, the current automation system will be more advanced with nanotechnology; at that time, robotics possibly will be abundantly built on artificial intelligence. Current transport might be diverted to high-tech vehicles, and airlines would be eco-friendly.
Hospitality and food science services	Nanotechnology will make a revolutionary change in food production and processing system. With nanotechnology food, maturation value can be identified and fixed according to time and necessity. As well as food packaging and delivery system will be improved which reduce the cost of production and might ensure the food for everyone.

Source: Aithal, and Aithal (2016).

Cognitive computing is the subdivision of AI, a self-learning algorithm pattern used to replicate humans through the practice of natural language and data mining methods for strengthening humans in decision-making (Garbuio & Lin, 2021). In complicated circumstances, cognitive computing is used when the response may be uncertain and ambiguous. This innovative approach can integrate the collected data from different sources of evidence while balancing perspective and contradictory support to indicate the most excellent achievable solutions (Henschel et al., 2020). To accomplish the best solution, Cognitive structures comprise a self-learning mechanism for simulating the human brain functions. Cognitive computing works based on adaptive (flexible to absorb the data adjustments), interactive (human-computer interaction), iterative and stateful (identify the complications through inquiring or dragging in supplementary data if a specified problem is indefinite or unfinished), and contextual (understanding the contextual and critical data processes).

The technological revolution has continuously changed our lives. New technologies (genetic variations, personalization of medicine, robotics) offer us advanced facilities and rapid solutions, like intelligent service, mass production, safety and security, and networking (Arslan et al., 2021). Bitkina, Kim, and Park (2020) mentioned that user experience is crucial for technological usability in modern life. Currently, various cooperative businesses use technology to define their activities for customers to experience their reactions and intentions (Michelangeli et al., 2022). Researchers are concerned about technological advancement and theoretical declarations about the future of technology and human activities, specifically automation, the use of robots, and interaction with robots.

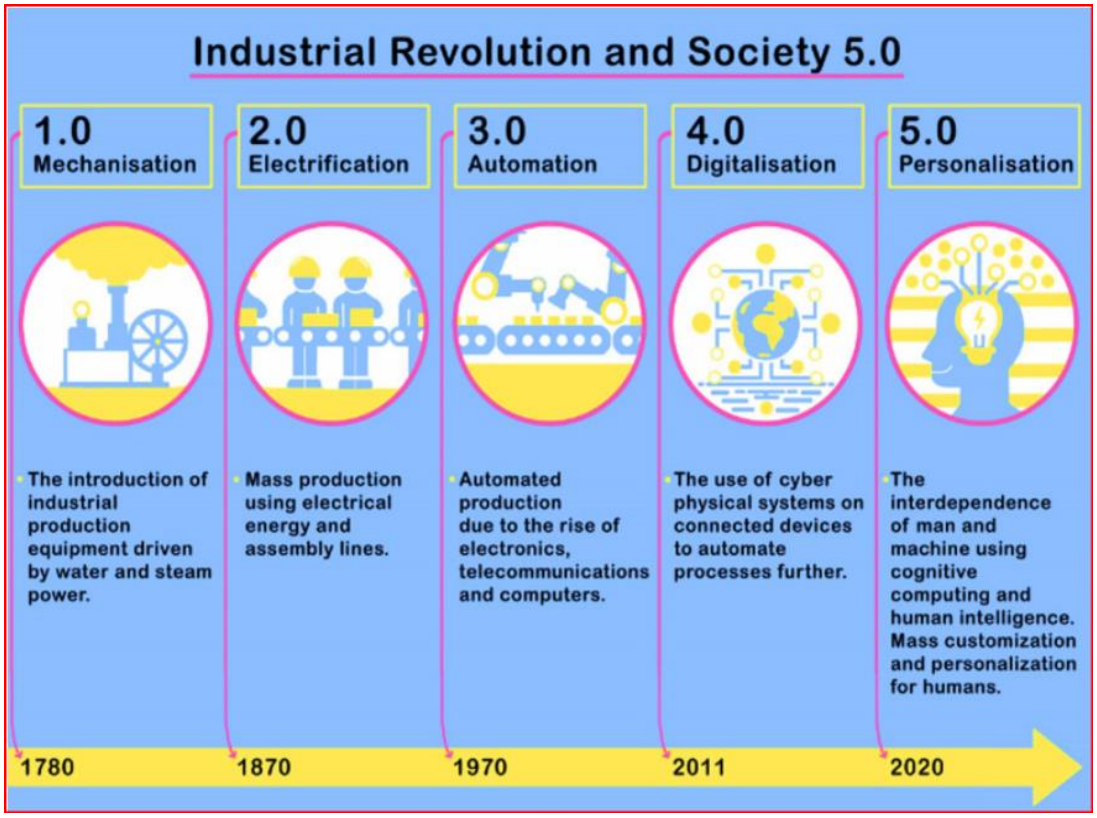


Figure 1: Industrial revolutions.
Source: Sarfraz, Sarfraz, Iftikar, and Akhund, (2021).

2.6 Technology and TTH

The relation between TTH and technology is prehistoric; at the time, people improved in civilization and brought changes in life by worldwide trade and business, and those financial activities related to tourism (Stipanuk, 1993). New challenges and innovations constantly threaten TTH in terms of technology. Tourism is one of the booming industries to keep growth in the last three decades, and to observe the rapid increase in technology, tourism will go further within the next decade (Parvez et al., 2021). As information and communication technology (ICT) has developed in TTH business, now traders, airport, restaurants, and hotel authorities would like to join in the advance robotic system as soon as possible. Specifically, electronic devices installation must be taken earnestly and revolved into a technological advantage (Law, Buhalis, & Cobanoglu, 2014).

Table 4: Robot's usage in the airport

Types of robots	Airports
Fleet Luggage robots	Philadelphia, Dallas, USA. Changi, Singapore, Geneva, Switzerland, Frankfurt, Germany
Disinfection robot	Anhui, China. Heathrow, UK. Hong Kong International. Incheon, South Korea.
Pepper, Norma, Amelia, Piper LG guide robot, and KLM's spencer (customer service robot)	Seoul, South Korea. Haneda, Tokyo, Japan. San Francisco, Los Angeles, Washington, D.C., Montreal, and San Jose International, USA. Munich, Germany. Amsterdam, Netherland. Sydney, Australia. Heathrow, Glasgow UK. Osaka's Kansai International, Japan
NESA robot	Heathrow, UK
Patrol robot	Changi, Singpour. Frankfurt, Germany
Cleaning robot	Cincinnati/Northern Kentucky International, Pittsburgh, USA. Seoul, Incheon, South Korea. Changi, Singapore. Heathrow, UK
Anbot security / Customs robot.	Shenzhen Airport, China

Table 5: Technology and robots use in hotel and restaurant industry

Global hotel brands	Used technologies
Hilton	Connie, Wayfinder robot, Room-service robot, Luggage robot, Digital key, FTG, Anti-microbial remotes, Voice assistants, Sonifi (in-room entertainment), Mobile API
Marriott	Savioke delivery robot, Rosé robot, Kennon W3 robot, GPNS, Mobile API, Sonifi (in-room entertainment), Voice assistants, Anti-microbial remotes
Hyatt	Droid (room service robot), HSIA, WHO, Anti-microbial remotes, Sonifi (in-room entertainment), Mobile API, Voice assistants
Resort World	Sinatra, Stardust, and Elvis (robotic puppies), Pepper robot, Voice assistants, SORA, STAYCAST, Sonifi (in-room entertainment), Mobile API, Anti-microbial remotes
Wyndham	Amazon Halo, Kryon's robotics, Touchless features, SOS alert, Wyndham connect, Mobile API, Sonifi (in-room entertainment), STAY CONNECT, Voice assistants, Anti-microbial remotes
Radisson	JEEVES service robot, Anti-microbial remotes, Sonifi (in-room entertainment), Mobile API, Voice assistants
Henn-na	Multilingual front office robots, Luggage robots, Voice assistants, STAY CONNECT, Sonifi (in-room entertainment), Mobile API, Anti-microbial remotes.
Flyzoo	Automatic check-in & out, Face-recognition room entry, Electic toilet, Mobile API, Sonifi (in-room entertainment), Voice assistants, Anti-microbial remotes
Omni	Kennon robot waiter, Sonifi (in-room entertainment), Mobile API, Voice assistants, Anti-microbial remotes
Viceroy	The mobile key, Voice assistants, Mobile API, Sonifi (in-room entertainment), Anti-microbial remotes
SH	Room delivery robot, Voice assistants, Sonifi (in-room entertainment), STAY CONNECT, Mobile API, Anti-microbial remotes

Caesars	Service robot (room and restaurant), Mobile API, Sonifi (in-room entertainment), Voice assistants, Anti-microbial remotes, Smart key card
Hard Rock	Anti-microbial remotes, Sonifi (in-room entertainment), Mobile API, Voice assistants, waiter robot
Accor	Voice assistants, Mobile API, STAY CONNECT, Sonifi (in-room entertainment), Mobile API, Anti-microbial remotes
Host	Intelligent key card, Anti-microbial remotes, Sonifi (in-room entertainment), Mobile API, Voice assistants
Aimbridge	Room service robot, Voice assistants, Mobile API. Sonifi (in-room entertainment), Anti-microbial remotes
Rosen	Mobile API, Voice assistants, Sonifi (in-room entertainment), STAY CONNECT, Anti-microbial remotes

The consequence of experience and maintenance of AI and robots in the hospitality industry mainly focuses on assisting customers best service experience. According to Lee, Kwon, and Back (2021), AI assists sensitive and applicable info which is not further frequently straight connected to visitors' reviews. In the hotel industry, such support is a vital component plus more suitable when visitors request provision for instructions or approvals (Arslan et al., 2021). Currently, AI provides material and assistance in hospitality atmospheres through initiative robotics investigation to simplify the robots into regular unification in the existing domain (Zalama, García-Bermejo, Marcos, Domínguez, Feliz, Pinillos, & López, 2014; Garbuio & Lin, 2021).

Now a day's, robots are beneficial in the positive job, for example, Automatic check and check out, housekeeping service or transporting baggage to a visitor room, front

office agent, cooking and serving F&B, personal assistant, identify visitors by scanning, sending automatic feedback by Chatbots, maintain direct reservation at any time and inform different offers or reminder automatically for the guest in the airline, hotel, and restaurant (Michelangeli et al., 2022; Calvaresi, Ibrahim, Calbimonte, Fragniere, Schegg, & Schumacher, 2021).

Although in the hospitality industry still now the application of AI and robots is not appropriate yet (Borràs, Moreno & Valls, 2014), the future of the TTH industry is going to be more automated and adventurous. Mainly in the airport, hotel, and restaurant industry, as a modern business strategy, the supportive robot is generated and maintained in sections to do the task efficiently plus accurately for the human employee (Ivanov et al., 2019). This highlights the article on the Z-generation labor force to work and act as a team efficiently with robotics. In the tourism context, a new technological revolution is an advanced service attitude with automation abilities to sustain a competitive advantage and ongoing struggles for improved quality outcomes (Bhatt & Grover 2005).

2.7 Technological Trends in TTH

The hospitality industry has direct and indirect impacts on people's lives. Therefore, people play different roles in this process as hosts or guests. With technological advancement, these people's interactions have expanded toward automation (Arslan et al., 2021). In this case, most of the effort depends immediately or ultimately on technology, making robotics an essential element in hospitality operations to offer customers one step further experiences (Arogyaswamy & Hunter, 2019).

As a result, management focuses on different technological devices to adapt and attract customers to their organization.

2.7.1 Service Automation through AI Robots

One of the best sensational and encouraging applications for personal and business operations is AI in service robots. AI enhances the performance capability of the service robots, even though there are different types of service robots in other functions (Michelangeli et al., 2022). AI base service robots refer to the intelligent task application representing human intellectual roles. In the service industry, the current trend is to be a touchless automated service provider, which is shifting the customer service system. Gradually robots have appeared as a trendy technology in the hospitality business (Garbuio & Lin, 2021). This robotic system develops the self-service notion and enhances speed, cost-efficiency, and precision conditions.

During the crisis period hospitality industry rapidly shifted to service robots. With the improvements of artificially intelligent robots or advanced algorithmic robots' airports, restaurants and hotels are diverting to a new touchless service to cooperate with customers (Arogyaswamy & Hunter, 2019). At present, airports adopt advanced AI robots (e.g., Josei pepper, LG robots, SITA baggage robots) to answer travelers' questions and guide them in the airport (Reis et al., 2020). Many hotels adopt Chatbots, robot assistance, Concierge robots, Aloft's butler robots, and EMC2's service robots. Moreover, robot-W3 is a new addition to the hotel service; this is smart and convenient, which can be equipped with KENNON's self-developed fully autonomous positioning and navigation technology.

Overall, AI base robots maintain an essential function in the hospitality service, mostly robots can perform like humans in any task 24/7. This possibly implies that hospitality authorities focus on robots to offer rapid service, save substantial cash, and reduce human fault. Particularly, customers also enjoy the automatic services system and look for required information at any time. With AI-based robots, this process will grow up and prospects for expanding.

2.7.2 Set out Touchless Service

Customers' interaction with amenities is reconsidered after the pandemic crisis when social distance becomes a significant issue, so touchless service becomes the option to continue the tourism and hospitality activities (Michelangeli et al., 2022). In this case, all hospitality organizations focused on robots and self-service operations. Robots are the way of implementing the concept of touchless service and maintaining social distance to keep safety distance between employees and customers (Parvez, 2020). The advancements of robotic technology show gesture sensors that arouse illuminations to voice-initiated controllers of employment.

The emerging technologies provide high-tech experiences to customers and hoteliers, and other employees across the natural language processing (NLP), which is the toolkit to attach the integrated customers' requests, even though current features (e.g., face recognization entrance, digital room keys, voice control switch, digital in-room view changer, and robotic assistant) that allocate customers to reveal the innovative practices (Lee et al., 2021). Essentially, the hospitality industry has adopted the application software to do their activity and provide access to customers by mobile technology, which positively impacts customers satisfaction.

Touchless services decrease the hazards and inspire the customers to encounter new hospitality services and a technological era of the TTH industry (Rahimizhian & Irani, 2020). Consequently, technological advancement offers a unique experience to customers and hoteliers; touchless service protocols may ensure the hygiene and safety of infections (Arslan et al., 2021; Garbuio & Lin, 2021). Hence, innovation impacts the TTH industry.

