The Robotic-Human Service Trilemma: the challenges for well-being within the human service triad

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Abstract

Purpose – The human service triad (i.e. the relationship between the customer, frontline employee (FLE) and managerial employee) experiences a range of well-being challenges when faced with the introduction of service robots. Despite growth in service robot scholarship, understanding of the well-being challenges affecting the human service triad remains fragmented. Hence, the purpose of this paper is to synthesise the literature and offer a research agenda aligned with the proposed Robotic-Human Service Trilemma. By taking a job performance approach (which considers the actions, behaviours and outcomes linked to organisational goals), the Robotic-Human Service Trilemma conceptualises three well-being challenges (intrusion, sideline and interchange). These challenges are realised via the realistic capabilities and constraints of service robot implementation.

Design/methodology/approach – This research relies on a systematic review of all disciplines concerning service robots. In total, 82 articles were analysed using thematic coding and led to the development of the Robotic-Human Service Trilemma and research agenda.

Findings – The analyses reveal the Robotic-Human Service Trilemma consists of three challenges: intrusion, sideline and indifference. The findings demonstrate that FLEs are required to counterbalance the constraints of service robots, leading to an uneven well-being burden within the human service triad. This

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paper suggests a research agenda for investigation of the challenges that underpin the Robotic-Human Service Trilemma.

Originality/value – Through the conceptualisation of the Robotic-Human Service Trilemma, this study is the first to explore how states of well-being equilibrium exist within the human service triad and how these states are challenged by service robots. The authors present a balanced centricity perspective to well-being that contrasts previous trade-off approaches and that enhances the body of service robot literature with a well-being lens.

Keywords Service robot, Systematic literature review, Well-being, Human service triad, Trilemma, Challenge

Paper type Research paper

Introduction

"Technology is a tool for both helping humans and destroying them. This is the paradox of our times which we are compelled to face" (Frank Herbert, 1987).

According to the World Economic Forum (2020), the combination of COVID-19's pandemic-induced lockdowns, economic difficulties and rapid technological developments within firms will see a transformation in tasks, jobs and skills of workers by 2025. Whilst many sectors suffered during the pandemic, the service robotics market saw a growth of 196% ($32 million USD) within the hospitality industry alone as contactless service was prioritised (International Federation of Robotics, 2021) due to safety precautions and restrictive government mandates (Schepers and Streukens, 2022). Immune to viruses, service robots, which are system-based autonomous and adaptable interfaces that interact, communicate and deliver services to an organisation's customers (Wirtz *et al.*, 2018), became an ideal option for reducing human contact and enhancing safety (Chuah *et al.*, 2021a).

Whilst experts predict service robots are here to stay, previous optimistic implementations have seen practitioners re-employ frontline employees (FLEs) due to robot service failures (Choi *et al.*, 2021). In 2019, the Henn-na Hotel in Japan, which once boasted an entire robotic workforce, fired half of its robotic staff due to the robots "creating more work than they were achieving" (Shead, 2019). Hotel guests became frustrated when robots were incapable of answering simple questions, or woke them throughout the night upon mistaking snoring for a guest asking a question (Grewal *et al.*, 2020). These discrepancies between service robot capabilities and actual service robot constraints lead to an increased burden on FLEs, who must manage robots and also mitigate tensions with guests due to service failures (Paluch and Wirtz, 2020). Thus, whilst service robots were introduced to directly benefit customers, the integration of the service robot was detrimental to the well-being of both customer and FLE. Hence, service organisations experience challenges in terms of potential tension between the well-being needs of the customer, the FLE and the managerial employee. We term simultaneous tensions in well-being experienced by all three actors in the human service triad-customer, FLE and managerial employee - (Parasuraman, 2000) due to service robot introduction, as a trilemma. A trilemma traditionally involves trade-offs between three competing options (Heffron *et al.*, 2015). To date, despite research considering the roles service robots are likely to fulfil, there has been no research to understand the Robotic-Human Service Trilemma that may result from robot integration.

Previous research has explored the potential roles service robots will take in the frontline service environment based on social expectations (Čaić *et al.*, 2018; Odekerken-Schröder *et al.*, 2020; Tuomi *et al.*, 2021). Whilst valuable in this emerging stage of service robotic literature, a role theory (Rizzo *et al.*, 1970) approach contributes to vague conceptualisations of service robot integrations, due to reliance on social expectations rather than performance capabilities. An alternate approach to service role theory is focussing on job capabilities and constraints (Borman and Motowidlo, 1997) whereby the performance abilities of a service employee determine the allocation of service tasks. Whilst there is service robot research using role theory (Lu *et al.*, 2020), no research has used a job performance approach to identify the allocation of tasks between service robots and FLEs. Indeed, researchers have highlighted the growing need to understand the moral and ethical implications of service robots (Tuomi *et al.*, 2021), but little progress has

been made to understand the well-being implications of actors (customer, FLE and managerial employee) and actor relationships within the human service triad due to deployed service robots. Previous research has identified that the tensions between FLEs, customers and the managerial employees create challenges (Ivanov *et al.*, 2019); however, there is currently no research that has framed these challenges from a well-being perspective, nor any research that has conceptualised the challenges in the human service triad as trilemmas.

The research problem of identifying the tasks to be allocated between FLEs and service robots in a way that minimises negative well-being impacts for the FLE, customer and managerial employee leads to two research questions: (1) how are capabilities and constraints in job performance distributed within the human service triad with a service robot and (2) how is well-being for each actor in the human service triad (FLE, managerial employee and customer) affected when service robots are present in the service environment? Using a systematic literature review we propose a new framework for conceptualising the Robotic-Human Service Trilemma, inclusive of three challenges: intrusion, sideline and indifference. Each challenge represents the interruption of the balanced state of well-being between two human actors of the human service triad.

We contribute to the robotics literature in service management in three key ways. We find that (1) there is a service robot-FLE task performance paradox which reflects the additional task burden on FLEs when service robots are present, (2) there is an over-inflation of social-emotional capabilities of service robots and (3) there is a need for blended augmentation-substitution integration of service robots. We also contribute the conceptulisation of the Robotic-Human Service Trilemma to the well-being literature in service management.

This article commences with the conceptual background of robots and the human service triad, job performance perspectives and well-being challenges. This is followed by the systematic literature review method. Subsequently, the findings are provided, culminating in the introduction of a new framework. Finally, the theoretical contributions and managerial implications are discussed and limitations and a future research agenda are outlined.

Conceptual background

Service robots and relationships in the human service triad

Service robots are system-based autonomous and adaptable interfaces that interact, communicate and deliver services to an organisation's customers (Wirtz *et al.*, 2018). Whilst still emerging, service robots have been implemented into various service industries such as hospitality, tourism and aged care, as waiters, receptionists and companions, amongst other roles. The service triad (Parasuraman, 2000) contains the three relationships of the human service triad to include the customer-organisation, employee-organisation and organisation-customer, with the added technology stakeholder in the centre, which seeks to highlight the induced shifts of interactions upon the introduction of technology.

The majority of service robotic literature concerning the service triad seeks to examine the dyadic behavioural elicitations of a customer or FLE when presented with service robots (Lariviere *et al.*, 2017). Most recently, Odekerken-Schröder *et al.* (2022) found evidence for the interplay between different actors in the 'customer-FLE-technology" service triad. Meyer *et al.* (2020) found that FLEs perceived role incongruency, advocation, tension (feeling alienated from work) and perceived loss of status due to service robots. Emerging research is beginning to embrace a multi-stakeholder perspective of service robot adoption (Zhong *et al.*, 2022); however, research concerning the relationships besides the customer within the triad have been relatively unexplored (Lu *et al.*, 2020), reflective of the fragmented and conceptual nature of the current body of service robotic literature. Honouring Parasuraman's (2000) original service triad, we place the service robot in the centre of the service triad to enable exploration of the potentially catalysing and/or inhibitory role this form of technology (service robot) has on all actors and inter-actor relationships in the service environment. When exploring human well-being in the service triad, we adopt Zhong *et al.'s* (2022) multi-stakeholder perspective whereby managers and backstage staff perspectives

reflect the nature of organisational human well-being impacts in robot adoption processes. Thus, we frame the service triad as the human service triad in this paper.