2.7.3 Cloud Migration

Cloud migration (e.g., Docker, Vagrant, Chef, .NET, Apache, and Mono) is the process of cloud computing, which generates a computer-generated mechanism to replicate a cloud environment as an automation platform (Janson & Gu, 2016). This platform comprises the expression of technology, where users can have service intelligence, and the advantage of using cloud services migrates physical servers to digital servers (Ammar et al., 2021). Digital service provisioning is applied to ensure quality enhancements in the service, which certify cloud environment activities through algorithm convolution, virtual machine task migration, resource sharing, and load stabilizing.

Cloud migration is not physical like other types of devices on the hospitality technology usage list, but overall, the TTH industry has begun the process of cloud computing migration technology. Emerging technology and new revolutions speed up the software integration possibilities, and cloud transmissions consider the low possession costs of technology for back-office effectiveness in hospitality prospects (Michelangeli et al., 2022). This is a straightforward decision for emerging and small and medium-sized enterprises (SME) and chain and prominent brand properties of TTH corporations can delve into how cloud migration possibly will simplify the

processes of service, decrease employment requirements, and offer a superior customer experience.

2.7.4 Integrated Customers Applications

A decade ago, integration data applications for the TTH industry were started. This is a platform for managing the requirements of a growing business; it is a substantially ascendable platform with several varieties of integration containing data applications (Arslan et al., 2021). Perceptively integrating a digital device for the customer experience grants a strong customer interaction. Through this platform, customers can access all kinds of service information like book an air ticket and check out all the facilities updates, contract the hotel room service and conveniences, spot restaurant service requests and connect any service is necessary (Michelangeli et al., 2022), which can upsurge customers' loyalty and offer an innovative network for upselling subsidiary facilities, eventually enhancing the customers' experience when implemented appropriately.

The guest experience is the aspect of associated guest involvement in-service operation. In this case, mobile apps may operate and present all these purposes. Customers' loyalty depends on a smartly intended application that includes the whole thing from contract announcements to the airline, hotel and restaurant, and other related services (Basuki et al., 2022). Leading hospitality organizations have several mobile apps to support and inform customers of daily updates and special offers (Michelangeli et al., 2022). Similarly, innovation offers the TTH industry to participate in the applications, allowing customers expanded capability to participate along with hoteliers and other customers at the hotel or restaurant. This process

improves customers' personal experiences and, in the long run, establishes a relationship and be cheerful and extremely empowered customers.

2.7.5 Location-Based Services

In the 21st Century, many computer systems and functions use location-based services (LBS). Technological developments like the internet, mobile networking, global positioning systems made modern location-based services possible (Przegalinska et al., 2020). LBS is a common phrase indicating software facilities that use online base information and geographical data to deliver to customers (Basuki et al., 2022). In selecting perspectives, LBS is used for different sectors, ordinarily used for navigation as software base tracking. Also, through the 4G/5G networking system, customers receive and supply information on their current location according to the requirements (Arslan et al., 2021). LBS also embraces customized weather services and even location-based entertainments.

LBS is significant in the modern business environment to drive experience from attached data to specific actions. LBS is one of the highly effective and beneficial attributes in service-oriented businesses, where customers' location is a widespread place to offer products and services (Vrontis, Christofi, Pereira, Tarba, Makrides, & Trichina, 2021). In this case, an online platform is one of the best commonplaces to deal with customers. Applying this principle in the hospitality industry, service authorities and employees must understand the customers' needs and are located at a particular time (Michelangeli et al., 2022). This type of service will establish an opportunity to progress the customer experience and loyalty. Tourism and hospitality organizations use location-based service features like SIP-DECT structures, even though these structures are in the primary stage and need more opportunities and

time to develop a better operating system. LBS has become apparent as vital to technology innovation in the hospitality industry.

2.7.6 Tech-Lounges

Tech-lounges is the innovation in the hospitality business, which is more extensively applied in the airport and hotel. Tech-Longue is an ultramodern catering service for customers with modern technological expertise (Tai, Wang, & Luo, 2021). These lounges offer leisure and advanced technological supports to users to get their job inefficiency. Tech-lounges service could enhance value to the product and service recommended to the travelers; this is obvious that tec-lounge ventures will boost airport and hotels' efficiency and decrease overall expenses (Farrell, Newman, & Corbel, 2021). In response, these lounges transformed the service process, and service receives behavior during and after the usage (Arslan et al., 2021). Nowadays, several airports and hotels have come out of specific crucial trends that have granted better opportunities to fulfill the distinctive requirements of travelers and customers.

In the TTH industry, tech-lounges are the new trend, which offers a public place to the customer with all advanced technological devices and ensures proper comfort and best services (Michelangeli et al., 2022). Suppose the airport, airline, and hotel industry would like to go one step further in service; in this case, tech-lounge is the addition where travelers and customers can get the next flight or next meeting.

Users have Wi-Fi access to do their emergency tasks and relax in a calm tech environment (Vrontis et al., 2021). In recent airline or hotel searches, maximum customers include tech-lounge in their searching criteria; therefore, TTH businesses

need to update with advanced technological facilities. Otherwise, this may reduce their occupancy rate and count as a disadvantage.

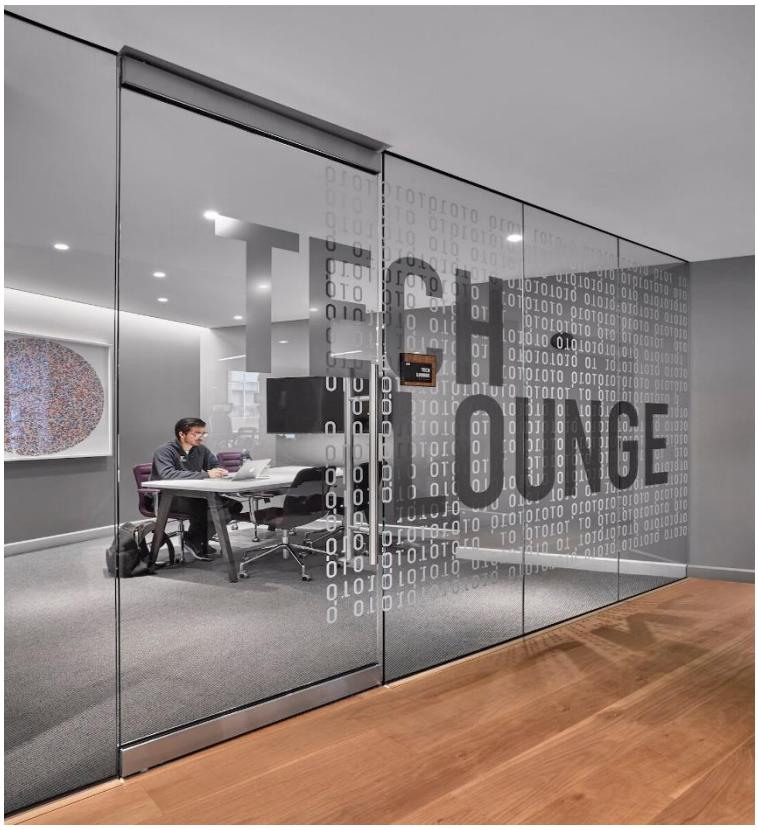


Figure 3: Tech-lounge. Source: bdcnetwork

2.7.7 Self-service Meeting Spaces

Self-service meeting space is an addition to self-service technology, which is described as service autonomous of non-stop service with any employees' association. This advanced meeting space has progressed to advanced online meeting technology and supporting materials, where there is no need traditional room setting (Arslan et al., 2021). Specifically, business travelers or customers require this type of facility to attend the online meeting, conference, or presentation. Self-service meeting space significantly impacts traditional hospitality service in the current circumstances (Tai et al., 2021). This meeting space allows attendance to contribute

immediately, and individually they can run their meeting without interfering with any service employees.

Associated with conventional meeting spaces, the function of self-service meeting space is more advance, reasonable, low cost, and time saver. Most of all, trendy hospitality organizations understand the current demand, and to be updated, they should arrange space as comprehensible as workable (Qamar, Agrawal, Samad, & Jabbour, 2021). Nowadays, changes are widespread in the hospitality industry with the advantages of innovation. Those who are faster in this change race do better and hold the leading position in the competitive business environment (Cobanoglu et al., 2021b). Therefore, hospitality leaders, specifically event management authorities, should be knowledgeable about adopting technological devices and setting up the required facilities for the online meeting in the hotel.

2.7.8 Predictive Analytics

Predictive analytics identifies future consequences based on previous datasets, which use machine learning technologies algorithmic data (Parvez, 2020). Predictive analytics focus on what will take place in the future, and the purpose is to understand data regarding the potential. Also, forecast the upcoming technological demand and supply through regression analysis techniques (Arogyaswamy & Hunter, 2019). Therefore, to identify the value of current and future data, predictive analytics develop a model, and the modeling calculations are used to predict future trends, enhancing performance through developing a new strategy for decision making (Scherer, Tondeur, Siddiq, & Baran, 2018).

Rapid technological innovation changes the service settings and adds more and more alternatives to expand the customers' experience. Steadily technological devices and software gather more data about the organization’s operations, employees' activities, and customer details (Vrontis et al., 2021). According to Michelangeli et al. (2022), each customer’s profile may have many future-direction data. Adopting these data may increase the experience management of what to do and what not to do. To analyze these data, businesses can identify future activities like action plans based on customers' demands and upcoming innovations.

To progress into future service innovation and adoption, the hospitality industry can be transparent about assessing customization and communications effectiveness (Arslan et al., 2021). The customers' experience must change and increase the desire for new products and services. Hence, customers’ demand is never the same as at present. Therefore, the hospitality industry possibility is expected to combine cloud infrastructures and touchless services (Zhou, Mistry, Kim, & Cobanoglu, 2021). The current global crisis can be one of the reasons for rapid diversification. With the advancements of technology, the hospitality industry can overcome time. To be sustainable in the long-term process, the organizations need to analyze their collected data and experience to establish their business strategy for the future.

2.8 Effects of AI and Robots in the Hospitality industry

Science and technological development bring up AI, which proves the capability to teething troubles by intelligence as long as it can copy human thinking, cognition, and accomplishment (Arslan et al., 2021). AI uses human contributed data through machine learning; this automation system increases job efficiency and decreases errors (Maurício, da Silva, & Wee, 2018). According to Tai et al. (2021), AI

indicates a significant invention in the hospitality industry. Its latent impression and the offers airlines and hotels may expand new opportunities to improve tourists traveling, loading, and dining experiences. Therefore, the demand for robots is increasing rapidly in the TTH industry.

Connie is considered the first-generation AI technology-supported robot in the hotel industry performed in the replacement of human janitor at the front desk of Hilton hotel in the USA (Hasan, Thaichon, & Weaven, 2021). Robots represent a significant innovation in the tourism sector, and their potential impact and use offer many new avenues to enhance and develop the visitor experience of travel and hospitality. Recently, a new technology, "Avvio," launched in the hotel industry as a world-first direct booking platform powered by AI; this device automatically connects with loyal customers through a machine learning system as well as allows customers direct booking to the hotel without any human assistance (Primawati, 2018).

Moreover, the hotel industry has already installed several devices in the hotel industry to provide more excellent service to the customers, among power management systems already handled by AI in general (Bowen & Morosan, 2018). Additionally, different airports, hotels, restaurants, theme parks, and tour operators have started to use AI devices like Ivy the Direct Messenger, which grips almost 90% of actual requirements, efficiently charming the critical opinion of communication through the hotel visit (Chung & Cakmak, 2018). This robot installed a high level of ML algorithms to answer specific questions asked by the customers. This robot can directly denote the necessary information to the applicable

department. Another incredible AI is Rose, the personable assistant, like Connie, but separately.

The capability to observe data service of travelers as well as automatic message, learning, planning, and cognizing is the main concern of installation AI devices (Mistry et al., 2021). Unfortunately, a steady human expectation of technology is changing rapidly. Consequently, researchers, scientists, and developers are working on modernizing robots (Garbuio & Lin, 2021). There are a large number of tools (e.g., Chatbots, Virtual Reality & Augmented reality, smart key, face recognition device, virtual butlers, IBM's Watson assistant, electronic wristbands, extensive data analysis, blockchain, and robot assistant) that relate to AI comprising exploration plus rational implications (Hollebeek, Elina & Matthew, 2018). According to the above discussion, AI and robots play a crucial role in TTH modernization. Besides this, it is also noticeable that these AI devices and robots are replacing the human place in the industry. It seems going to generate substantial technological unemployment shortly.

2.9 Technological Effect on Unemployment

According to Gerdes, Richardson, Mager, and Faulkner (2016), at present, machines have transformed themselves progressively from tools to interactive social objects and preserve an imperative role in our regular life from morning to the late-night, now a day's machine can operate without human interaction, but the human cannot live without technologies contribution (Arslan et al., 2021). It is approximately recognized that the technological revolution's vigorous nature contradicts our capability in the workplace and identifies the effects of individual technology on employment shortly (Farrell et al., 2021). However, the suspicion of unemployment

by artificial intelligence came forward when Keynes (1930) suggested *'technological unemployment theory.'* In this theory, they mentioned two main ways of technological innovations affect employment: - a) "by directly displacing workers from tasks they were previously performing (displacement effect), b) by increasing the demand for labor in industries or jobs that arise or develop due to technological progress (productivity effect)" (cited in Petropoulos, 2018, p-9).

Numerous departments of different categories of hotels have straight collaboration with tourists through the robotic device, besides those devices work along with employees as a support system or as a piece of expert machinery (Arslan et al., 2021). Probable prospects to approve robot devices in the hotel can acme the service experience at different levels. The department's front desk, doorkeeper, meetings or events, and housekeeping are mentioned as rapidly changing by robotic employment (Ivanov et al., 2019). In this case, robotic intelligence will maintain a substantial role in appealing an actual revaluation of the new hospitality era (Scherer et al., 2018).

Present-day customers can communicate directly to any device like Chatbots 24/7 to gather required facts about their destination selection to experience outstanding hospitality (Ammar et al., 2021). During this time, customers can experience other robotic services like google assistant to Virtual Reality, Avvio, Connie, Ivy managerial assistant, and other service robots beyond an intellect of pleasure, gratification, and inquisitiveness (Grönroos & Ravald, 2011). When the hotel industry robot is implemented, it can warn future job crises. Although technological progress has bight history in human welfare, as a result, in 1819, Ricardo mentioned, technological advancement has massively removed the arrangement of employment

from every industry (Frey & Osborne, 2017); in his view, technological unemployment was extravagant.

On the other hand, present days' researchers think in a different way rendering to Manyika, Chui, Miremadi, Bughin, George, Willmott, and Dewhurst (2017) and Arogyaswamy & Hunter (2019) in the future labor market, people will be unemployed not directly because of technology but unemployment will because of low skill, lack of technical knowledge, and improper research knowledge. Their research also mentioned that a study done by McKinsey Global Institute (2017) accomplishes that shortly 2030, approximately 40% in the USA, 20% in Europe, more than 15% in China, and India could be a prize (Manyika et al., 2017). According to the world economic forum, in the future, 54% of employees need to improve their essential expertise progressed or relearned; among them, 35% of employees probably need more than six months' preparation, and 10% of the employees need more than a year preparation to continue their jobs (Bowen, & Morosan, 2018).

Scholars named this procedure "job polarization," and Darvas and Wolff (2016) state that, thus transformation in employment among developing EU countries (the UK, Sweden, Spain, Italy, France, and Germany) jobs have been differentiating for graduates such as management position and entry-level are going to fulfill by robots. Accordingly, technological improvement indicates high quality and accuracy in future job market requirements, so the human resource must be skillful within the technological development. In that case, the HRM of an organization can offer training, seminar, and conference to develop the need for human labor to sustain and

make a balance for employment (Amjad, Abbas, Zia-Ur-Rehman, Baig, Hashim, Khan, and Rehman, 2021).

2.10 Human Resource and Robots

Petropoulos (2018) warned in his research near future technological impact, “we should keep in mind that the era of AI is in its early stages and the penetration of robots in our economy and production is expected to significantly rise as a consequent of the rapid, ongoing technological progress.” In 2014 Bowles constantly calculated computerizing job risk in the EU labor market, and the originated effect was an average of 54% of employments were under threat. Another research was conducted by Graetz and Michaels (2015) on robot performance in 17 countries of the sample.

They mentioned that from 1993 to 2007, above 150%, work improved in the standard of robots per million hours from 0.58 to 1.48, important to substantial efficiency achievements. The study also identified that from 1993 to 2007, those countries annually improved the robot’s function per hour. Therefore, the researcher identifies that the robot did not differentiate the labor market; nevertheless, it seems to offend comparatively low-skilled employees instead of skilled employees (Boxall, 2018). Similarly, Acemoglu and Restrepo (2017) cast off statistics in the post-1990 period to display that “1 additional robot per 1,000 workers reduces the US employment-to-population ratio by 0.18–0.34% and wages by 0.25–0.5%”.

Graetz and Michaels (2015) used a different regional method instead of an industry-country board method to identify the competition between human resources and robots in the invention; they exploit the heterogeneity in both the change of using the

robot in national and as in local labor circulation through different industries. Therefore, in assessing the effect of robots' infiltration in native labor markets, this negative outcome advocates that this transformational effect controls the efficiency effect of process robots (Amjad et al., 2021).

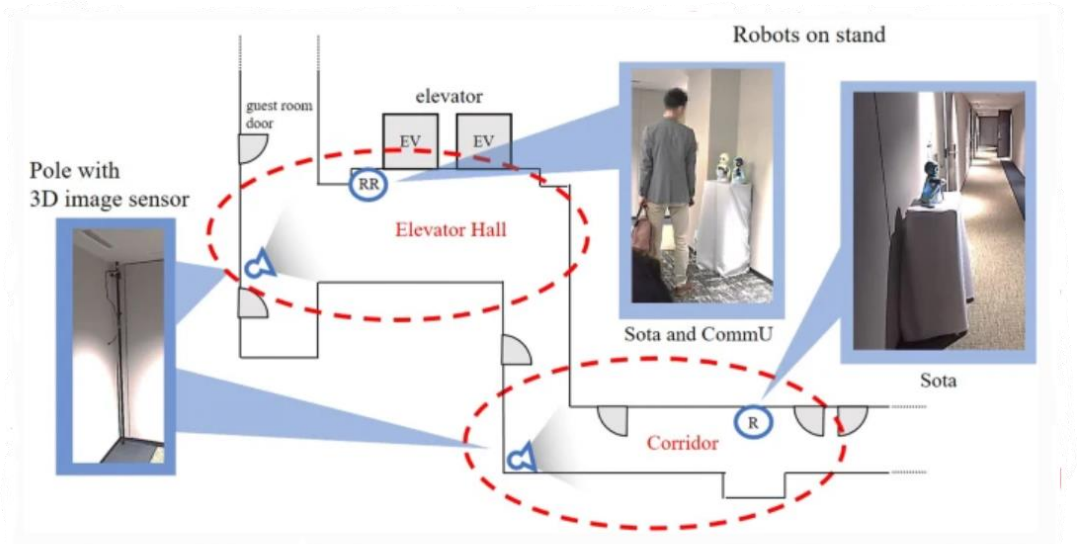


Figure 4: Human resources and Robots.
Source: Nakanishi et al. (2020)

Additionally, constructive excess effects are diffident. Consequently, the robotic impact on employment is most prominently in industries records discovered to robots in the routine manual. Acemoglu and Restrepo (2017) in the USA where point out the negative effect on unemployment, mainly in the industrial sector, but such improvement of technology guide to be the next foremost step to increase the effectiveness of artificial robotic services in the service industry (Hasan et al., 2021).

Researchers have some arguments on replacing human resources and preference of robots in the production and service industry, so they relate that robots' working hours are almost 24/7 (Barney & Wright, 1998). In contrast, a human can perform

around 8/6 or 40 hours. Likewise, the robot can be diverse in numerous tasks and enlarge its efficiency through software and hardware modernizations. Robots do not have psychological disengagement, physical disability, sickness, or socialization. Hence, they can maintain the same task continuously without any mistakes promptly. So, in the near future, robotic technologies will be available everywhere, as well as easy it is easy to install in compere with human employees get appointed. Comparing the employment of humans and robots, the upcoming time seems fuzzy for human workers, and this becomes a significant concern for the researcher as well as employees, many of them already replaced and observing that their present works diverting or occupied by robots (Frey, & Osborne, 2017).

Similarly, in 2017, McClure discourse that, in the future human supervisor may not be essential to control robots, because of its rapid progression in the artificial intelligence sector specify that slowly robotic devices are affecting human life both positively and negatively, but in upcoming days' robots will be more functional in different area and organizations will jump into the technical advantage for more flexibility in management and profit merging thus vigorously will consider using robots instead of human resources (Amjad et al., 2021). so robotic diversification needs to support human development, so it is essential to create and propose an approach in service delivery. As a minimum immediately, focus on some planned circumstances to function appropriately.

2.11 Strategic HRM

Strategic HRM performance has been established in several values possessed by strength and has appeared as an essential issue and influential linked to requests for flexibility and managerial implementation (Barney & Wright, 1998). Top

management needs to rebuild HRM strategy to emphasize the business's current requirements to solve recent and imminent challenges (Becker & Huselid, 2006). Maintaining a proper balance of relationships among employees, supervisors, and managers requires an influential strategic HRM and the recent human resources robots that have joined as an employee in the service industry (Amjad et al., 2021). Therefore, a proper management strategy is essential to control, support, motivate, and operate human and robot resources together.

Boxall (2018, p-23) describe the certainty of the HRM as “I still see HRM as complementary to Industrial (now, more commonly, Employment) Relations but I fairly quickly changed my view that HRM should be defined as an inherently development-oriented approach.” Besides, Pfeffer (1995) designated how efficient businesses accomplished modest improvement across their employees; the author suggested 13 strongly related HR practices, accordingly: job safety, discernment in employment, decent payment, motivation wage, employee proprietorship, data distribution, involvement, and permission, self-succeeded crews, teaching and training expansion, fractious-application and training, representational equality, salary solidity, and promotion inside.

Burt (1992) consequently tries to develop his specific outset of sociological investigation; he wishes to not depend on the publication only. His concepts should be applied in real organization practices. At that time, Burt recognized well that if his idea can impact technology diversification, then a methodological sociology investigation may relate with transformation and impact over the theoretical constructions to measure the human character and applied in employment.

Therefore, management needs to understand the employees' psychology and mindset to introduce them to something new or motivate them to collaborate. At present, HRM bonds with employees may help them understand their motive and intention; based on that, HRM may establish new strategies to handle robotic adoption and employee involvement (Barney & Wright, 1998). Appropriate HRM practices are efficient in an articulate approach (Rondi, Überbacher, von Schlenk-Barnsdorf, Massis, & Hülsbeck, 2021). This implies that instead of observing HRM strategies in quarantine, they should apply in the organization to monitor, select, train, support, and motivate to be their best to achieve the organizational goal.

Table 6: Summary of investigative Human-robots collaboration research in literature review.

Author(s)/Year	Focus	Context	Research design	Finding
Baltrusch et al. (2021)	Human-robot collaboration	How does HRC influence job quality	Four factors analysis	People preferred to cede their control authority to the robot. The sociality of a robot is an essential attribute for integration in a manufacturing environment and to change perceptions from industrial equipment to a sociable coworker.
Paluch et al. (2021)	Willingness to work with collaborative service robots	Frontline employees	Qualitative problem-centered interviews, N=36	Robots will change working structures and possibly hierarchies within service organizations as well. Roles will be redistributed and redefined, as will the responsibilities.
Xu et al. (2020)	Service robots	Leadership in hotel management	A three-stage Delphi study	service robots are anticipated to increase efficiency and productivity of hotel activities; they may also pose challenges such as high costs, skill deficits, and significant changes to the organizational structure and culture of hotels
Hinds et al. (2004)	Human-Robot Interaction in a Collaborative Task	How people respond to robotic coworkers	A 3×3 laboratory experiment	Humanoid robots may be appropriate for settings where people have to delegate responsibility to these robots or when the task is too demanding for people to do and when complacency is not a significant concern.
You et al. (2018)	Human-Robot Similarity	Willingness to Work with a Robotic Co-worker	Quantitative experiment, N=200	Trust in a robot, the link between intention to work with the robot, and the willingness to work with a robot over a human coworker is a positive sign.
Sinha et al. (2020)	Robotics at workplace	Behavioral intention to accept robot	The online survey, N= 864	Anthropomorphism and technophobia significantly influence behavioral intention, and technophobia acts as a significant competitive mediator.
Maurtua et al. (2017)	Human-robot collaboration	Industrial applications	Four By Three project, N=115	The trust of workers on fenceless human-robot collaboration in industrial robotic applications as well as to gauge the acceptance of different interaction mechanisms between robots and human beings.
Del Giudice et al. (2021)	Humanoid robot adoption	Labour productivity and product innovation	Regression method	Humanoid robot adoption is still not affecting labor productivity, and it is positively and significantly connected with the completely new and slightly untouched production of innovative.
Bolano et al. (2021)	Human-robot collaboration	Design and Evaluation of a Framework	Designed interaction concept	Speech communication can increase productivity and higher acceptance by humans, and a

				proper system can improve the overall interaction, making speech.
Dzedzickis et al. (2022)	Applications of Robotics	New Trends and Possibilities	Literature review analysis	development of intelligent companion equipment for robots and the related features for robotic applications for robot-human collaboration and acceptance of robots in the workplace.

2.12 Hypothesis development

Automation and digitalization have transformed the tourism industry towards robotics. The use of robots in TTH has changed the environment of production, cost of services, and performance (Tussyadiah & Park, 2018). Abou-Shouk and Soliman (2021) predicted that robotics technology would positively affect the service environment, revenue cycle, and efficiency in upcoming years. Vatan and Dogan (2021) stated that service robots could interact with employees and customers in various ways, and this ability makes robots social beings. Therefore, service robots can be designed according to their purpose, for example, in the form of animals or humanoid robots.

Researchers have attempted to develop theories and strategies for management to promote and facilitate collaboration with robots in the service industry (Reis et al., 2020). Wirtz et al. (2018) analyzed service robots and divided them into three levels: Micro-level (which focuses on customer issues such as safety, confidentiality, depersonalization, dehumanization, and social inadequacies, as well as basic employee needs), meso level (which focuses on online service marketing and market value variations), and macro-level (this level focuses on social inequalities, stakeholders, and employment issues). These levels have excelled in highlighting the characteristics, features, and capabilities of robots in the current service industry operating in airports, hotels, and restaurants and have also increased employees'

behavioral intentions toward robots and awareness of robots (Kitsios & Kamariotou, 2019).

2.12.1 Behavioral Intentions in the Use of Robots

In the era of Industry 4.0, business success depends on rapid demand response, successful transfer, and technology acceptance in the workplace (Haldorai et al., 2021). Furthermore, with Industry 5.0, businesses need to understand the critical factors for maintaining synergy between humans and machines (Pillai, Haldorai, Seo, & Kim, 2021). Robots are a potential future trend in hospitality services to bring social, economic, and business effects (Bilgihan & Nejad, 2015). The technology acceptance model (TAM) assumes that acceptance or adoption of new technologies is assessed by employers' attitudes toward the technology and their behavioral intention to try it (Venkatesh, Thong, & Xu, 2012; Ho et al., 2021). Similarly, robot acceptance and adoption also lead to behavioral intention to maintain reliability while representing independent variables of anthropomorphism (Sinha et al., 2020).

Anthropomorphism is recognized as an automatic psychological phenomenon in which feelings, self-awareness, intelligence, presence, and appearance are transferred from a person to an entity/machine (Weber, 2018). Anthropomorphism is the main element for accepting AI-related technology in numerous fields, such as customer service, service delivery, and hospitality and tourism (Lu et al., 2019, Marasco et al., 2019; Yu, 2020). Epley et al. (2007) described three characteristics that motivate people to anthropomorphize non-human substances: stimulated managerial knowledge, reflective motivation, and sociality motivation. Van Pinxteren et al. (2019) also mentioned that these three factors provide more profound visions about mental steps and motivational procedures of employees anthropomorphizing robots

in the organization by eliciting human characteristics from them. As a result of these three antecedents, employee intention to use robots would promote a higher level of trust and lead employees to develop an optimistic mindset and focus on the behavioral intention of using robots (Sinha et al., 2020).

2.12.2 Perceived Usefulness

According to Davis (1989, p. 320), perceived usefulness is "the degree to which a person believes that using a particular system would improve his or her job performance." In TAM, perceived usefulness refers to the practical value of technological use, while an individual's moral values change when existing values are compatible (Feather, 1995). In the service sector, perceived usefulness is a motivational factor that usually motivates performance outcomes (Turja et al., 2020).

Therefore, HRM should adopt appropriate, safe, and suitable ways when introducing robots for human-robot collaboration. According to Dautenhahn et al. (2005), the acceptance of robots in the organization may be related to predictions, expectations, intentions, and social skills because robots can perform tasks as colleagues with their human partners. Consequently, acceptance of robots in an organization as partners and collaborators requires attention and motivation (Rasoolimanesh et al., 2019).