From a role theory to a job performance perspective of service robots

Service robot roles in service environments. A role is defined as a set of expectations about a position in a social structure (Rizzo *et al.*, 1970). Expectations define behavioural requirements or limits ascribed to the role, with these expectations conditioned by general experience and knowledge, values and perception (Rizzo *et al.*, 1970). Larivière *et al.* (2017) seminally posited substitutive (i.e. the replacement of human input in the service encounter) and augmented (i.e. the assisting and complementary role of technology in the service encounter) roles technology may take within the employee and customer relationship. This provided an overarching foundation for extended research into the roles of service robots. Here, Tuomi *et al.* (2021) found that in live service robot hospitality environments, such augmentative and substitutive service robot roles can have serious socioeconomic implications at both the micro and macro level via the automation of tasks, processes and ultimately jobs. Whilst service robots proved effective in performing relatively simple and repetitive tasks (e.g. taking orders, dealing with payments, providing information), service robots also hindered FLEs in augmentative roles due to the need of human intervention upon service failure (Tuomi *et al.*, 2021). This included table-clearing robots not emptying its trays, resulting in FLEs chasing them and customers ignoring service robots and entering unauthorised areas (Tuomi *et al.*, 2021). Yet service robots enabled backstage staff to upskill by increasing operational efficiency allowing dedicated time for employees to increase training and skills and receive internal promotion through reimagined human roles. Čaić *et al.* (2018) reported similar findings where service robots empowered focal and network actors through value co-creation in the aged care context via ally and enabler roles. Yet some focal and network actors also experienced value co-destruction via interference within the network and anxiety and fear over potential substitution within the network via intruder and replacement roles respectively (Čaić *et al.*, 2018). Extant research infers a linkage of between the capabilities and constraints of service robots and other actors (customer, FLE and managerial employee) that contribute to dichotomous service robot roles (Wirtz *et al.*, 2018; Huang and Rust, 2021; Lin and Mattila, 2021). However, a role theory approach fails to account for actual service robot performance capabilities within a given service environment. The lack of focussed understanding of actual service robot capabilities results in the assumption that service robots have similar capabilities to that of humans, leaving greater room for potential service failure.

Job performance of service robots and frontline employees. Job performance refers to the "scalable actions, behaviour and outcomes that employees engage in or bring about that are linked to and contribute to organisational goals" (Viswesvaran and Ones, 2000). Job performance consists of task performance, actions that are part of the formal reward system and address the requirements as specified in job descriptions (Borman and Motowidlo, 1997; e.g. serving guests, preparing food) and contextual performance, behaviour that does not directly contribute to organisational performance but does maintain and support the social and psychological environment (e.g. volunteering for periphery tasks, boosting morale).

Service robots are capable of performing cognitive-analytical tasks or emotional-social tasks such as greeting customers (Wirtz *et al.*, 2018), both of which support task and organisational performance. Further, service robots are able to deliver homogenous output, with customisation at scale, potentially no biases and the ability to engage in surface acting (Wirtz *et al.*, 2018). In contrast, FLEs deliver heterogenous output with variation in customisation dependent on the FLE's skill set and the specific needs of the customer (Wirtz *et al.*, 2018). Whilst there may be unintended bias towards customers, FLEs do display and experience genuine emotions, can engage in deep acting, out-of-the-box thinking and creative problem solving (Wirtz *et al.*, 2018).

Emerging research expands upon the aforementioned benefits and constraints of service robots and FLEs whereby research suggests preference for a service robot or human delivered service can be task-specific (Holthöwer and van Doorn, 2022) as well as goal oriented (Tojib *et al.*, 2022). Whilst service robots lack emotions and social skills and have less capacity for service personalisation (Hoang and Tran, 2022), as service robots are not human, Holthöwer and van Doorn (2022) found that service robots alleviate consumer embarrassment in service encounters as service robots mitigate the fear of being socially judged via the removal of human presence. When job performance concerns cleaning a venue (in the hospitality context), Hoang and Tran (2022) found customers generally perceived robot cleaners to be less competent than FLEs and thus perceived the service environment to be less clean. However, when the cleaning task was considered disgusting (when the cleaning environment is unsanitary or otherwise provokes feelings of disgust) or disruptive (troubles or inconveniences the customer), consumers view service robot cleaners as more competent than FLEs (Hoang and Tran, 2022). Whilst research on customer preference of service robot versus FLE job performance is emerging, there is substantial opportunity for further exploration of the distribution of service tasks from a job performance perspective, which can have a significant impact on the well-being of the human actors in the service triad.

Well-being in the human service triad and service robots

Moral and ethical impacts of service robots on human well-being. Well-being is considered a multi-faceted construct, comprising of not mutually exclusive hedonic and eudaimonic well-being (Giraldo *et al.*, 2020). According to Ryan and Deci (2001), hedonic well-being focuses on happiness and defines well-being in terms of pleasure attainment and pain avoidance. Eudaimonic well-being focuses on meaning and self-realisation and defines well-being in regards to the degree a person is fully functioning (Ryan and Deci, 2001). These forms of well-being are not mutually exclusive, meaning that a change in one form of eudaimonic well-being can also change the form of hedonic well-being and vice versa (Giraldo *et al.*, 2020). Further, when seeking to understand well-being affected by the job performance of service robots and FLEs, there are two overall approaches: individual well-being (including subjective or objective well-being) and collective well-being (service system).

Service system well-being is viewed as a collective concept whereby it is assumed that all entities that are nested in different levels of a service ecosystem are influenced by each other's actions, behaviours, resource levels, norms and practices (Leo *et al.*, 2019). This includes the micro (actor to actor interactions), meso (community well-being of the institutions) and macro level (societal well-being where institutions govern entire service ecosystems (e.g. nation and government)) (Kuppelwieser and Finsterwalder, 2016). Thus, service system well-being is considered an aggregate construct of well-being at a group level (Leo *et al.*, 2019); however, well-being efforts in one system can have spillover effects into other systems (Finsterwalder and Kuppelwieser, 2020a). Aligning to a job performance lens (which considers the actions, behaviours and outcomes linked to organisational goals), according to Chen *et al.* (2021) it is an individual's (or focal actor's) involvement in the service or activity ecosystem as well as engagement with other actors that contribute to their individual well-being.

Individual well-being is classified into two categories, subjective well-being which includes people's emotional responses, domain satisfactions and global judgements of life satisfaction and objective well-being which is based on quality of life indicators such as material resources and social attributes (Diener *et al.*, 1999). In this paper we conceptualise subjective well-being to include both hedonic and eudaimonic dimensions. According to the Gallup-ShareCare (Gallup, 2008) well-being index, subjective well-being comprises of five dimensions: purpose (how you occupy your time and liking what you do every day), social (meaningful friendships and connections in life), financial (effective management of money

and financial security), community (sense of engagement and involvement where you live) and physical (having good health and energy to get things done on a daily basis) (Gallup, 2008). Current understanding of the well-being needs of individual actors within the human service triad (customer, FLE and managerial employee) is limited. A review of the current body of literature suggests such job performance needs are dependent on the actor and service setting, whereby tensions and/or alignment across actors contributes to overall service system/ecosystem well-being (Groven *et al.*, 2021). According to (Chen *et al.*, 2021) well-being is an outcome of experienced and realised value via co-creation activities in a particular socio-cultural context and environment subjectively. Thus, actors co-create well-being with other actors in particular settings dependent on their process of sense and meaning making (Finsterwalder and Kuppelwieser, 2020b). As of yet, it is unclear what activities are associated with various dimensions of subjective well-being within the context of service robot interactions for each actor within the human service triad. Thus, there is opportunity to understand the specific well-being needs within the human service triad for individual actors in relation to their activities within the service robot context.

Whilst ethical, moral and well-being implications have been highlighted by authors and explored to some degree, the specific impact of well-being for the human actors within the service triad is still relatively unexplored. Current research largely focuses on customer outcomes in response to customer ethical and morality perceptions of service robots. For instance, Etemad-Sajadi and Sturman (2022) found that when a service robot is seen as a threat to privacy and data protection, it negatively impacts customer intention to engage with a service robot. More so, when a service robot is perceived as a threat to human jobs, there is a decrease in customer intention of use (Etemad-Sajadi and Sturman, 2022). Thus, there is a need to understand the specific well-being impacts for the three human actors within the service triad due to service robot implementation.

Well-being trilemma and service robots

A trilemma is a useful lens to understand the interactions between three human actors. There are two approaches to trilemma conceptions: the trade-off approach and the balanced approach. The traditional trade-off trilemma approach refers to the presentation of three options whereby an individual must sacrifice one option for the sake of accepting the other two options (Obstfeld *et al.*, 2005). Trade-off trilemmas include the policy/economic trilemma (Obstfeld *et al.*, 2005), the blockchain trilemma (Musharraf, 2021), the financial trilemma (Schoenmaker, 2011) and the judicial trilemma (Dunoff and Pollack, 2017) (Table 1). In contrast, the balanced trilemma approach presents three options as conflicting aspects which can be collectively embraced, albeit with concerted effort. The most prevalent balanced trilemma approach is the energy trilemma, which concerns the balance between three challenges, energy security, social impact and environmental sustainability, when providing energy to populations (CSIRO, 2019) (Table 1). Our research adopts the balanced trilemma approach. We label this the well-being trilemma and conceptualise it as the balancing of the well-being challenges within the three dyadic human relationships of the service triad. We define a well-being trilemma as the collective state of network well-being imbalance (opposite to equilibrium) along all three relationships of the human service triad. In contrast to the energy trilemma, where the apexes of the triangle represent the three conflicting challenges, the sides of the well-being trilemma represent the challenges as they are the dyadic well-being relationships between each actor (apexes).