In the organizational setting, it is challenging to consider the personal value and intentions of employees regarding the use of robots or to consider robots as employees (Turja et al., 2020), as this concept is regarded as an essential dependent variable for elucidating employees' behavior toward robots (Tavitiyaman, Zhang, & Tsang, 2020). The perceived usefulness of self-service devices in hotels has a sensitive influence on employees' behavioral intentions (Kim & Qu, 2014).

Zhu and Chang (2020) found a positive correlation between the perceived usefulness of robotic service and the adoption intention of robotic users by relating the capabilities of different tourism industries. Moreover, the perceived usefulness of information and communication technologies in hotels promotes employees' behavioral intentions (Varga, Mistry, Ali, & Cobanoglu, 2021) toward new technologies (Pantano & Stylidis, 2021) and robot adoption (Tavitiyaman et al., 2020). However, employees' values, psychology, and perceived usefulness would directly affect their intention to use and collaborate with robots (Turja et al., 2020). Therefore, this study proposed the following hypothesis;

H1. *Perceived usefulness positively influences the behavioral intention of robots' usage in the workplace.*

2.12.3 Perceived Ease of Use

Perceived ease of use is someone's faith in a particular approach that can be simply implied and enhance the intensity of use and collaboration between operators and the structure (Zuniarti, Yuniasih, Martana, Setyaningsih, Susilowati, Pramularso, & Astuti, 2021). Hansen, Saridakis, & Benson (2018) said that perceived ease of use encourages behavioral intention and perceived usefulness, amplifying the positive impact of perceived behavior on intent to use robots. Davis (1989, p. 320) describes perceived ease of use as the point to which "a person believes that using the system will be free of mental effort." According to Basuki et al. (2022), Perceived ease of use in hospitality is the ease of using innovative technology for offering smart service. It is essential to adopt advanced technological devices to compete in the competitive market environment. In general, perceived ease of use increases a customer's confidence or employees in the business organization.

According to TAM, perceived ease of use of robots is related to attitudes toward the technology, and these attitudes predict employees' behavioral intentions regarding robot use (Rasoolimanesh et al., 2019). Perceived ease of use is defined as "the extent to which a person believes that using a particular system is possible without effort" (Davis, 1989, p. 320). Robots are known to be the helping hand of humans in a task. Therefore, robots can exert more effort and perform complex tasks that are difficult and demanding for humans. In this case, humans would be more willing to collaborate with robots, and robots could act as colleagues of humans (Dautenhahn et al., 2005). In this situation, this study hypothesizes the following:

H2*. Perceived ease of use positively influences the behavioral intention of robots' usage in the workplace.*

2.12.4 Robot Awareness

Jobs can be eliminated by technology (robots), not by work (Bowen and Mangum, 1966), because technology is a different perspective that shows up in accomplishments rather than occupations (Bhargava et al., 2021). In the career planning process, employee awareness extends to maintaining the current work situation and the prospects of a future career in the industry. Therefore, employee awareness has a favorable or unfavorable impact on important career outcomes (Brougham & Haar, 2018). According to Panichayakorn and Jermsittiparsert (2019), the performance of managers and workers is highly influenced by robots, as several researchers have indicated that robots may take over the position of workers in the future. Qureshi and Syed (2014) believe that robots have more economic advantages than humans: They are inexpensive to maintain, faster to train, stress-free to upgrade and overhaul, and less prone to fatigue from monotonous tasks.

In a company's workplace, the introduction of robots can unconsciously lead to the psychological destruction of employees. Their perceptions of robots are related to feelings, emotional approaches, the motivation of robot users, and the advantages and disadvantages of using robots (Dörnyei and Ushioda, 2021). According to Qureshi and Syed (2014), robots have several benefits, such as increasing productivity and reducing costs; therefore, the demand for the adoption of robots at different levels is increasing day by day. Due to the adoption of robots, employees' awareness about robots is also increasing. Similarly, Panichayakorn and Jermsittiparsert (2019) also mentioned that the introduction of robots could reduce labor costs and have an optimistic impact on the company's economic circumstances. Therefore, the employees' awareness will affect the career outcomes and change the attitude to keep up with the times and technology to collaborate in the new organizational environment. In this context, employees can establish themselves psychologically and observe their career success (Brougham & Haar, 2018).

2.12.5 Advantages of Robots

In the service industry, the proliferation of robots has increased dynamically due to labor shortages as substitutes for employees and as a helping hand to humans to perform simple and complex tasks in various departments (reception, kitchen, porters, butlers, concierge services) of hotels, airports, restaurants, and bars (Zhu & Chang, 2020). On the other hand, some restaurants have deployed robot chefs with humanoid/anthropomorphic hands. In addition, service robots typically perform service tasks and functions, such as greeting customers, assisting with check-in, recording guest requests, demands, and complaints, and providing information (Christou et al., 2020; Vatan and Dogan, 2021).

In the tourism and hospitality industry, robots fulfill various customer requests (Tuncer, Unusan, & Cobanoglu, 2021) or carefully complain as support for human employees or in the absence of employees (Christou et al., 2020). Therefore, the use of artificial intelligence (AI) or machine learning-based service robots in tourism is widespread among customers and employees, as robots reduce employee workload and complete essential tasks quickly and accurately (Parvez, 2020). Bowen and Morosan (2018) found that AI robots will provide a competitive advantage in solving all challenges by 2030. Therefore, Hypothesis 3 can be formulated as follows:

H3. *The advantages of robots positively influence robotic awareness among employees.*

2.12.6 Disadvantage of Robots

Even though the progress of robotics affects business development, robots can have some negative consequences in the service environment. According to Vatan and Dogan (2021), hotel employees seem reluctant to use robots because they fear unemployment. Varga et al. (2021) said that fear of unemployment increases psychological stress, leads to hyperactivity, increases anxiety and depression, fuels internal gossip, and leads to turnover, lack of commitment, and lack of involvement, especially when tourists are interested in robotic services. Chan and Tung (2019) found that while service robots can provide higher levels of sensing (e.g., customers' visual impressions) and intelligence (e.g., increasing customer curiosity through quick problem-solving ability), overall robots have lower levels of influencing ability than humans.

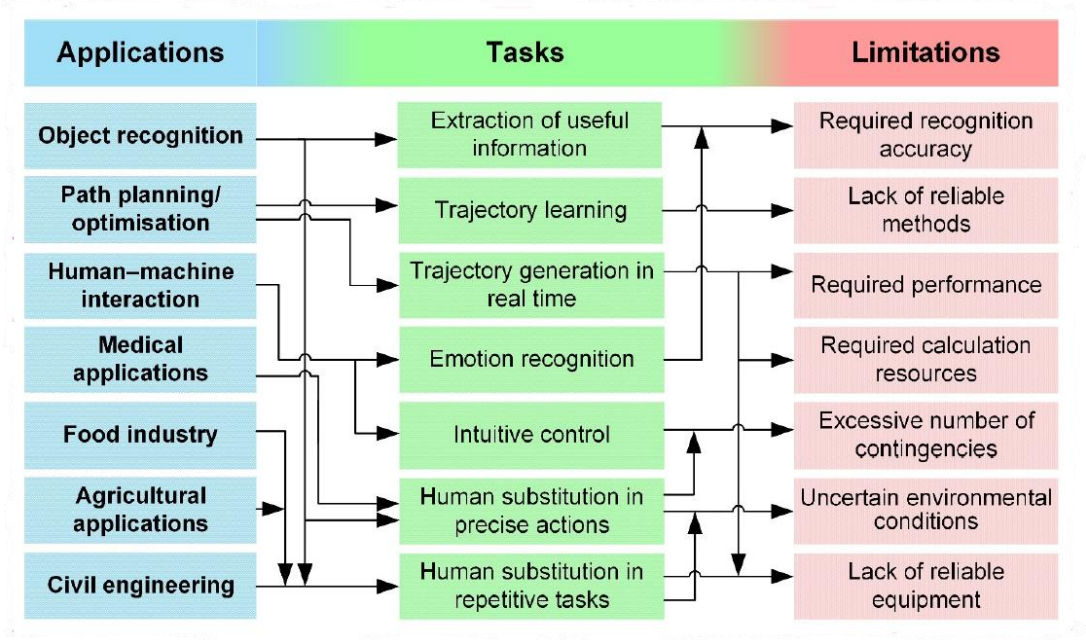


Figure 5: Disadvantage of Robots.
Source: Dzedzickis et al. (2022).

Hospitality is human-intensive, and for human-connected service systems, the over-introduction of robots may result in a mental health disadvantage because there will be no social interaction between humans. In terms of service perspective, robots can be used for routine, repetitive, dangerous, and complex tasks (difficult or impossible for human employees) and not for traditional service and exceptional service for VIP guests (Lee et al., 2019). According to the above discussion, the fourth hypothesis is proposed as follows:

H4*. Disadvantages of robots have a significant relation with robotic awareness among employees.*

2.12.7 Robots' User Motivation

The term motivation comes from the Latin verb "movere," meaning "to move"; thus, a motivated person may make positive choices to participate in an action. According to Vallerand, Pelletier, Blais, Briere, Senecal, & Vallieres (1992), intrinsic motivation is an inspiration to participate in the task and perform the task with pleasure; in contrast, extrinsic motivation defines the impulse to complete the task as

a reward because external aspects are necessary for the person. In this context, motivations can increase the willingness to accomplish other tasks or plans (e.g., the intention to accept a robot as an employee) to achieve the organization's goal (Bitkina et al., 2020).

Turja et al. (2020) noted that a higher evaluation of motivations could increase the positive effect on the usefulness, usability, and benefits of robots and user (e.g., employee) awareness of the positive aspects of service robots. Robots in the hospitality industry have been shown to positively affect employee behavior and development, especially in technological areas to practice advanced teamwork (Liboni, Cezarino, Jabbour, Oliveira, & Stefanelli, 2019) and HRC (Molitor, 2020). Therefore, it can be said that motivating employees through the concepts of robot use positively contributes to stimulating their performance and enhances their trust in collaboration. With this in mind, this study hypothesizes the following:

***H5**. Robots' user motivation positively influences the robotic awareness of employees.*

2.12.8 Human-Robot Collaboration (HRC)

Collaboration is the partnership between different agents to achieve a common goal (Terveen, 1995). In recent industrialization, the term HRC has been widely used. Industry 4.0 leads to technology (AI, robotics) to preserve physical labor in service and manufacturing processes (Lasi et al., 2014). In addition, connectivity and digitization are impacting the service industry. Human workers need technical support to deal with increasing data, and social robots can collaborate with humans. In this design, human employees and social robots share a workspace and are expected to work as a team (Molitor, 2020).

Social robots are increasingly used as teammates and perform complex tasks together. In this context, the service industry is at the forefront of adopting new technologies and ensuring the perfection of the customer experience. Especially in the hospitality industry, robotic technologies have made a significant contribution (Libert et al., 2020). Nowadays, service robots and algorithms as artificial

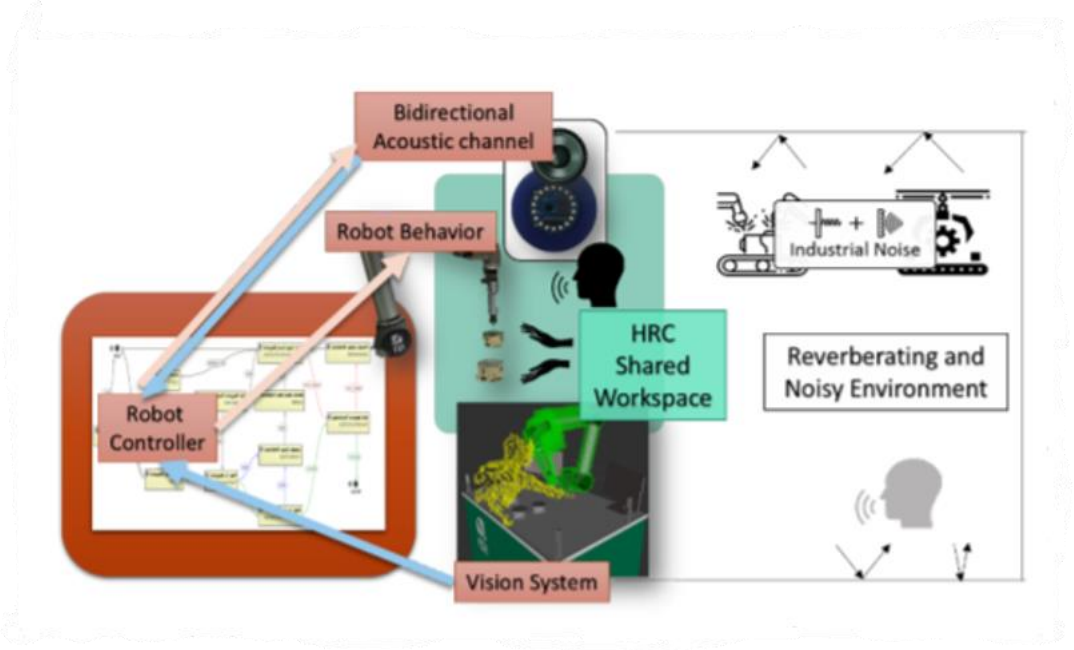


Figure 6: The effectiveness of human-robot collaboration applications. Source: Bolano et al., (2021).

Intelligence (AI) formulas in the hospitality industry are becoming essential measures of organizational operations. Djuric et al. (2016) and Jocelyn et al. (2017) described a new type of robot used in the service industry: collaborative robots or "cobots." In this way, cobots can take on different tasks and benefit from each other's strengths, and the robots would pay attention to physically complicated and repetitive tasks.

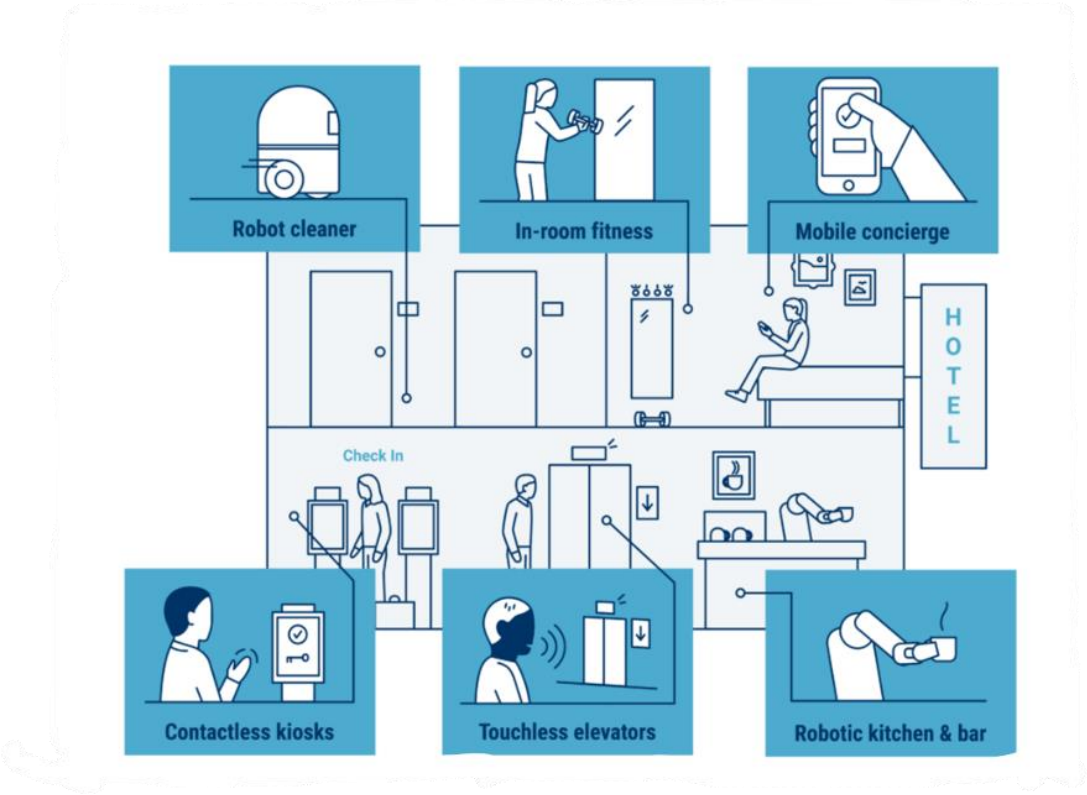


Figure 7: Human-robot collaboration in TTH. Source: CB insights

In contrast, human workers can pay attention to tasks that require human skills (Reis et al., 2020). HRC-related metrics include characteristics such as time spent in autonomous or controlled mode or self-awareness. System-related metrics are diverse and include safety, effectiveness, efficiency, and team productivity. Ultimately, advances in human-robot collaboration can provide broad perspectives on the proper use of technology in the hospitality industry (Bröhl et al., 2019; Libert et al., 2020).

Based on the TAM (Davis, 1989; Venkatesh and Davis, 2000), actual usage can be realized with behavioral intention as a predictor. Thus, the behavioral intention of robot use is expected to lead to HRC in the workplace (Zhou et al., 2021). Moreover, awareness of the new technology may motivate employees to accept collaboration in

the workplace (Pantano & Stylidis, 2021). Based on the above discussion, this study hypothesizes the following:

H6. *Behavioral intention of robot usage positively influences human-robot collaboration at workplace.*

Robotic awareness is the perception of the components of a situation and the prediction of a forthcoming future setting (Camblor, Salotti, Fage, & Daney, 2021). There is a common awareness in the scientific literature on presenting new pioneering applications at work; this awareness of innovation is challenged to adopt robots in the hospitality industry (Baltrusch, Krause, de Vries, van Dijk, & de Looze, 2021). The awareness has affected intention, and the personal conicity directs the individual adjustment and collaboration with robots.

According to Charalambous, Fletcher, & Webb (2016), trust impact, the understanding and intention to develop the collaboration, and the trust-associated subjects were defined: task complexity, robot's physical attribute, robot's performance, robotic speed, and accuracy, human's support, and safety. Therefore, robots' performance and shape might impact decision-making procedures, such as the humanoid geomorphology of the robot will reduce workplace stress and anxiety through human-robot collaboration;

H7. Robotic awareness *positively influences human-robot collaboration at workplace.*

2.12.9 Strategic HRM Involvement

As technology becomes more advanced, creative, and sophisticated, it can impact various jobs and reshape obsolete positions (Vatan and Dogan, 2021). Bhargava et al. (2021) also cite those technological advancements such as the Internet of Things

(IoT), machine learning (ML), data science, virtual reality (VR), and artificially intelligent robots (AI) will reduce traditional occupations and create highly skilled jobs across industries. In this case, business leaders must find a new way to manage employment and position strategic management elements to ensure long-term services succeed in the marketplace (Rodríguez-Molina, Frías-Jamilena, Del Barrio-García, & Castañeda-García, 2019). Robots' work capacity, reliability, and the higher speed with which they complete tasks 24/7 make them attractive.

According to Samala et al. (2020), robotics in the workplace reduces employees' fears about data confidentiality and security and represents an impartial part of the risks. Therefore, robots in the workplace have both positive and negative effects on employees' behavioral intentions regarding the use of robots. In this case, the strategic HRM involvement may be crucial to ensure the safety of employees' workplace and to use robots as support (Becker & Huselid, 2006). Therefore, robotics professionals and organizational managers such as HRM should consider these predictive variables to motivate and inspire employees to change their behavioral intentions positively and accept robots as employees or helpers (Sinha et al., 2020). The covariance between the behavioral intention of robot use and HRC in the workplace can be characterized as causal covariation and represents causal pathways to strategic HR involvement (Marler & Parry, 2016). Therefore, the hypothesis:

H8. *Strategic HRM involvement moderates the relationship between behavioral intention of robot use and human-robot collaboration in the workplace.*

Tourism and hospitality are human-intensive industries where customers like to have a warm welcome and interaction with humans (Gursoy, Chi, Lu, & Nunkoo, 2019). According to Sinha et al. (2020), industries should identify the need for robots and recognize the purpose of accepting or rejecting robots in service. Robots face technical difficulties due to installed algorithms. In addition, technological implementations in organizations can pose significant challenges to the workforce (Libert et al., 2020). Consequently, human resources should strategically engage by dedicating themselves to training and developing the workforce to meet the challenges ahead and maintain the robots.

Human resource involvement can first be based on a resource-based view (looking at the organization's resources for sustainable competitive advantage, physical, financial, social, and non-physical resources to achieve an economic benefit). The second point of necessity is based on the value chain concept, which considers the company's competitive advantage in primary logistics, operations, sales, marketing, customer service, and supporting activities such as procurement, infrastructure, HRM, technological development). Third, companies seek to position themselves in a differentiated way, determine competitors, offer one or more unique selling propositions, and develop differentiated goods and services. Therefore, this study hypothesizes the following:

H9. *Strategic HRM involvement moderates the relationship between robotic awareness and human-robot collaboration.*

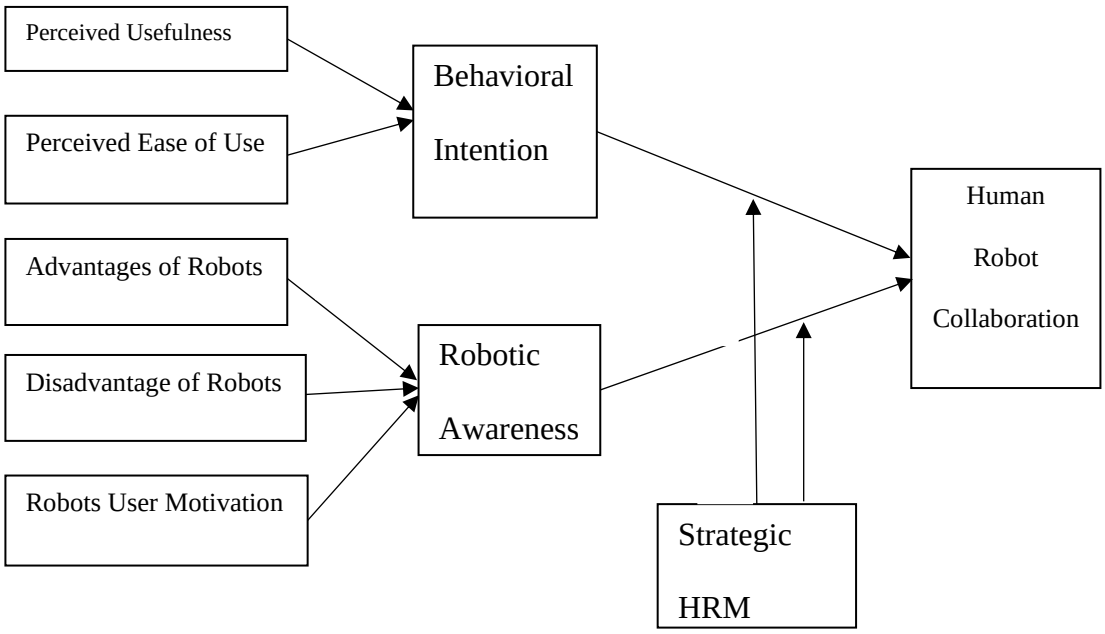


Figure 8: Research Model

2.13 Summary

In the hospitality literature, technological advances are extensive, despite there being still research requirements on technologies' role for enabling equivalent privileges and availability for all customers. Besides, employees also need space to receive an advantage in their workplace. Therefore, technological transformation or adoption is essential for presenting access to employees to understand the use of technology in the hospitality services environment. To understand the employees' perception of technological use at the workplace, management needs to know how to leverage the employees' concerns and motivation. It seems essential to analyze employees' perceptions entirely in the current outlines and conditions to relate with the research aim because employees' perception of technological advancement and robotic adoption in the organization-related research is at the primary level.

According to Bowen, Galang & Pillai (2002), employees empowerment is essential even though the technology is performing better in some specific steps, so research on the impact of technology development on employment, employees' perception, human-robot collaboration, management decision-making process or strategy, and strategic HRM involvement in employees motivation and convenience on cooperation are at the beginning stage. Strategic HRM involvement in human-robot conspiracy is still predominantly inadequate to fulfill the requirement of literature. As such, this study highlights the research gaps in the existing explorations and proposes promising future paths for scholars to advance this critical area of research.

Chapter 3

RESEARCH METHODOLOGY

3.1 Introduction

According to Kothari (2004), the word ‘Research’ comprises two words = Re+Search. It means to search again. So, research suggests a systematic investigation or activity to gain new knowledge of the already existing facts”. To maintain an understanding of the goals of this proposal, this part defines what the research is, an academic activity to graceful new points and modify the existing faults, eliminating present misunderstandings and adding fresh knowledge to the academic world. Clough and Nutbrown (2007) indicated that research is applicable: for a purpose investigate an idea, topic, or subject is so-called research, this investigation may discover the theory/hypothesis and spread-out researcher’s knowledge in a particular perspective a specific area.

This research used a quantitative approach with the Amazon Mechanical Turk (Mturk) survey, which combines technological support to check the reliability and consistency of the conclusions. The design of this research was carried out in two phases, in which the data was collected, analyzed, and validated accordingly. In the first phase, initially, a pilot study was applied among the tourism and travel industry employees to confirm and ensure the accuracy of the variables. In the second phase, the quantitative survey was adopted to examine the employees’ perceptions and

willingness to use robots and the strategic HRM involvement to motivate employees in collaborating with robots.

3.2 Methodological Consideration

Philosophers and researchers have been said to be at "war" for decades over the use of quantitative or qualitative approaches (Tashakkori & Teddlie, 1998). According to Kumar (2019), the model or hypothesis or theory analyzed policiesative and qualitative approaches as well-matched has been categorized as diverse methods, which some have called pragmatism. Patton (2002) points out that not all questions are theory-based. Understanding concrete and practical questions concerning the world and how things work does not require a scholar to place their research into a theoretical framework (Patton, 2002).

Quantitative research frequently includes the methodical and experiential study of phenomena over data as well as calculation besides statistical data processing. Quantitative relation's scientific countenance and experiential statement are essential in the progression of numbers assessing in quantitative research (Basias, & Pollalis, 2018). In quantitative research, statistics are stereotypically designated and examined in a mathematical system (Goertz & Mahoney, 2012). This dissertation follows the quantitative methodology approach; therefore, at first, research gone through (a) test a theory and verify hypotheses in the analysis of the large volume of data, (b) research effectively carried out through Mturk, and (c) the surveys data calculated and analyzed by smart PLS-SEM. As Martin and Bridgmon (2012) mentioned, distinctive statistical software used in a quantitative study, statistics handling, and this research used Smart PLS-SEM to test the measurement model and hypothesis.

3.3 Research Objectives

In determining the appropriate research methodology, research problems and objectives are essential to consider (Phillips & Burbules, 2000). This dissertation's primary questions are: what is the effect of technological development on employment alternation besides the role of strategic HRM to balance humans and robots? Along with these questions, research will answer another two objectives to clarify the effect of digital technology, unemployment, strategic HRM, and the strategic HRM involvement in that circumstance. The objectives of this research are:

Objective 1: To critically examine how technological development affects employment perception on robots' adoption in the hospitality industry.

Objective 2: To analyze the influences of strategic HRM involvement to establish an advanced employment strategy to resolve the hospitality employment problem and motivate employees to collaborate with robots.

3.4 Research Philosophy

According to Saunders, Lewis, & Thornhill (2009), the nature of the advanced knowledge is associated with research philosophy and supportive to the research strategy, so it replicates the researcher's understanding of the world; they also described interpretivism; positivism, realism, and pragmatism are the variations of research philosophy, among them, positivism and interpretivism are the most uses (Mumtaz, 2021). In 1991 Galleries also acknowledged that the two main research philosophies are positivism and interpretivism. These research classifications are well known as the first coating of the research onion diagram. Each layer of this onion diagram indicates one research stage and allows an operative evolution in the research methodology design (Bryman, 2021).

Anthropologists, sociologists, psychologists, and economists have agreed their individual discipline's methods and idiosyncratic difficulties are almost similar, as well as philosophers also defined the nature of their self-restraint close linking to the basic science subjects like sciences, biology, physics, chemistry, besides scholars' state two philosophically addressed core questions (Wei, Jiang, & Gai, 2021). Therefore, understanding social and behavioral issues requires other research subjects, so-called social science. Benton and Craib (2010) mentioned that social science studies need to be further methodical to answer the recommended research problems and represent the subject matter of philosophy. This dissertation is philosophically reachable in the segment of designate and facts of research by positivism study which structure the approach.

3.5 Research Approach

In a positive research area, the research approach can either be slender, for instance, examining the effect in between two specified variables, or, wider, for example, analyzing the combined data (Snyder, 2019). Agreeing with Sirakaya-Trk and Uysal (2011), theoretical development, extension, creation, and theory testing are the two sections in the research study. Theory base hypothesis development and testing are associated with deductive research methodology connected with positivism. The inductive research method follows through the data collection and analysis to create the theory (Bell & Bryman, 2007).