The concept of balanced centricity is helpful in understanding this balancing act of well-being. Balanced centricity occurs when all actors have their interests and needs fulfilled, increasing both individual and actor-network well-being (Groven *et al.*, 2021). As disruption to frontline service environments continues through augmentative (assisting and complementing service employees in the service encounter (Marinova *et al.*, 2017))

Table 1.
- Summary of different trilemmas in academia and industry

Author/s (year)	Origin	Trade-off	Balance	Type	Definition	Apexes
CSIRO (2019)	Industry		✓	Energy	"A balance between energy security, social impact, and environmental sustainability. These three things are presented as conflicting aspects of energy production . . .. The energy trilemmas appears to be different: meeting it requires achieving all three goals, although within the parameters of the particular wishes or interest of the actor in question"	• Affordability • Reliability • Sustainability
Obstfeld *et al.* (2005)	Industry and academic	✓		Policy/Economic/ Macroeconomic	Countries may choose from three options when making fundamental decisions about their international monetary policy agreements However, only one option of the trilemma is achievable at a given time, as the three options of the trilemma are mutually exclusive	• Setting a fixed currency exchange rate • Allowing capital to flow freely with no fixed currency exchange rate agreement • Autonomous monetary policy
Ledger (2021)	Industry	✓		Blockchain	"A set of three main issues that developers encounter when building blockchains. More often than not, creators are forced to sacrifice one 'aspect' for the sake of the other two"	• Scalability • Decentralisation • Security
Steinbuks and Hertel (2014)	Industry		✓	Global land use	"The optimal allocation of scarce land, both across competing uses as well as across time"	• Food • Energy • Environment
Schoenmaker (2011)	Industry	✓		Financial	"The financial trilemma states that financial stability, financial integration, and national financial policies are incompatible. Any two of the three objectives can be combined but not all three, one has to give."	• Financial stability • Financial integration • National financial policies
Dunoff and Pollack (2017)	Academic	✓		Judicial	"states the by design, and the judges that service on, international courts face an interlocking series of trade-offs amongst three core values. The trilemma is that it is possible to maximise, at most, two of these three values. The Judicial trilemma does not identify an 'ideal' court design. Rather it provides a framework that enables international actors to understand the inevitable trade-offs that international courts confront, and thereby helps to ensure that these trade-offs are made deliberately and with a richer appreciation of their implications."	• Judicial independence • Judicial accountability • Judicial transparency

Source(s): Table by authors

and substitutive (replacing human input in the service encounter) roles of technology (Larivière *et al.*, 2017), there is an increasing need to understand how long-standing service relationships and triadic well-being exchanges are impacted at the human level due to the change in job performance of actors.

Method

We conducted a systematic literature review to identify the job performance capabilities and constraints of service robots and FLEs and effects on stakeholder well-being within the human service triad. Considering the fragmented understanding of service robots within the body of literature, a systematic review provides an effective synthesis of current research "to know what we know" through the full body of relevant empirical evidence (Rousseau *et al.*, 2008). Our systematic review employed a three-step approach involving literature search, selection and analysis of articles following the PRISMA method (Page *et al.*, 2021) reflected in Figure 1. The PRISMA method is a widely endorsed reporting guideline for systematic reviews (Page *et al.*, 2021).

Literature search

We employed an iterative process to create a search string with keywords reflective of the physical service environment ("frontline and deliver") and the service triad ("interaction or relationship") concerning service robots. Whilst this study focuses on the capabilities, constraints and resulting tensions of service robots within the service triad, these terms were iteratively excluded from the final search string as they garnered poor quality and irrelevant results. Thus, broader search terms were used and the identification of capabilities, constraints and tensions emerged through the data analysis. Due to the nascency of the body of research, this search string ("service robot" AND frontline AND deliver AND (interaction or relationship) proved the most useful in yielding an appropriate number of relevant results. This search string was used in the ProQuest, EBSCOHost, Taylor and Francis, Science Direct and SpringerLink databases collectively covering 19,000 scholarly journals. These searches generated 252 scholarly papers across the databases, considering all disciplines. Whilst the PRISMA method does suggest including articles found in the reference lists of papers resulting from the initial search, this was not embraced in order to limit subjectivity in the article selection process to ensure replicability in the systematic review.

Literature selection

Aligning to the PRISMA method we employed exclusion criteria that removed technical papers, conference articles, non-peer reviewed, non-English, abstract only, non-full papers, prior to 2010 (due to the recent rapid pace of research in the service robotics field), duplicated articles, non-tangible service robots and journals with minimum (below Q1) impact factors. We ensured that only embodied service robot literature was included (as opposed to virtual robots or chatbots) considering the fragmented nature of conceptualisations of service robots within the body of literature. After these criteria were applied, we retained 65 papers which were screened for face validity.

We then excluded another 7 articles after reviewing paper abstracts. Exclusions were largely due to misaligned terminology and conceptualisations of service robots (e.g. termed as chatbots, avatars) or artificial intelligence papers containing no reference to embodied service robots. 58 full text articles were reviewed and 11 articles were further excluded. The researchers held discussions to reconcile any areas of disagreement with unanimous agreement of 47 articles remaining for analysis. No additional articles were added to the final set of articles to maintain the systematic integrity of the process. An additional article literature search and selection was conducted in October, 2022, which increased the number of total articles analysed to 82 (Figure 1). Overall, the analysis of the additional articles

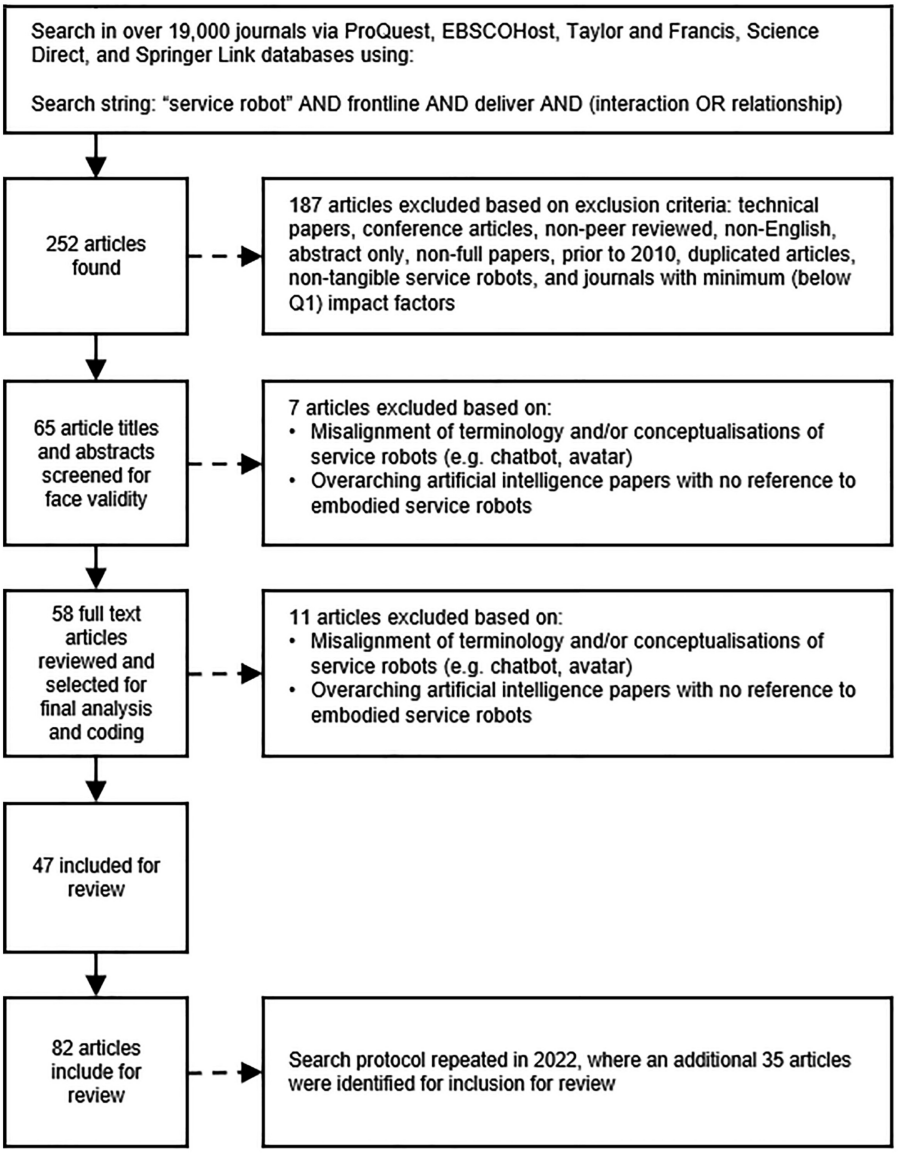

Figure 1.
Overview of literature search and selection

Source(s): Figure by authors

reinforced the existing findings and indicated that emerging research has begun to embrace a job performance lens to service robot implementation.