In the deductive assessment, although sufficient study has been published in international learning experiences and operationalized theories over multinational but not essentially adequate to attach and experiment with informal interactions of variable quantity stemming in a comprehensive analytical theory. However, this

dissertation is conducted by operational theories that existed in the literature, which expand a greater clarification of knowledge with hypothetical perception through a quantitative method. Johnson, Onwuegbuzie, and Turner (2007) declared the quantitative is the situations of understanding employee's mindset as well as this would be the best pattern. Therefore, determining the outcomes of employees, SHRM, and their role in internationalization requires a deductive approach.

3.6 Study design and sample

In testing the hypotheses, the between-subjects experimental design was examined by survey style: (literal vs. multipole choice) × service mediator: (human vs. robot) × moderator (HRM). The scale items were measured on a 5-point Likert scale anchored from 1- Strongly Disagree to 5 – Strongly Agree. As part of the precursory approach to ensure the validity of the survey instrument, all items were adapted from previous studies. Robots' advantages (5 items) and disadvantages (4 items) were adopted from (Ivanov et al., 2018). Perceived Usefulness (4 items) and Perceived Ease of Use (4 items) were adapted from (Venkatesh and Davis, 2000). Behavioral Intention of Robots Usage (3 items) was adapted from (Jeong & Shin, 2020). Robots' user motivation (6 items) was adopted from (Lu, Cai, and Gursoy, 2019). Robots' awareness (4 items) was adopted from (Brougham & Haar, 2018). Human-Robot collaboration (7 items) items were adopted from Hoffman (2019). Strategic HRM involvement (7 items) was adopted from (Ragu-Nathan et al., 2004).

In May 2021, a total of 500 travel and tourism employees from the U.S.A were randomly asked to participate in the survey with a screening question (are you currently working in the travel, tourism, and hospitality industry) at the beginning. The random sampling method was used to collect the research data to illustrate the

different geographic distribution of the research area (Zikmund, 1997). After completing the survey, we kept the sample (n = 377) and removed 123 responses by the CAPTCHA tool.

Chapter 4

RESULTS AND DISCUSSION

4.1 Introduction

The workplace characteristics may essentially transform, and employees are interacting with machines at workplaces. The collective use of robots impacts the transformation of the workplace and employment, so the concern is how jobs have been transforming from manual to automatic or semi-automatic, and robots will replace humans or support humans to establish a human-robots collaborative team (Baltrusch et al., 2021). On the other hand, researchers point out that robotic adoption could improve job and service quality, while robotics could be responsible for heavy, hard, repeat, and dirty jobs. Besides supports employees to be creative and interactive jobs. Therefore, collaboration with robots could be motivative and logistic.

Adopting robots into the workplace can be acknowledged as a new team-mate introduction. Strategically, escalating awareness of robotics might help adjust robots' attributes to the requirements of the employees or team of human-robot to improve the human-robot collaboration for better service and performance. Furthermore, the different opportunities of adapting robots may diversify the characteristics of human-robot collaboration to impact employee performance. The improved job quality may guide the HRM in decision-making and set up a new strategy.

4.2 Findings

4.2.1 Evaluation for Model Assessment

Using Smart PLS Ver, the present study applied partial least square-based structural equation modeling (PLS-SEM). 3 to test the measurement and relationship models of the study. So, the first step in PLS-SEM is to test the measurement model, i.e., testing the reliability and validity of the constructs (Sarstedt, Hair Jr, Nitzl, Ringle, & Howard, 2020; Rigdon, Sarstedt, & Ringle, 2017). Ringle, Da Silva, and de Souza Bido (2014) reported that validity magnitude includes convergent and discriminant validity.

Convergent validity is tested through factor loadings (λ) and average variance extracted (AVE) and while discriminant validity is tested through cross-loadings and Fornell-Larcker criteria (Fornell & Larcker, 1981). Values of factor loading are higher than 0.60 are also acceptable (Hair Jr, Matthews, Matthews, & Sarstedt, 2017; Chen & Tsai, 2007) if they are not disturbing the overall reliability (i.e., Cronbach alpha or composite reliability) and validity (AVE values) of the constructs. In this study, reliability analysis was done with composite reliability values (CR), and CR values equal to 0.70 or higher indicate high construct reliability (Sarstedt et al., 2020; Rigdon et al., 2017).

For analyzing validity and reliability (i.e., testing the measurement model), the study ran a series of PLS algorithms with 5000 sub-samples and reported that one item (i.e., RA5) of advantages of robots, and three items of strategic HRM involvement (i.e., SHRMI1, SHRMI2, and SHRMI3) were deleted from their respective constructs because of the low factor loading values which were disturbing the overall

reliability and validity of the measurement models (Sarstedt et al., 2020). Table 7 exerts final factor loadings. AVE values are also part of convergent validity. Their value is higher than 0.50 (Sarstedt et al., 2020; Rigdon et al., 2017), which explains over 50% of the variance from observed variables as their latent factor. The study confirmed the existence of convergent validity. Meanwhile, composite reliability demonstrates the overall reliability of the measurement constructs. The study found that the values for each construct were higher than the value of 0.7 (Sarstedt et al., 2020; Rigdon et al., 2017), which confirms the excellent reliability of all study constructs.

Table 7: Validity and Reliability of the constructs

Scales	Factor loadings	Composite reliability	Average variance extracted
Perceived Usefulness (PU)		0.803	0.506
PU1	0.629		
PU2	0.730		
PU3	0.712		
PU4	0.768		
Perceived Ease of Use (PEOU)		0.861	0.607
PEOU1	0.784		
PEOU2	0.784		
PEOU3	0.744		
PEOU4	0.804		
Advantages of Robots (RA)		0.915	0.729
RA1	0.775		
RA2	0.897		
RA3	0.876		
RA4	0.863		
Disadvantages of Robots (RDA)		0.848	0.582
RDA1	0.720		
RDA2	0.779		
RDA3	0.792		
RDA4	0.760		
Robots User Motivation (RUM)		0.889	0.572
RUM1	0.733		
RUM2	0.741		
RUM3	0.768		
RUM4	0.683		
RUM5	0.782		

RUM6	0.825		
Behavioral Intention of Robots Usage (BI)		0.879	0.707
BI1	0.786		
BI2	0.863		
BI3	0.871		
Robotic Awareness (RAW)		0.898	0688
RAW1	0.798		
RAW2	0.852		
RAW3	0.829		
RAW4	0.837		
Human-Robot Collaborations		0.909	0.590
HRC1	0.651		
HRC2	0.802		
HRC3	0.743		
HRC4	0.820		
HRC5	0.784		
HRC6	0.801		
HRC7	0.766		
Strategic HRM Involvement (SHRMI)		0.856	0.599
SHRMI3	0.655		
SHRMI5	0.793		
SHRMI6	0.817		
SHRMI7	0.819		

Note: ***p < .001

4.2.2 Discriminant Validity

Discriminant validity is measured based on two statistics, i.e., (1) cross-loadings and (2) Fornell-Larcker criteria (1981). Cross loadings indicate that the loadings of one construct with its items should be higher than the loadings on the other constructs of the same things while cross-loading is done for testing purposes (Rigdon et al., 2017). It means that observed variables share the higher loadings with the same construct than other constructs in the model (Ringle et al., 2014). Table 8 shows that the loadings of each construct's items were higher with the same construct than the others, confirming discriminant validity item-wise.

On the other hand, Fornell-Larcker criteria suggest that each construct's square root of AVE value should be higher with its construct than the off-diagonal values in the

table compared with the other constructs (Fornell and Larcker, 1981; Ringle et al., 2014). Table 9 exerts that the values fulfilled the criteria and confirmed the existence of discriminant validity construct-wise.

Table 8: Cross Loadings

	Advantages of Robots	Beh.Intent. of Robots Usage	Disadv. of Robots	Strat. HRM Involv.	Human-Robot Collaboration	Ease of Use	Usefulness	Robotic Awareness	Robots User Motivat.
BI1	0.394	0.786	0.606	-0.054	0.450	0.419	0.420	0.485	0.479
BI2	0.341	0.863	0.509	-0.102	0.547	0.369	0.513	0.487	0.420
BI3	0.339	0.871	0.482	-0.029	0.535	0.420	0.489	0.438	0.417
HRC1	0.338	0.454	0.375	-0.083	0.651	0.323	0.364	0.424	0.349
HRC2	0.451	0.538	0.487	-0.080	0.802	0.444	0.502	0.601	0.529
HRC3	0.374	0.385	0.425	-0.065	0.743	0.327	0.396	0.499	0.389
HRC4	0.467	0.460	0.520	-0.021	0.820	0.471	0.504	0.618	0.527
HRC5	0.493	0.411	0.470	-0.059	0.784	0.433	0.505	0.588	0.459
HRC6	0.535	0.468	0.533	-0.045	0.801	0.443	0.507	0.637	0.485
HRC7	0.402	0.547	0.473	-0.080	0.766	0.352	0.490	0.613	0.418
SHRMI3	-0.043	-0.042	-0.028	0.655	-0.071	-0.058	-0.040	-0.094	-0.059
SHRMI5	0.036	-0.038	0.022	0.793	-0.027	-0.023	-0.026	0.008	-0.020
SHRMI6	-0.037	-0.052	-0.037	0.817	-0.054	-0.038	-0.003	-0.060	-0.011
SHRMI7	-0.030	-0.083	-0.056	0.819	-0.068	-0.012	-0.078	-0.017	-0.066
PEOU1	0.434	0.371	0.465	0.001	0.463	0.784	0.458	0.506	0.376
PEOU2	0.414	0.367	0.358	-0.063	0.372	0.784	0.486	0.463	0.490
PEOU3	0.334	0.328	0.374	-0.023	0.366	0.744	0.495	0.409	0.373
PEOU4	0.365	0.413	0.398	-0.053	0.424	0.804	0.550	0.469	0.488
PU1	0.238	0.383	0.264	0.004	0.399	0.309	0.629	0.322	0.374
PU2	0.389	0.379	0.380	0.009	0.425	0.533	0.730	0.393	0.519
PU3	0.339	0.384	0.386	-0.152	0.390	0.486	0.712	0.400	0.449
PU4	0.429	0.454	0.412	-0.017	0.516	0.487	0.768	0.497	0.523
RA1	0.775	0.377	0.464	-0.024	0.482	0.417	0.457	0.519	0.416
RA2	0.897	0.326	0.550	-0.033	0.451	0.368	0.393	0.548	0.447
RA3	0.876	0.320	0.601	-0.028	0.477	0.409	0.399	0.588	0.460
RA4	0.863	0.421	0.632	-0.040	0.545	0.496	0.443	0.593	0.504
RAW1	0.513	0.382	0.461	-0.094	0.512	0.509	0.430	0.798	0.453
RAW2	0.541	0.537	0.531	-0.034	0.644	0.554	0.485	0.852	0.561
RAW3	0.552	0.427	0.518	-0.029	0.627	0.427	0.466	0.829	0.449
RAW4	0.580	0.489	0.532	-0.063	0.679	0.482	0.510	0.837	0.477
RDA1	0.740	0.325	0.720	0.030	0.479	0.396	0.361	0.509	0.458
RDA2	0.380	0.511	0.779	-0.075	0.410	0.392	0.430	0.395	0.298
RDA3	0.435	0.501	0.792	-0.025	0.485	0.401	0.389	0.486	0.352

RDA4	0.424	0.591	0.760	-0.073	0.485	0.369	0.380	0.475	0.386
RUM1	0.406	0.396	0.378	-0.041	0.437	0.451	0.542	0.423	0.733
RUM2	0.398	0.391	0.376	-0.028	0.475	0.387	0.547	0.394	0.741
RUM3	0.433	0.361	0.330	-0.025	0.433	0.415	0.464	0.448	0.768
RUM4	0.344	0.346	0.332	-0.093	0.375	0.365	0.406	0.436	0.683
RUM5	0.411	0.450	0.417	-0.047	0.445	0.465	0.488	0.435	0.782
RUM6	0.439	0.408	0.420	-0.032	0.515	0.444	0.543	0.512	0.825

Note: ***p < .001

Table 9: Fornell-Larcker Criteria

	1	2	3	4	5	6	7	8	9
Advantages of Robots	0.854								
Behavioral Intention of Robots Usage	0.423	0.841							
Disadvantage of Robots	0.662	0.628	0.763						
Strategic HRM Involvement	-0.037	-0.074	-0.043	0.774					
Human-Robot Collaboration	0.573	0.610	0.614	-0.079	0.768				
Perceived Ease of Use	0.496	0.477	0.512	-0.046	0.523	0.779			
Perceived Usefulness	0.495	0.565	0.509	-0.054	0.612	0.639	0.711		
Robotic Awareness	0.660	0.557	0.618	-0.065	0.747	0.594	0.572	0.829	
Robots User Motivation	0.536	0.518	0.497	-0.058	0.591	0.557	0.658	0.586	0.757

Note: Diagonal values represent square of AVE, and below values are coefficient of correlations
***p < .001

4.2.3 Multicollinearity Statistics (VIF)

Variance inflation factor (VIF) indicates a multicollinearity problem when its value goes higher than 5 (Rigdon et al., 2017). In our case, the VIF values were lower in both the observed constructs (outer VIF) and the latent constructs (inner VIF) (Sarstedt et al., 2020; Rigdon et al., 2017). Table 10 exerts that the value for each construct was lower than 5; thus, multicollinearity was not a problematic aspect in the present study.