Literature analysis

To analyse the 82 articles a two-stage approach was employed. First, we used a detailed coding template to capture metadata (author, year, paper type, research design, method, participants and discipline) and codes related to the study's objectives (e.g. service robot

capabilities and constraints, tensions between stakeholders). The research team inductively coded the articles in relation to the research categories through NVivo then captured metadata and consolidated findings in Excel. Figure 2 visualises the coding process, utilising the Gallup-ShareCare (Gallup, 2008) well-being index and the Borman and Motowidlo (1997)

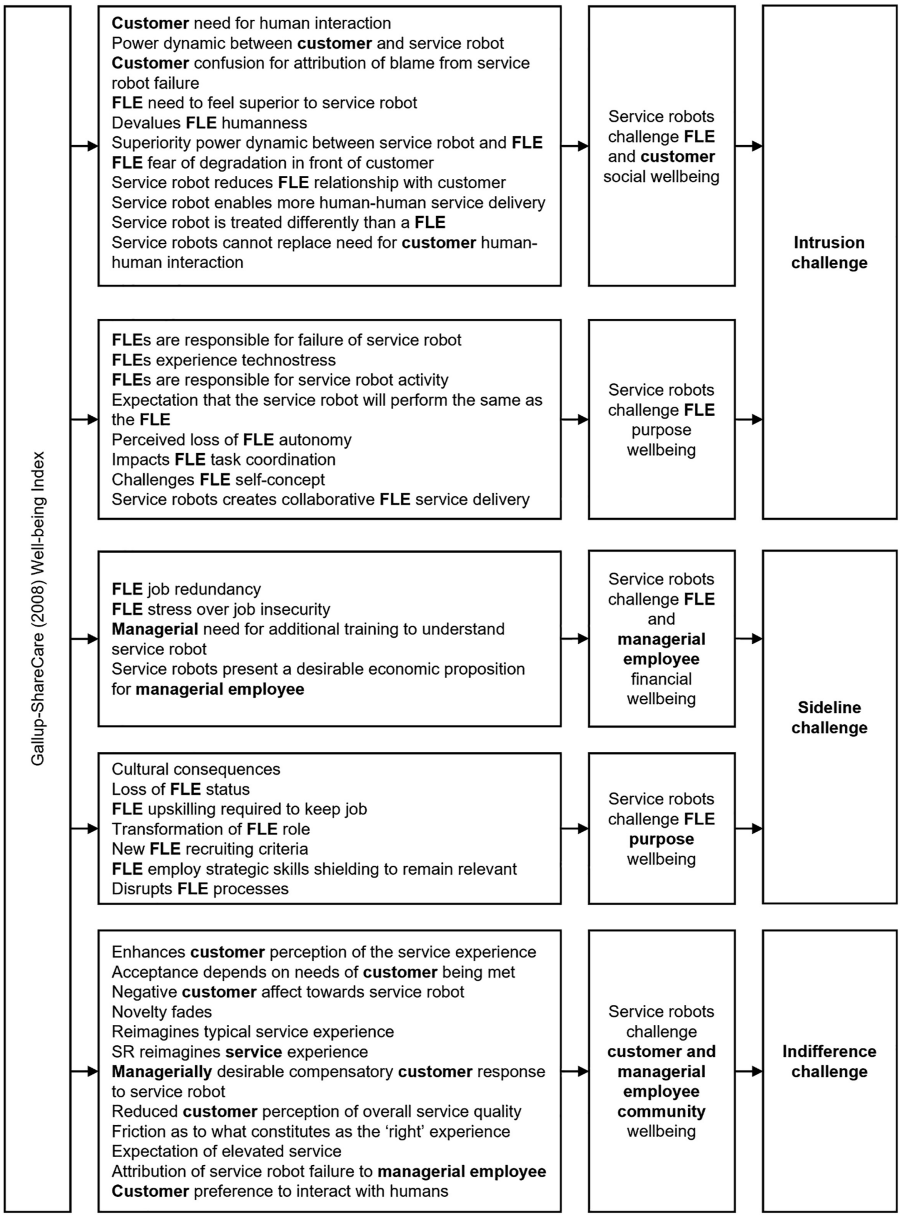

Figure 2.
First and second cycle coding analysis

(*continued*)

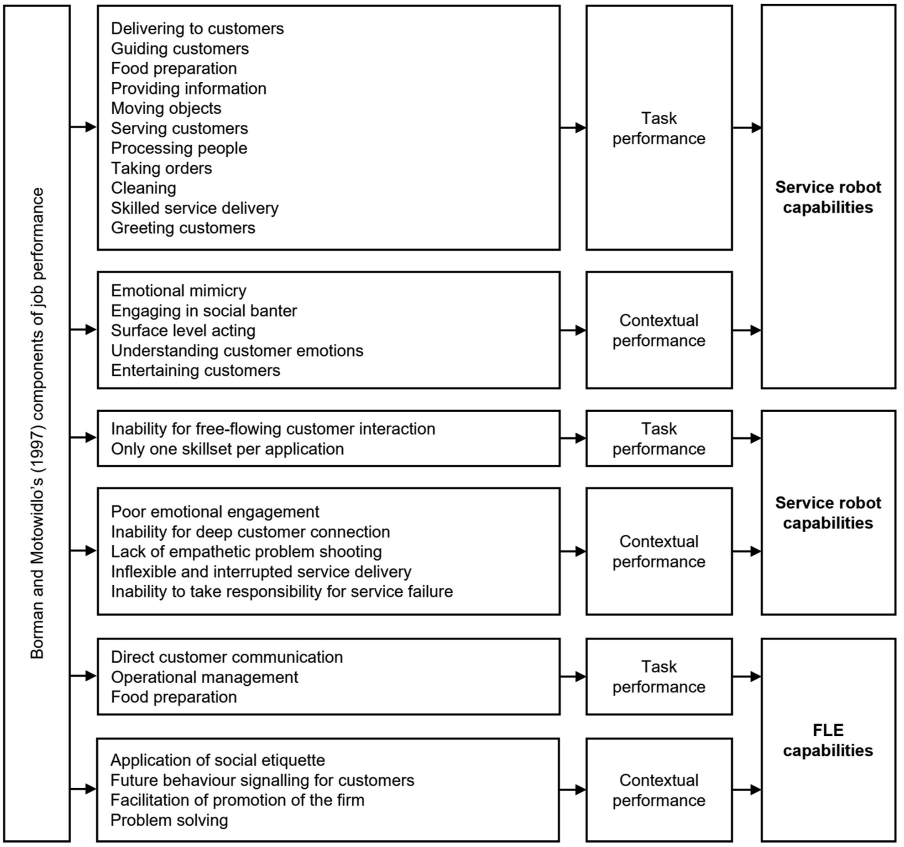

Figure 2.

Source(s): Figure by authors

components of job performance. Table 2 gives an overview of the metadata associated with the selected articles for each of the three stakeholders within the human service triad, including the list of analysed articles and distribution across country and journals (web appendix). Overall metadata revealed that there is a heavy tourism, leisure and hospitality management perspective within the body of literature, with many studies using a convenience sample of undergraduate students as participants.