Table 10: Multicollinearity statistics (VIF)

	1	2	3	4	5	6	7	8	9

Advantages of Robots				1.980
Behavioral Intention of Robots Usage			1.453	
Disadvantage of Robots				1.872
Strategic HRM Involvement			1.006	
Human-Robot Collaboration				
Perceived Ease of Use	1.689			
Perceived Usefulness	1.689			
Robotic Awareness			1.451	
Robots User Motivation				1.478

Note: ***p < .001

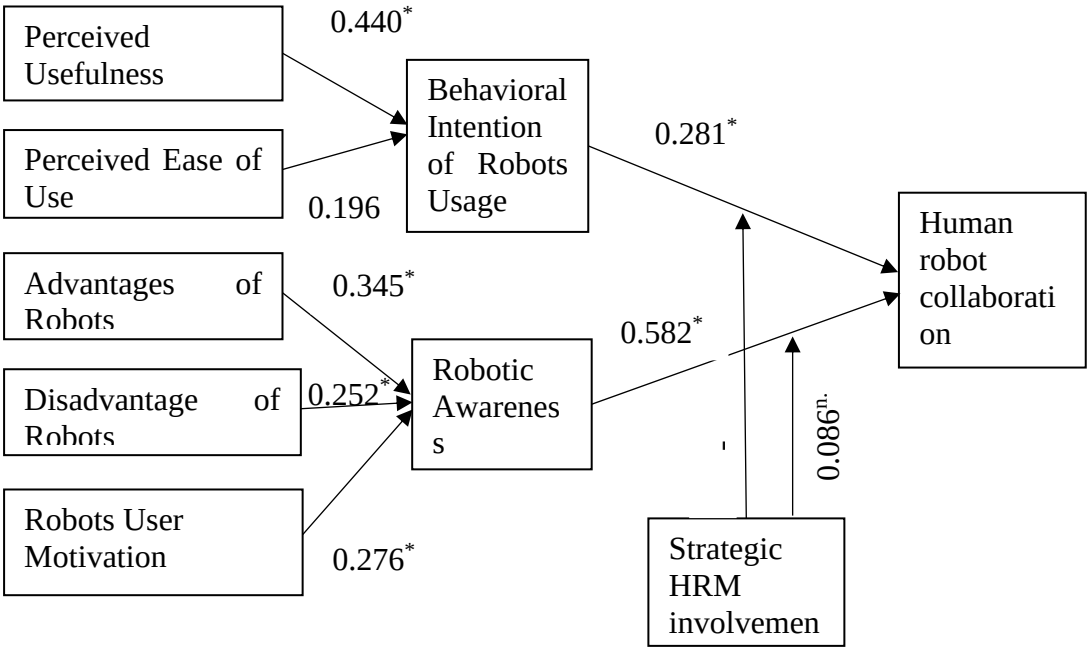
4.2.4 Assessment of Path Model

The second step of applying PLS-SEM was to test the path coefficient values to test the various relationship in the constructs according to the proposed hypotheses of the study (Rigdon et al., 2017), and this technique is highly recommended in analyzing the multi-regression analysis (Sarstedt et al., 2020; Ringle et al., 2014). For this purpose, bootstrapping with 5000 sub-samples was run for the acceptance and rejection of the various hypotheses of the study-based beta (β) path co-efficient values, t-statistics (which should be ≥ +1.96), and p-values which should be <0.05 in case of 5% significance level was selected (Sarstedt et al., 2020; Rigdon et al., 2017).

Table 11 and Figure 8 show that the study reported that perceived usefulness significantly and positively influenced behavioral intention of robot usage (β=0.440, t=7.734, p=0.000), so hypothesis 1 was supported and accepted on the acceptance grounds. Similarly, perceived ease of use significantly and positively influenced behavioral intention of robot usage (β=0.196, t=3.248, p=0.001); therefore, hypothesis 2 was accepted. The study also found that behavioral intention about using robotic technology was more influenced by perceived usefulness than perceived ease of use.

In the next part of the model, the advantages of robots significantly and positively influenced robotic awareness among employees (β=0.345, t=6.203, p=0.000), so hypothesis 3 was accepted. Similarly, the disadvantages of robots also significantly and positively influenced robotic awareness (β=0.252, t=4.655, p=0.000) so, hypothesis 4 is supported. On the other hand, the robot's user motivation also significantly and positively influenced robotic awareness among employees (β=0.276, t=5.690, p=0.000); therefore, hypothesis 5 is accepted.

In response to the direct effects of robotics-related antecedents on behavioral intention and robotic awareness, the study also examined the impact on human-robot collaboration. Accordingly, the study found the behavioral intention of robot usage significantly and positively influenced human-robot collaboration (β=0.281, t=5.445, p=0.000) so, hypothesis 6 was accepted. Moreover, robotic awareness also greatly influenced human-robot collaboration (β=0.582, t=12.004, p=0.000) so, hypothesis 7 was rejected. Automated awareness is a highly recommended factor that posiinfluences the relationship between humans and robots.



Note: ***p < .001, **p<0.05, *p<0.1, n.sp>0.05

Figure 9: Structural Equation Modeling: Path Model

Table 11: Path coefficients

Hypotheses	Relationships	β	S.D	t-value	p-value
H1	Perceived Usefulness -> Behavioral Intention of Robots Usage	0.440	0.057	7.734	0.000
H2	Perceived Ease of Use -> Behavioral Intention of Robots Usage	0.196	0.060	3.248	0.001
H3	Advantages of Robots -> Robotic Awareness	0.345	0.056	6.203	0.000
H4	Disadvantage of Robots -> Robotic Awareness	0.252	0.054	4.655	0.000
H5	Robots User Motivation -> Robotic Awareness	0.276	0.048	5.690	0.000
H6	Behavioral Intention of Robots Usage -> Human-Robot Collaboration	0.281	0.052	5.445	0.000
H7	Robotic Awareness -> Human-Robot Collaboration	0.582	0.048	12.004	0.000

Note: ***p < .001, **p<0.05, *p<0.1, S.D= standard deviation

Table 12: Moderating relationships

Hypotheses	Moderating Effects	B	S.D	t-value	P Values
	Strategic HRM Involvement -> Human-Robot Collaboration	-0.021	0.039	0.530	0.596
H8	Behavioral intention of robot's usage* Strategic HRM Involvement -> Human-	-0.037	0.059	0.635	0.526

	Robot Collaboration				
H9	Robot awareness* Strategic HRM Involvement -> Human-Robot Collaboration	0.086	0.067	1.292	0.197

Note: ***p < .001, **p<0.05, *p<0.1, S.D= standard deviation

Table 12 shows the testing of the moderating effect of strategic HRM involvement using logistic regression (Dawson, 2014) as used by Jirakraisiri et al. (2021) in their study. The study employed two-way interactions of logistic regression by Jeremey Dawson (2014). Two-way logistic regression interaction exerted the insignificant moderating effect of strategic HRM involvement on the relationship between behavioral intention of robot usage and human-robot collaboration (β= -0.037, t=0.635, p=0.526) so, hypothesis 8 was not supported according to acceptable threshold values. On the same lines, strategic HRM involvement did not moderate the relationship between robot awareness and human-robot collaboration (β=0.086, t=1.292, p=0.197) so, hypothesis 9 was also not supported.

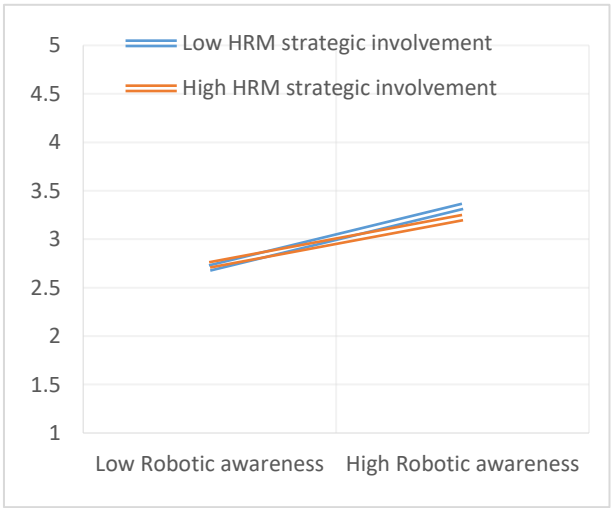


Figure 9. Strategic HRM involvement with Behavioral Intention of robot usage affects Human-robot collaboration

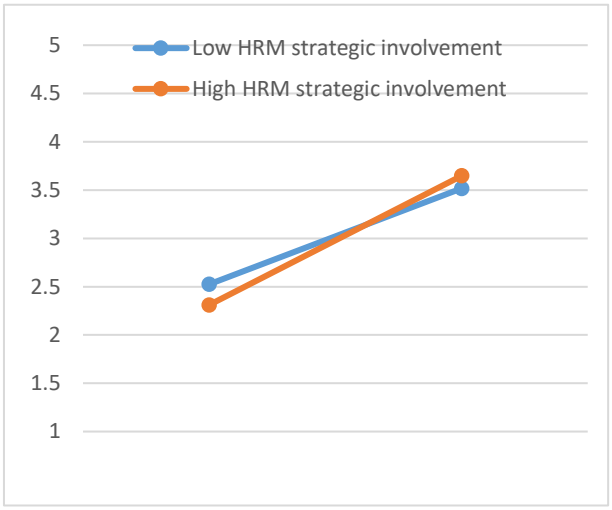


Figure 10. Strategic HRM involvement with Behavioral Intention of robot usage affects Human-robot collaboration

4.2.5 Testing Model Adequacy and Relevancy

The study also assessed the model adequacy and relevancy in R^2 and Q^2 (i.e., cross-validated redundancy and cross-validated communality). R^2 is a coefficient of determination and is used to test whether the effect is more substantial in terms of all explained independent variables than the unexplained variables in the model; we categorized its values in three different levels: strong (R^2 ≥0.75), moderate (R^2 ≥0.50), or weak (R2 ≥0.25) (Sarstedt et al., 2020; Rigdon et al., 2017; Ringle et al., 2014).

Table 11 exerts that perceived usefulness and perceived ease of use explained 34.2% of the total variance in the behavioral intention of robot usage, which indicates a weak effect. Additionally, the advantages, disadvantages of robots, and robot user motivation explained 54.5% of the total variance in robotic awareness, indicating a moderate contribution to changing the endogenous variable. In turn, two subsequent (e.g., behavioral intention of robot usage and robotic awareness) had a strong effect (61.3%) in bringing the change in human-robot collaboration.

On the other hand, values of Q^2 were generated by applying the blindfolding technique in Smart PLS. The values of Q^2 indicate the model's relevancy and adequacy if the values are higher than zero (0) (Sarstedt et al., 2020). Table 13 shows that the Q^2 values fulfill the criteria, so there are good model adequacy and relevancy.

Table 13: Model Adequacy and Relevancy

Constructs	R Square	R Square Adjusted	Cross-validated Redundancy (Q^2)	Cross-validated Communality (Q^2)
Behavioral Intention of Robots Usage	0.342	0.338	0.234	0.408
Human-Robot Collaboration	0.613	0.609	0.353	0.453
Robotic Awareness	0.545	0.541	0.362	0.466

4.3 Discussion of Results

Research on robots and human-robot collaboration is gradually developing, and new topics are being studied in various industries besides tourism and hospitality (Choi et al., 2020). Researchers are focusing on different areas ranging from current trends to near-future opportunities. In social science research, robotics collaboration is a reasonably new idea related to the human experience of human-robot teamwork in the workplace (Liboni et al., 2019). Robotics can help industrial companies provide effective services that increase the company's productivity and reduce the workload of human employees (Ivanov et al., 2018; Parvez, 2020). This study presents a research model based on TAM to determine human employees' intentions in human-robot collaboration by examining the effects of antecedents, including perceived usefulness, perceived ease of use, robot advantages, robot disadvantages, and robot user motivation and robot awareness.

The results of this study shed light on the usefulness and ease of use of robots in the processes of employees' behavioral intentions in using robots. Employees' understanding of the usefulness and usability of robots in the workplace could promote their intention to perceive them as colleagues. Similarly, employees' perceptions of robots' users' benefits, drawbacks, and motivations could influence their awareness of using robots in the workplace (Dörnyei & Ushioda, 2021). Therefore, employees need to accept and be trained to work with robots in the workplace (Zhou et al., 2021).

The results also show that employees' behavioral intentions toward robot use positively impact human-robot collaboration; employees' perceptions of the benefits of robots at work change their intentions, and psychologically, they are ready for advanced collaboration with robots. Similarly, Bolano et al. (2021) found that in the collaboration, human employees (operator) direct the robots to cooperate by using verbal command or mechanical language in an acoustically exciting situation and speech up the job performance with better quality.

The results show that employees who are aware of the use of robots at work will be motivated to accept robots as colleagues; thus, they will consider robots as co-workers at work, which will reduce various psychological depressions and anxieties. In this case, management can support, develop, and motivate employees (Khan & Noor, 2020). Recent studies have found that customers and employees perceive robots differently but are self-motivated to use robots (Berezina et al., 2019; Liao & Sundar, 2021).

However, the results of the study show that HRM departments do not actively motivate or inspire employees. As a result, HRM involvement failed to moderate the relationship between employees' behavior regarding robot use and human-robot collaboration. The results also encouraged by the discoveries of Arslan et al. (2021), argued that human employees might connect and collaborate with robots and virtual collaboration can only be probable if management applies a proper strategy to keep robots as a supporting hand of human employees and robots do particularly physically hard and repeated tasks. Bolano et al., (2021) also found that interaction strategy and an appropriate structure in an organizational environment can develop the total collaboration between humans and robots. So, it is identified that HRM must apply proper strategy and structure to establish human-robots collaboraticooperation.

A similar lack of moderation was found in the relationship between employee awareness and human-robot collaboration. Vrontis et al. (2021) and Xu, Zhang, Yang, and Wu (2020) address HRM strategies and policies to be changed to cope with human-robot collaboration. Strategic HRM involvement cannot be effective by following traditional methods, applications, and mentality (Bowen et al., 2002). According to Arslan et al. (2021), human-robot collaboration increases the challenges for HRM strategies to deal with employees' fears of future unemployment by robots. Therefore, HRM strategies need to maintain the spirit of collaboration to solve employees' motivation problems.

Vrontis et al. (2021) also suggest that HRM managers should acquire advanced technical knowledge in this area to fill the gaps in existing frameworks. Innovative and AI-enabled decision-making in HRM (Qamar et al., 2021) will likely shape the

current and future modern workplace. HRM must focus on preparing employees to accept robots as their team members (Arslan et al., 2021; Vrontis et al., 2021) by alleviating their fear of job loss (Vatan & Dogan, 2021) and improving their technical skills (Cubric, 2020). Human-centered approaches and employee understanding of the advantages and disadvantages of robots can promote workplace acceptance (Vatan & Dogan, 2021; Del Giudice et al., 2021a, b).

Finally, with technological advancement, service will transform to robotics, but robots cannot replace human service; authentic human contact may make different contributions in the workplace and demonstrate exceptional bond-building performances. HRM needs to understand that robots are machines that can easily be copied, and human service is unique (Bowen et al., 2002). Moreover, customers are human too, so they need a personal connection with other humans and feel a friendly environment, not just robotic. Therefore, customers' requirements for human contact can be particularly appropriate in after-sales circumstances. This dissertation's findings suggest that "touch" and "tech" can together offer the best service ever. In this situation, HRM should keep in mind that service employees might add an exclusive element to technology, despite the consequences of its functionality. It must be stated that the recent research's results are simply illustrative in the setting of human-robots collaboration. In the future, when humanoid AI robots with emotion will become further matured in daily life, researchers, professionals, and management are proposed to continue studying human psychology and behaviors to understand the best combination of human and robots' employees also can investigate whether emotional infection still affects the collaboration between human-robot.