Findings

The first research question of *how are capabilities and constraints in job performance distributed within the human service triad with a service robot?,* is addressed through four themes: (1) FLEs counterbalance the constraints of service robot performance; (2) FLEs provide transferrable task performance to mitigate rigid robot service delivery; (3) FLEs complete integral social-emotional tasks due to inseparability from service delivery; and (4) service robots require blended augmentative-substitutive integration for effective service delivery. The second research question, *how is well-being for each actor in the human service triad (FLE, managerial employee and customer) affected when service robots are present in the*

Actor perspective	Articles (%)	Field/s (scimago)	Sample
Customer	64%	• Tourism, Leisure and Hospitality Management (51%) • Marketing (19%) • Business and International Management (10%) • Human-Computer Interaction (7%) • Computer Science (4%) • Management of Technology and Innovation (3%) • Applied Psychology (2%) • Multidisciplinary (2%) • Strategy and Management (2%)	• Hotel guests with service robot exposure • Hotel guest without service robot exposure • Undergraduate students • Random sampling • Potential customers • Academic experts • Travellers
Frontline employee	11%	• Tourism, Leisure and Hospitality Management (33%) • Marketing (22%) • Safety and Management (11%) • Business and International Management (11%) • Human-Computer Interaction (6%) • Management of Technology and Innovation (6%)	• Frontline hospitality workers • Managers and executives
Managerial employee	18%	• Tourism, Leisure and Hospitality Management (24%) • Marketing (21%) • Management of Technology and Innovation (14%) • Computer Science (14%) • Strategy and Management (10%) • Business Management and Accounting (7%) • Sociology and Political Science (7%) • Business and International Management (3%)	• Hotel managers • Academics • Undergraduate students • Hotel industry experts
General	7%	• Business and International Management (34%) • Computer Science Applications (17%) • Hardware and Architecture (17%) • Business Management and Accounting (17%) • Tourism, Leisure and Hospitality Management (17%)	• NA

Source(s): Table by authors

Table 2.
Overview of studies from a metadata perspective

service environment?, is addressed by the provision of a unique conceptual model, the Robotic-Human Service Trilemma framework containing three core challenges that impact human well-being: intrusion, sideline and indifference challenges.

Frontline employees counterbalance the constraints of service robot job performance

An overview of the capabilities and constraints of service robots and FLEs, distinguishing between conceptual and empirical works is shown in Table 3. Within the literature that examined the capabilities and constraints of both service robots and FLEs together, 70% of all articles explore capabilities of service robots and/or FLEs, whilst 30% of all articles explore their constraints. Of the articles that examined service robots (72% of all articles), 67% discussed their capabilities and 33% discussed their constraints. Of articles that focussed on employees (27% of all articles), 78% discussed FLE capabilities, whilst 21% discussed FLE constraints. Three themes arise from the data that show the inflated role of the FLE via job performance and the counterbalancing effect this has for FLEs.

Frontline employees provide transferrable task performance to mitigate rigid robot service delivery

Exploration of the FLE task performance was disproportionately low compared to the attention given to understanding the task performance of service robots in service environments. Task performance capabilities of FLEs included delivering objects and food preparation (Mende *et al.*, 2019), direct customer communication (Garry and Harwood, 2019) and operational management (Mingotto *et al.*, 2021) (Table 3). However, the task performance capabilities of FLEs are known to be more extensive as they span across multiple frontline service environments and were reflected in the task performance capabilities and constraints of service robots. The list of capabilities discussed for both service robots and FLEs is not exhaustive (Table 3), but rather a direct reflection of the dominance of hospitality and tourism environments as service settings where robots have been more frequently introduced.

The findings demonstrate that the identified task capabilities of FLEs also directly reflect service robots' major constraint, wherein service robots are unable to have more than one skillset per service environment application. Whilst service robot task capabilities are job specific, task capabilities of FLEs are transferable (yet not communicated in the literature) as the human experience spans across many environments, with the transfer of skills and knowledge relatively unlimited. Consider the context of an FLE pouring customers drinks from a coffee bar. In the instance that a customer may spill a drink, the FLE would be able to use their task performance knowledge from other experiences to mitigate this error and would clean the mess with a nearby cloth. A mechanical arm service robot would be used in this context, such as OrionStar's robotic coffee master (a humanoid robotic barista that simulates master brewing techniques; The Robot Report, 2020). However, the mechanical arm would not be capable of this transfer of task performance knowledge and adaptability as the arm designed to pour drinks is not designed to clean spilled drinks. Mitigation would instead require intervention from a different robot (e.g. cleaning robot) or a human (Um *et al.*, 2020).

Whilst literature explores the contextual ability of FLEs to problem solve and engage in out-of-the-box thinking (Wirtz *et al.*, 2018), at a task-based level organisations rely on the transferrable task capabilities of FLEs to be ready to step in for the service robot should it fail. This transferability is seen as an outcome, such as that of adaptive expertise. Hence, there is an additional load and pressure for FLEs to employ on-the-spot measures in task performance from other experiences to mitigate the limitations of service robots outside the scope of their designed work.

Constraints in the job performance of FLEs were not explored in any articles and instead included nebulous themes including extensive training (Reis *et al.*, 2020; Wirtz *et al.*, 2018), restrictive working hours (Prentice and Nguyen, 2021) and exhaustion (Qiu *et al.*, 2020). Thus, the ability to participate in messy human experiences elevates FLEs' transferrable task performance capabilities as the gold standard in the service environment.

Frontline employees complete integral social-emotional tasks due to inseparability from service delivery

The literature revealed differences in conceptual projections of contextual performance of service robots, versus *actual* performance outlined in empirical works. Conceptual articles project that service robots will be capable of engaging in social banter (Belanche *et al.*, 2020a; Mahr *et al.*, 2019), emotional mimicry (Belanche *et al.*, 2020b; Bolton *et al.*, 2018; Paluch *et al.*, 2020), surface-level acting (Bolton *et al.*, 2018; Wirtz *et al.*, 2018) and understanding customer emotions (Thomas *et al.*, 2021). However, at an empirical level, service robots are only capable of entertaining customers (e.g. sing, dance, talk; Chuah *et al.*, 2021b) and performing emotional mimicry (Yam *et al.*, 2021; Yu and Ngan, 2019) (Table 3). Empirical articles identify service robot contextual constraints as actions surrounding emotional engagement with the

Table 3. Service robot and frontline employee capabilities and constraints in job performance

		Service robot		Frontline employee	
		Capabilities	Constraints	Capabilities	Constraints
Task performance	Conceptual	• Delivering to customers • Guiding customers • Food preparation • Providing information • Moving objects • Serving customers • Processing people • Taking orders • Cleaning • Skilled service delivery	• Inability for free-flowing customer interaction • Only one skillset per application	• Direct customer communication • Operational management	NA
	Empirical	• Delivering to customers • Guiding customers • Food preparation • Providing information • Moving objects • Serving customers • Processing people • Taking orders • Greeting customers	• Inability for free-flowing customer interaction • Only one skillset per application	• Direct customer communication • Operational management • Food preparation	NA
Contextual performance	Conceptual	• Emotional mimicry • Engaging in social banter • Surface-level acting • Understanding customer emotions	• Poor emotional engagement • Inability for deep customer connection • Lack of empathetic problem shooting • Inflexible and interrupted service delivery	• Application of social etiquette • Future behaviour signalling for customers • Facilitation of promotion of the firm • Problem solving	NA
	Empirical	• Emotional mimicry • Entertaining customers	• Poor emotional engagement • Inability for deep customer connection • Lack of empathetic problem shooting • Inability to take responsibility for service failure	• Application of social etiquette	NA

Source(s): Table by authors

customer and fostering deep human connection in service delivery. This is echoed by conceptual works, amongst other limitations. Indeed, non-technical fields (such as services marketing) have a tendency to optimistically overinflate the contextual social-emotional capabilities of service robots in conceptual works, whilst not considering the technical limitations that inform service robot constraints. With 50% of all articles discussing service robot capabilities and 24% of all articles discussing service robot constraints in job performance, there is a bias towards exploring the potential of service robots, rather than technical limitations.

In reality, FLEs are required to fulfil the shortfall in social-emotional capabilities of service robots to still facilitate successful service delivery. There is importance placed on the only empirical capability for FLEs (application social etiquette (Choi *et al.*, 2019; Lin and Mattila, 2021; Meyer *et al.*, 2020); that encompasses reading social situations and delivering appropriate social-emotional conduct to mitigate service robot shortcomings). However, application of social etiquette encompasses a wide range of interpersonal skills that are positively associated with service outcomes. Hence, the literature has over-generalised a crucial skillset of the FLE that contributes to substantial contextual job performance overcompensation to mitigate service robot limitations. This gap of understanding the constraints and capabilities between conceptual and empirical work indicates a lack of understanding of technical knowledge within the dominant services marketing and tourism and hospitality research.

Service robots require blended augmentation-substitutive integration for effective service delivery

Analysis of the literature revealed that substantial number of works explored the use of the service robot in a combined substitutive and augmentative context (39% of articles). Substitutive contexts occur where the role of technology is to replace the human FLE, whereas augmentative contexts concerns technology assisting and complementing human FLEs in service delivery (Lariviere *et al.*, 2017). Instead, most literature involved a blend of both augmentative and substitutive service delivery. Despite clear conceptual differentiation between modes of service robot integration with FLEs in seminal works (substitution and augmentation (Larivière *et al.*, 2017), real world implementations are more nuanced due to feasibility issues). This lack of mode differentiation provides support for Ivanov (2020) in that *tasks* can be substituted, but cannot necessarily substitute the "bundles" of tasks that make up a *job*. Despite the eagerness of some service sectors to introduce service robots to innovate, current levels of feasibility remain low. Service robots providing full substitution for jobs, without human intervention, should be regarded as a long-term goal. This suggests organisations must continue to substantially rely on FLEs when implementing supposedly substitutive service robots, contributing to the increasingly uneven job distribution for employees.

The granular perspective of analysing the job performance of service robots permits a more nuanced understanding of how service robots are implemented. It amplifies reality rooted in actual performance and removes conceptual desires fuelled by role theory. In light of the substantial use of a role theory perspective in past research (Čaić *et al.*, 2018; Huang and Rust, 2021; Lin *et al.*, 2021; Tuomi *et al.*, 2021; Wirtz *et al.*, 2018), the use of a job performance perspective enables more detailed insights than could be adequately facilitated by role theory.

When considering the usefulness of integrating service robots into service environments, the systematic literature reveals that this usefulness is dependent on the realisation of service robot capabilities and constraints in line with the demands of the service environment. Therefore service robot usefulness involves situations where service robot idealisation of

their performance matches the reality of the service environment. Unuseful service robots represent a misalignment between actual service robot job performance and the projected idealisation (similar to role) of unrealistic service robot performance in the service environment. This shortfall in service robot performance can result in service failures that require human intervention (Tuomi *et al.*, 2021) amongst ambiguous liability for the FLE (Grewal *et al.*, 2020; Meyer *et al.*, 2020). Thus, service robot usefulness or unusefulness is dependent on the presence of an expectation versus performance gap.

The Robotic-Human Service Trilemma Framework

Adopting a job performance perspective enabled this systematic review to identify that FLEs are substantially impacted by the introduction of service robots as they counterbalance the constraints of service robots with their transferable performance capabilities. Expanding upon this, it was found that service robots also impact human well-being within the human service triad through the Robotic-Human Service Trilemma, consisting of three core challenges for each dyadic human relationship within the service triad: intrusion, sideline and indifference. Thus, the presence of a challenge pertains to the interactions between two actors within the micro level of the service ecosystem (Finsterwalder and Kuppelwieser, 2020b). The human service triad's optimal state of well-being is a state of balanced centricity (Groven *et al.*, 2021), whereby all actors' well-being needs and interests are fulfilled simultaneously. Here, we suggest that within balanced centricity is a state of well-being in equilibrium between each dyadic human relationship. A challenge arises when a service robot interrupts a well-being state of equilibrium between two actors. This relates to Verleye *et al.*'s (2017) concept of network imbalance, which refers to a situation where the interests of at least one actor in a network are not secure. The trilemma occurs when all three challenges are present (intrusion, sideline and indifference); thus, there is a decrease in well-being at a network level in all dyadic relationships. This can result from the degree of the imbalances (moderated by accountability, communication, engagement and responsiveness (Verleye *et al.*, 2017)) not being addressed and spreading imbalanced well-being across the rest of the human service triad.

We provide an overview of the challenges in Table 4, which provides the affected actor relationship, a visualisation of the challenge, the challenge definition and prevalence within the body of literature. We present each challenge and associated well-being impacts for different actors. In this section, we describe the nature of each challenge and conclude with the introduction and visualisation of the Robotic-Human Service Trilemma Framework (Figure 3).

The Intrusion challenge. The need for FLEs to counterbalance constraints and provide transferable task performance, and the inseparability of integral social-emotional tasks is represented by the Intrusion challenge. A service robot can cause an Intrusion challenge on actor well-being when introduced to the customer-FLE relationship due to the interrupted dyadic human connection akin to standard frontline service delivery. We define an Intrusion challenge as one where the long-standing human connection within the customer-FLE relationship has been altered, thereby impacting the state of social well-being equilibrium for both the customer and FLE. There is an additional well-being impact for the FLE as frontline careers often have a significant social dimension, also impacting purpose well-being for the FLE. An example is the service robot reducing the level of human interaction between a customer and FLE (Reis *et al.*, 2020), or the FLE being liable for the service failure of service robots (Grewal *et al.*, 2020; Meyer *et al.*, 2020), thus hindering their relationship with the customer due to the robot's failings (Table 4).

Analyses revealed that an Intrusion challenge was present in 38% of articles exploring well-being within the human service triad (see Table 4). Twenty percent of all articles

explored the well-being impact between the customer and service robot (33 empirical and 13 conceptual), 6% of all articles explored the well-being impact between the service robot and the FLE (11 empirical, 4 conceptual) and 11% of all articles explored the well-being impact between the customer and FLE as a result of an introduced service robot (15 empirical and 10 conceptual). There has been strong focus on customer reactions to service robots, but limited works as to how FLEs are impacted by service robots despite their substantial involvement in the service environment. Forty percent of articles explored service robot scenarios in FLE augmentation roles, 34% in frontline substitution, with 26% of articles exploring a mixed augmentation and substitution role for FLEs.

Indeed, the literature revealed that a service robot can create an Intrusion challenge by impacting both customer and FLE social well-being. There is an impact on social well-being for both the FLE and customer, but also an intertwined social and purpose well-being impact for the FLE. Social well-being for the FLE is directly impacted through the ambiguous liability of the service robot upon service failure (Leo and Huh, 2020; Simon *et al.*, 2020). Whilst service robots are, by definition, autonomous, upon service failure they are unable to be held accountable for poor performance. Instead, blame is attributed by the customer to the FLE for the inability to perform the service (Meyer *et al.*, 2020), jeopardising the withstanding relationship between the customer and the FLE. Pertinent to some frontline careers, is the motivation of interacting with customers and developing meaningful connections. This intertwined nature of purpose and social well-being for FLEs is reflective of the role personal values take in the development of customer-oriented behaviours. As service robots can reduce the frequency of customer to FLE interactions as well as jeopardise them upon service failure, this intertwined social and purpose well-being pertinent to the career choice of some FLEs is impacted. Instead, FLEs can experience negative well-being impacts (Table 4). Whilst extant research has explored the perceptions of FLEs due to the introduction of service robots, inclusive of role incongruence, degradation and tension (Meyer *et al.*, 2020), we suggest that such perceptions and reactions are due to a deeper career-based value set for the FLE that is the driver for these reactions.

The Sideline challenge. The reality of service robots requiring blended augmentative-substitutive integration for effective service delivery is represented by the Sideline challenge. A service robot can create a Sideline challenge for the relationship between the FLE and managerial employee relationship due to the altered organisational dynamic and value exchange. We define a Sideline challenge as one where the longstanding exchange of job security, status, sense of value and valued skills is disrupted between the FLE and managerial employees, impacting the purpose and financial of well-being exchanged within this dyadic relationship. With service robots introduced by the manager, FLEs' purpose and financial well-being is impacted as they have been "benched" whilst a more economically viable employee (service robot) is explored. An example of impacted FLE well-being is having to brace organisational shifts in culture and recruitment criteria (Chi *et al.*, 2020; Xu *et al.*, 2020). These organisational shifts tend to occur when service robot capabilities are applied in a substitutive (as opposed to augmentative) manner, sometimes unintentionally devaluing once desirable employee capabilities. An example of impacted managerial well-being is the financial investment to prepare the workforce for working alongside service robots (Table 4).

Analyses revealed that 23% of articles exploring well-being within the human service triad explored a Sideline challenge (Table 4). Six percent of all articles explored the well-being impact between the service robot and FLE (11 empirical, 4 conceptual), 8% of articles explored the well-being impact between the FLE and managerial employee (10 empirical, 8 conceptual) and 9% explored the well-being impact between the service robot and managerial employee (17 empirical, 4 conceptual). Despite the substantial involvement of FLEs in the service environment, investigation for well-being of FLEs continues to be disparate. The far majority of articles (60%) utilised a combined augmentation and substitutive role, with very

Table 4. Overview of challenges within the human service triad and well-being effects

Challenge	Relationship	Visualisation of dilemma	Definition of dilemma	Prevalence in literature (articles)	Actor well-being dimension	Description
Intrusion	Customer and Frontline Employee		A dilemma whereby social and purpose well-being is impacted through the reduction of valued scripted human interaction in the frontline service environment	*Relationships* • ·Customer to service robot: 19% • ·Service robot to frontline employee: 6% • ·Customer to frontline employee: 11% *Role implementations* • ·Substitution: 34% of Intrusion articles • ·Mixed: 26% of Intrusion articles • ·Augmentation: 40% of Intrusion articles	*Customer* *Social*	• ·Innate need for human interaction • ·Reduced customer-FLE service dynamic
					Frontline employee *Social*	• ·FLEs feel the need to be superior to service robots in front of customer • ·FLEs get the blame of robot service failure • ·Fear of degradation in front of customer
					Purpose	• ·Impacts task coordination • ·Disrupts FLE processes • ·Challenges self-concept • ·FLE perceived loss of autonomy • ·Feel like SR devalue their humanness

(*continued*)

Table 4.