Chapter 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

Technological developments have impacted practically all businesses and professions to alterations the employment system, while technological devices occupy the place of entry-level or, in some cases, skilled level jobs; therefore, technology upgraded the requirements of the professions at skilled and researcher level (Rotman, 2013). Technological change brings a new shape in its commercial operation, known as possibilities and procedures. Scholars are authoritative to recognize better than before the motorists, limitations, level, and effects of the technological revolution on hospitality perform an automation system. As outcomes, its impact on entry-level and skill level employment, to resolve this problem in the upcoming time hospitality industry strategic HRM may concern their employment strategy and set up a new department for human resources and technological resources (Becker & Huselid, 2006). This new department may work with humans and robots together, and it may call human and robot resource management (HRRM).

In the human and robot resource management system, HRM should balance human resources and high-tech. Technology advancement depends on the use of humans because robotics is neither good nor bad. Robots are just the creation of the advanced human brain, which was invented to support humans in their activities, and with time

robots spread out from industry to personal life (Paluch, Tuzovic, Holz, Kies, & Jörling, 2021). Nevertheless, to properly use this technological development in the hospitality industry, HRM needs to emphasize the significant consideration of the numerous factors and collaborate with all comprised participants (Bowen et al., 2002). The interaction of technology in the organization is the proper use with employees for organizational support and to fulfill customers' requirements. In the future hospitality industry, humanoid service robots will progressively contribute to the workplace with human employees, influencing collective delicacies.

5.2 Contributions

Since the last decade, humans' dependency on technological innovation has rapidly increased, and being updated with technology has become a trend in daily life. Hospitality is one of the promptly transforming industries because technical advantages increase customer demand, and a growing number of customers desire to receive automatic or robotic services. From the consumer's point of view, robotics lets consumers go through facilities without immediate interface with human employees (Tai et al., 2021). However, from employees' perspective, robots are judged as a crucial component of assistance or can be the reason for unemployment or job risk (Vatan & Dogan, 2021). Additionally, in management assessment, robots may decrease service costs and expand consumers' service experience with various service preferences (Considine & Cormican, 2016).

This dissertation presents pragmatic implications of robotic advancement and its effect on employees' perception of their understanding of robots and willingness to collaborate with robots. The dissertation suggests that robotics have been considered a required component in hospitality service in the future, and robots' adoption will be

a must factor. Human employees also should work with robots. Consequently, it becomes critical to identify the employees' perception and prepare management to adopt service robots. How to set up the robots, in which position it will work, who will replace them from that position, what about that employee's job? Will they transform to a skilled position or be unemployed? Several questions are coming out with the advantages of service robots. This dissertation found that employees' perception of robots is positive, and their willingness to use robots is their personal choice/decision. There is no motivation or involvement of strategic HRM.

In consideration of the future hospitality industry, the implication of the dissertation will be based on several issues, like technological awareness, training and technical education for employees, and strategically advanced HRM departments. HRM needs to be smart and advanced to take the right decision at the right time, should not depend on any specific elements or service materials. The contributions of this dissertation are treble. At first, this dissertation enhances the limited literature of employees' perception of human-robot collaboration in the hospitality industry. Second, this study extends the technology acceptance model by adding independent variables. Third, this is one of the first studies focusing on strategic HRM involvement as a mediator in human-robot collaboration.

In a primary assessment, technological advancement has been changing the service facilities in the hospitality industry, specifically service robots' adoption has a significant impact on customers satisfaction. On the other hand, robots' adoption in hotels, restaurants, and airports gradually occupied the job position of human employees. Therefore, employees are concerned about service robots, and this

dissertation focused on employees' perception of robots' introduction in the workplace and how employees react to this issue. Precisely, the benefits and risks, advantages, and disadvantages of service robots, whether the adoption of robots changes employees' behavioral intentions to use robots, and awareness of robots to promote human-robot collaboration (HRC). HRM can play a significant role in this process by modifying the business strategy based on the overall situation and employee's perception, not just focusing on customers' demands.

5.3 Theoretical Contribution

Organizational commitment, communication, conflict resolution, and teamwork among employees were discussed in several ways in the existed theory and literature. Employee-employee, employee-supervisor, or employee-management collaboration is a common research area in social science. At present, technological advancement is rapidly changing the workplace environment and different technical devices, and different types of service robots (field robots, professional cleaning robots, inspection and monitoring robots, logistic support robots, medical robots, rescue and security robots, entertainment robots, front desk robots, chef and waiter robots) have been adopting in the service industry, and hospitality is one of the leading service industry of robots adoption in the concern of virus and safety issues. This raises the question of how to identify employees' perception of robots and their intention to use and work with robots and how robots induce unemployment. Therefore, theoretical combination and theoretical extension become essential. This dissertation discussed the employees' perception of human-robot collaboration through the extension of TAM, which incorporates the role of HRM in robots' adoption as an employee and their role toward the human employee.

This dissertation used TAM as a reference model to identify the employees' perception of human-robot collaboration based on perceived usefulness, ease of use, advantage of robots, disadvantage of robots, and robot user motivation. This study explored the human-robot collaboration in hospitality industry and to do so, employees' awareness was studied and analyzed how this interaction fit into the extended technology acceptance model. The model extended in this dissertation established a new research path for human-robot interaction based on employees' intention and strategic HRM involvement (Becker & Huselid, 2006). The extended model effectively measures the HRM strategic advancement to establish collaboration between human robots.

Research on the service robotics literature has been using collaboration scenarios and investigational models in travel, hospitality, and tourism research, which could consider the approaches of research traveler or customer experiences in human-robot collaboration or interaction. Many authors showed in their investigation that employees work in a schedule base and together with a team which is a physically represented portrait. Therefore, the behavioral intention of robots' usage and robotic awareness may enhance employees' interest or anxiety about robots. The purpose of this dissertation was to enrich service robotic insight concerning several basic tasks in the hospitality organization, which may open a variety of possible ways for TTH research.

The TAM includes robot usage, robotic awareness, and human-robot collaboration in the TTH industry with this research study. Additionally, the proposed model attempts to clarify the antecedents of human-robot collaboration. The study's results exposed

that employees' intention of robots' usage is meaningfully snowballing after acknowledging the facilities of the technological procedure in the workplace and numerous tourism subdivisions are being discoursed, while robots in restaurants, hotels, and airports obtain maximum research attention (Tung & Law, 2017; Yu, 2020; Wiese et al., 2021). This study has discovered the significant factors that lead to human-robot collaboration.

5.4 Managerial Contribution

In the service sector, the progress of robots is increasingly applied. However, the existence of robots does not currently mean that they will replace humans in the travel, tourism, and hospitality industry (Ivanov et al., 2018; Reis et al., 2020). Therefore, top managers need to focus on improving HRM to support employees in human-robot collaboration, customize a strategic plan based on the new vision, and properly motivate and train human employees to interact with robots. Therefore, this study provides estimated insights on employees' required perceptions, behaviors, and capabilities about robots, simplifies the procedure for robots' participation in human teams, and facilitates their optimum arrangement.

From the strategic management point of view, monitoring service robots is essential to cover the currently planned requirement areas. Therefore, this study has shown that managers must consider employees' expectations and develop the ability to acquire technical knowledge. In conclusion, managers' visions beyond existing innovations could stimulate new directions in the robotization of the TTH industry and require further research to discuss the sensitivity in employee psychology that will assist the industry in creating a balanced workplace.

5.5 Limitations and Future Research

This study had several limitations that will require future directions of study. First, employees' perceptions, willingness, and intentions were not analyzed according to their job positions. Therefore, future studies need to examine the factors that separate employees' perceptions according to their job positions to fulfill the future research requirements to support human-robot collaboration.

Second, the analysis could not include the HR managers' perception of employees' understanding of robots. At the same time, the results show that strategic HRM involvement as a facilitator is not significant. HRM involvement could not moderate the relationships between employees' intention to use robots, awareness, and human-robot collaboration. Therefore, future research may include top management, HRM opinions, and their eagerness to understand employees' mindset and objectives to enforce employees in human-robot collaboration and acceptance processes.

Moreover, future studies need customers, stakeholders, investors, and governments' rules and regulations to adopt robots to replace humans. Finally, future researchers could provoke real-world conditions to encourage employees to collaborate with robots. In this case, the robots are the employees' new workplace experience co-creators.

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APPENDIX

English Survey Items

Are you currently working in the hospitality industry (i.e., airline, airport, cruise ship, hotel, restaurant, theme park, bar, casino, etc.)?

Yes

No

What is your age?

What is the name of the company you work for? (PLEASE do not put FAKE information)

What is your title in your company/organization? (PLEASE do not put FAKE information)

Do you use robots in your workplace/organization? Please watch this video to understand the concept of robot usage
https://www.youtube.com/watch?t=4&v=3R67RGjZoOM&feature=emb_imp_woyt&ab_channel=UiPath

Yes

No

I am not sure

You will have several statements about the use of robots in your workplace. Please answer them based on your perceptions and level of agreement.

PerceivedUsefulness

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Using the robot would improve my performance in my job.	○	○	○	○	○
Using the robot in my job would increase my productivity	○	○	○	○	○
Using the robot would enhance my effectiveness in my job.	○	○	○	○	○
I would find the robot to be useful in my job.	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

PerceivedEaseOfUse

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
My interaction with the robot would be clear and understandable.	○	○	○	○	○
Interacting with the robot would not require a lot of my mental effort.	○	○	○	○	○
I would find the robot to be easy to use.	○	○	○	○	○
I would find it easy to get the robot to work with	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

HumaRobotCollaborati

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The human-robot team will work fluently together	○	○	○	○	○
The human-robot team will improve over time	○	○	○	○	○
The robot will contribute to the fluency of the interaction	○	○	○	○	○
I will do my best to make the human-robot team better	○	○	○	○	○
The robot will contribute equally to the team performance	○	○	○	○	○
I will be the most important team member on the collaborative team	○	○	○	○	○
The robot will be the most important team member on the team	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

RobotsAdvantages

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Robots will provide more accurate information than human employees	○	○	○	○	○
Robots will be able to provide information in more languages than human employees	○	○	○	○	○
Robots will deal with calculations better than human employees	○	○	○	○	○
Robots will be faster than human employees	○	○	○	○	○
Robots will be more polite than human employees	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

Robots'disadvantage

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Robots can malfunction during service	○	○	○	○	○
Robots can misunderstand a question/order	○	○	○	○	○
Robots consume too much electricity	○	○	○	○	○
Robots can't do special requests/they work only in a programmed frame	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

BehavioralIntentuion

Please let us know about your intention to use robots in your workplace.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I think I will use the robot concierge regular basis during my work in my organization	○	○	○	○	○
I am certain to use the robot concierge during the next service as well	○	○	○	○	○
I plan to use the robot concierge all the time	○	○	○	○	○

RobotAwareness

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I think my job could be replaced by robots	○	○	○	○	○
I am personally worried that what I do now in my job will be able to be replaced by robots	○	○	○	○	○
I am personally worried about my future in my organization due to robots replacing employees	○	○	○	○	○
I am personally worried about my future in my industry due to robots replacing employees	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

RobotsUserMotivation

Please let us know your level of agreement with the following statements.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I would have fun interacting with artificially intelligent robots	○	○	○	○	○
Interacting with artificially intelligent robots is enjoyable	○	○	○	○	○
Interacting with artificially intelligent robots is entertaining	○	○	○	○	○
I would find the interaction with artificially intelligent robots is cooperative	○	○	○	○	○
The actual process of interacting with artificially intelligent robots would be helpful	○	○	○	○	○
I personally feel artificially intelligent robots are friendly	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

StrategicHRMinvolvem

What is the level of your agreement on strategic involvement of HRM for human–robots' collaboration

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Our HR management involvement with human-robot collaboration is strong	○	○	○	○	○
Our HR management is interested in human-robot collaboration	○	○	○	○	○
Our HR management understands the importance of human-robot collaboration	○	○	○	○	○
Our HR management supports the human-robot collaboration	○	○	○	○	○
Our HR management considers human-robot collaboration as a strategic resource	○	○	○	○	○
Our HR management understands human-robot collaboration opportunities	○	○	○	○	○
Our HR management keeps the pressure on operating units to support human-robot collaboration	○	○	○	○	○
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree

My age

- ○ 18 - 24 years
- ○ 25- 29 years
- ○ 30- 34 years
- ○ 35 - 39 years
- ○ 40 -44 years
- ○ 45- 50 years

Gender

What is your sex?

- ○ Male
- ○ Female
- ○ Other

Education

What is the highest level of school you have completed or the highest degree you have received?

- ○ Less than high school degree
- ○ High school graduate (high school diploma or equivalent including GED)
- ○ Some college but no degree
- ○ Associate degree in college (2-year)
- ○ Bachelor's degree in college (4-year)
- ○ Master's degree
- ○ Doctoral degree
- ○ Professional degree (JD, MD)

Maritalstatus

Are you now married, widowed, divorced, separated or never married?

- ○ Married
- ○ Widowed
- ○ Divorced
- ○ Separated
- ○ Never Married

Employment

Which statement best describes your current employment status?

- ○ Working (paid employee)
- ○ Working (self-employed)
- ○ Not working (temporary layoff from a job)
- ○ Not working (looking for work)
- ○ Not working (retired)
- ○ Not working (disabled)
- ○ Prefer not to answer

Position

My position in the organization

- ○ entry level
- ○ skilled level
- ○ management level
- ○ Others

Department

Please specify the type of department:

- ○ Front office
- ○ F&B
- ○ Housekeeping
- ○ Food preparation
- ○ Maintenance
- ○ Marketing
- ○ Others

TotalExperience

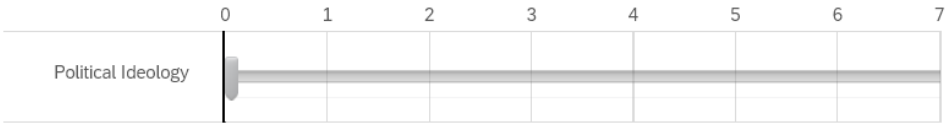
Professional experience in general (total time of experience)

- ○ 6-12 months
- ○ 1 - 3 years
- ○ 4 - 6 years
- ○ 7- 10 years
- ○ 11 - 15 years
- ○ More than 15

Choose one or more races that you consider yourself to be:

- [ ] White
- [ ] Asian
- [ ] Black or African American
- [ ] Native Hawaiian or Pacific Islander
- [ ] American Indian or Alaska Native
- [ ] Other

Here is a 7-point scale on which the political views that people might hold are arranged from extremely liberal (left) to extremely conservative (right). Where would you place yourself on this scale?



Any questions or comments?