Challenge	Relationship	Visualisation of dilemma	Definition of dilemma	Prevalence in literature (articles)	Actor well-being dimension	Description
Sideline	Frontline Employee and Managerial employee		A dilemma whereby purpose and financial well-being is impacted via the devaluation of human capital in the frontline service environment	*Relationships* • ·Frontline employee to service robot: 6% • ·Frontline employee to managerial employee: 8% • ·Service robot to managerial employee: 9% *Role implementations* • ·Substitution: 32% of Sideline articles • ·Mixed: 60% of Sideline articles • ·Augmentation: 8% of Sideline articles	*Frontline employee* *Purpose*	• ·Feelings of loss of status within organisation • ·Reimagined criteria for human recruitment • ·Organisational cultural changes • ·Upskilling required to remain relevant • ·Transformation of previous role
					Financial	• ·Human capital is economically undesirable for managerial employees (long term) • ·Stress over potential job redundancy • ·Stress over job security
					Managerial employee *Financial*	• ·Need for training to prepare for service robots • ·Need for upskilling of current workforce • ·High investment

(*continued*)

Table 4.

Challenge	Relationship	Visualisation of dilemma	Definition of dilemma	Prevalence in literature (articles)	Actor well-being dimension	Description
Indifference	Managerial employee and Customer		A dilemma whereby community well-being is impacted as the economic value proposition of a service robot supersedes the desire for meaningful engagement in the frontline service environment	*Relationships* • ·Customer to managerial employee: 11% • ·Service robot to managerial employee: 9% • ·Service robot to customer: 19% *Role implementations* • ·Substitution: 33% of Indifference articles • ·Mixed: 63% of Indifference articles • ·Augmentation: 4% of Indifference articles	*Managerial employee Community* *Customer Community*	• ·Feels economic value proposition for hiring service robots, not employees • ·Acceptance depends on customer needs being met • ·Potential for reduction in overall service quality • ·Expecting elevated service if with service robot • ·Friction as to what constitutes the "right" experience for service robots • ·Preference to interact with an employee • ·Elicits compensatory responses due to decreased human interaction

Source(s): Table by authors

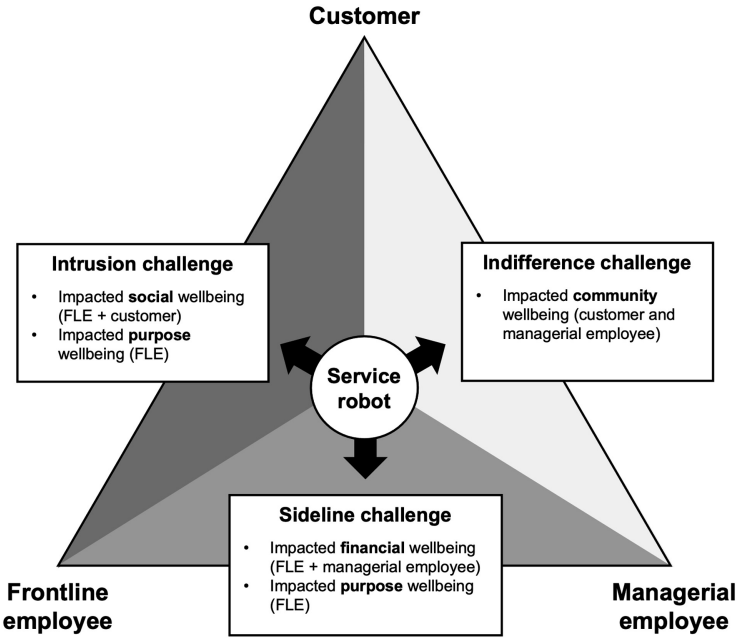

Figure 3.
The Robotic-Human Service Trilemma

Source(s): Figure by authors

few implemented in a purely augmentative role. This reveals that at a data collection level, it is likely not feasible to implement robots purely to replace the FLE, but instead requires substantial monitoring or involvement by the FLE.

Overall, a service robot can bring about a Sideline challenge to well-being by impacting the traditional purpose and financial well-being organisations provide for FLEs, yet only impacting the financial well-being of the managerial employee due to training and investment costs (Table 4). Purpose well-being for the FLE can be associated with the employee value proposition an organisation provides, inclusive of development, social and economic value. Through the Sideline challenge, pre-existing employee value propositions are challenged (Lu *et al.*, 2020; Xu *et al.*, 2020), resulting in impacted purpose well-being for the FLE. The Sideline challenge from service robots makes FLEs experience perceived loss of status (Meyer *et al.*, 2020; Xu *et al.*, 2020) and changes in company culture amongst (Chi *et al.*, 2020; Xu *et al.*, 2020) other negative well-being impacts (Table 4). The traditional financial well-being exchange between the FLEs and managerial employee is also challenged by this sideline impact, as service robots present an economically desirable value proposition for the organisation that is difficult for human capital to compete with (Qiu *et al.*, 2020; Reis *et al.*, 2020; Xu *et al.*, 2020). Our findings suggest that the impact of service robots is greater than one event of negative financial well-being (redundancy or job loss) or mere agitation when working with service robots, but impacts the FLE's present purpose well-being due to ongoing organisational changes.

The Indifference challenge. The inseparability of integral social-emotional tasks from service delivery is represented by the Indifference challenge, a challenge in well-being for the customer and managerial employee. We define the Indifference challenge as a situation where the state of balanced community well-being between the customer and managerial employee is altered by the removal of human interaction. An Indifference challenge occurs when the customer-managerial employee relationship is rendered transactional and at-arms'-length

due to lack of human engagement with the organisation, thereby impacting community well-being of the customer. This results in a "passing by" interaction between the customer and managerial employee and a sense of "indifference", as the relationship is merely based on economic value. An example of this is when the managerial employee implements service robots for economic benefit (Qiu *et al.*, 2020), which is perceived by the customer as transactional.

Analyses revealed that 39% of all articles that explored well-being within the human service triad explored an Indifference challenge (Table 4). Eleven percent of all articles discussed the well-being impact of service robot introduction on the customer and managerial employee (20 empirical, 6 conceptual), 9% of all articles explored the well-being impact of service robot introduction on the managerial employee (17 empirical, 4 conceptual) and 19% explored the well-being impact of service robot introduction on the customer (33 empirical and 13 conceptual). This reveals that there is bias in the service robotic field to focus on the well-being of customers and not the well-being impact on the managerial employee as the latter is the actor purposely introducing the service robot.

A service robot can create an Indifference challenge for well-being by impacting the community well-being of both the customer and managerial employee. Community well-being for the managerial employee relates to their engagement with their customer base. Through the Indifference impact, the nature of the relationship turns from reciprocal to transactional and at-arms-length (Gursoy *et al.*, 2019; Seyitoğlu and Ivanov, 2020). The customer is aware of the economic value proposition that comes with introducing service robots for the managerial employee, which changes their view of the firm and their subsequent approach. Customer acceptance of service robots is dependent on their service needs from the organisation, with an elevated expectation of the service due to the introduction of service robots (Yoganathan *et al.*, 2021) (Table 4).

Proposing a framework for the Robotic-Human Service Trilemma. The Robotic-Human Service Trilemma combines the three core challenges of well-being experienced by the three actors in the human service triad (customer, managerial employee, FLE) when service robots are present: intrusion, sideline and indifference (See Figure 3). This framework provides much needed understanding for the specific and collective well-being impacts for actors within the human service triad from a job performance, rather than role theory, perspective. This approach leverages the realistic capabilities and constraints of service robots for implementation, rather than utilising an approach based on the desirability of projected service environment integration. These challenges reflect the interconnected and competing well-being states of equilibrium of customers, FLEs and the managerial employee, when a service robot is introduced to the service trilemma. For instance, due to the introduced service robot, the FLE experiences impacted social and purpose well-being with the customer, but also impacted financial and purpose well-being with the managerial employee. Therefore, this substantial impacted well-being experienced by the FLE off-balances the well-being centricity of the network, as it interacts with other actors within the human service triad.

Discussion

The purpose of this research was to propose the framework of the Robotic-Human Service Trilemma and offer a research agenda for investigating the unintended challenges to human well-being within the human service triad. The first research question of *how are capabilities and constraints in job performance distributed within the human service triad with a service robot?,* was addressed by the finding that the adaptive nature of FLEs is required to counterbalance the constraints in job performance of service robots, which leads to an unbalanced distribution of job performance overall. The second research question – *how is well-being for each actor in the human service triad (FLE, managerial employee and customer)*

affected when service robots are present in the service environment? – was addressed by the Robotic-Human Service Trilemma, whereby each actor experiences a well-being challenge (intrusion, sideline and indifference) due to the introduction of a service robot. The systematic literature review revealed the Robotic-Human Service Trilemma in which between-actor relationships can experience intrusion, sideline and indifference challenges. This review suggests that FLEs are required to counterbalance the constraints of service robots, leading to an uneven well-being burden within the human service triad. Addressing the tensions underpinning the unbalanced nature of FLE job performance and well-being can aid in bringing balanced centricity to the collective service trilemma (Groven *et al.*, 2021).

Theoretical contributions

This research offers four theoretical contributions to the service literature on service robots as well as service literature on well-being. The first contribution is the *service robot-FLE task paradox which reflects the additional task burden on FLEs when service robots are present*. The lack of adaptability of a service robot, such as a drink-pouring robot being physically and cognitively unable to clean up a spilled drink, requires FLEs to engage in additional work to compensate the limitations of the robot. If the FLE does not intervene then the service failure perpetuates to affect the customer, resulting in physically hazardous (slipping on spilled beverage) or negative brand perception (e.g. poor service environment hygiene standards) consequences. So in many ways there is a paradox created; the service robot is deployed in an organisation to relieve the task burden on FLEs (Paluch and Wirtz, 2020) and/or to save time/money for the organisation; however, the very presence of this robot occasionally increases the task burden which in turn increases the cost for the organisation. The findings reveal that the "human difference" in tangible service delivery is the FLE's ability to transfer task performance knowledge from different environments and life experiences to mitigate service failures in their current service environment, as also demonstrated by a recent study on FLE interaction quality (Odekerken-Schröder *et al.*, 2022). This highlights the service robot's main constraint wherein the service robot is incapable of operating outside its purposeful design within the service environment, both physically (in terms of its physical design) and cognitively (problem solving limited to the task at hand). Whilst previous literature has identified constraints of service robots to include interrupted service delivery, limited skill sets and out-of-the-box thinking (Reis *et al.*, 2020), our research identifies the overarching constraint wherein service robots are unable to transfer capabilities from other contexts to mitigate shortcomings, also known as lack of adaptability. This finding is new in the service robot literature. This finding contrasts with previous research that defines service robots as an "adaptable interface" (Wirtz *et al.*, 2018). We find that this adaptability dimension is largely facilitated by the FLE creating a task paradox.

The second contribution is the *over-inflation of social-emotional capabilities of service robots*. We found that estimations of the capabilities of social-emotional service robots are overinflated and require FLEs to compensate for service robot shortfall to still ensure a successful service delivery. This contrasts with many conceptual works wherein the combination of lack of technical understanding of service robot limitations and optimistic service role projections (Wirtz *et al.*, 2018) indicates a lack of feasible understanding of realistic social-emotional service robot implementation. Whilst this optimism can be linked to a lack of technical understanding in these transdisciplinary fields, this over-inflation of social-emotional capabilities of service robots can be linked to the technology effect bias. The technology effect bias is where constant exposure to advances in technology can result in implicit associations between technology and successful outcomes. These associations condition decision makers to be overly optimistic of technologies where they expect consistently successful outcomes (Clark *et al.*, 2016). As technological successes often produce

dramatic and memorable results (high saliency) and technological failures do not change the status quo of the experience (low saliency), we maintain an implicit association between technology and success (Clark *et al.*, 2016; Greenwalk *et al.*, 1998). This research suggests that the technology effect bias is more evident regarding the social-emotional capabilities of service robots.

The third contribution is the *need for blended augmentation-substitutive integration of service robots*. We found that service robots need to be integrated in a blended augmentation-substitutive form successful for service delivery, whereby service robots can substitute the human performance of certain tasks (e.g. pouring drinks, or waiting tables), but not the human role altogether that encompasses all tasks (being a waiter). Therefore, whilst some tasks are substituted, the role of the FLE is augmented to include service robot support. This nuances extant literature where service robot integration is not black and white by taking a job performance, rather than role, approach to the literature. Whilst it has been seminally suggested that robots can only be introduced in an augmented or substituted role (Larivière *et al.*, 2017), we found that tasks, not roles, can be augmented or substituted. A similar notion has been noted in the context of medical robots, where Yang *et al.* (2017) propose different levels of robot autonomy: no autonomy, robot assistance, task autonomy, conditional autonomy, high autonomy and full automation. Their findings suggest a current transition in implementation of service robots from robot assistance (where the FLE maintains continuous control of the system whilst the robot provides certain assistance) to task autonomy (where the FLE maintains discrete control of the system and the robot can perform certain operator-initiated tasks automatically) (Yang *et al.*, 2017).

The fourth and final contribution is to the well-being literature. The data supporting the Robotic-Human Service Trilemma reveal that within each relationship between human actors (the human service triad of customer, FLE and managerial employee) *states of well-being equilibrium exist and these states can be disrupted by service robots*. Well-being states of equilibrium occur when there is balanced well-being, such as balanced centricity, within the dyadic relationships of the service triad. The intrusion, sideline and indifference well-being challenges presented by service robots appear to have an off-balancing effect to these states of well-being equilibrium causing well-being imbalance. Previous well-being research acknowledges that individual and collective well-being is interactive and that the impact of one level of well-being can impact the other (Giraldo *et al.*, 2020). Whilst Mende and van Doorn (2015) found that co-production activities between employees and customers in financial services improves the objective and subjective well-being of customers, our research found that co-production of services with robots can have negative impacts for both customers and employees. Finsterwalder and Kuppelwieser (2020b) suggested that services may generate spillover effects in well-being, sometimes resulting in the misuse of resources (co-destruction) to improvise the well-being of one actor at the detriment of another actor. Our research expands this conceptual understanding by finding that service robots can disrupt a state of homeostasis (state of stable equilibrium between interdependent elements) (and not exchange) of dyadic well-being within the human service triad. This trilemma is new to both the service and well-being literature and is very relevant to our understanding of how the actors within the human service triad interact. Overall, this research highlights that service robots can negatively impact actor well-being, especially actors who derive multiple forms of well-being from their relationships in the human service triad.

Future research agenda

This review offers key insights and contributions into how FLEs support and manage robot integration and how three well-being challenges experienced by the triad are encapsulated by the Robotic-Human Service Trilemma. Nevertheless, analyses have revealed several

important gaps for future researchers seeking to understand the integration of service robots into the service environment and service robot and FLE job performance capabilities and constraints. Concerning the exploration of human well-being in the context of service robots, whilst there are continued calls for research to understand ethical dimensions of service robot design (design for ethics, use of ethics and ethical service encounters, protection of customer and employee welfare and addressing diverse customer needs) (Lu *et al.*, 2020), the body of literature at large fails to recognise the value in adopting a well-being approach in future research. Whilst Henkel *et al.* (2020) does acknowledge the need to explore well-being trade-offs, this paper expands beyond their call for research. We adopt a balanced centricity perspective via the Robotic-Human Service Trilemma and focus on the states of well-being equilibrium within the dyadic human relationships in the service triad. These insights have directly informed a future research agenda to aid service robot research in the services marketing field (Table 5).

At a general level, there is opportunity to understand how service robots might support/improve human actor well-being, rather than replace social capital with technology (that service robots facilitate). This can include exploring strategies to enable and constrain well-being across the human service triad. Considering the disruption service robots bring to actors within the service environment (Buhalis *et al.*, 2019), there is opportunity to explore how surrounding environmental factors may contribute to the improvement or detriment of actor well-being, including the importance of customer-to-customer interaction, physical design choices (e.g. service environment layout) and different service industries.

The four ways in which FLEs support and manage service robot integration directly informed the creation of the three challenges of the Robotic-Human Service Trilemma. For the *Intrusion* challenge, existing research has largely focussed on the customer and their perceptions and reactions towards an introduced service robot (Choi *et al.*, 2021). However, considering the impact on social well-being for the FLE and customer, there is value in understanding determinants that may result in this social well-being challenge. Future research of the customer might investigate the difference in need for human interaction across various service environments, both within the hospitality and tourism industry and in more diverse service environments such as healthcare. Considering the intertwined nature of social and purpose well-being for the FLE, there is value in exploring how service robots trigger this well-being relationship effect and to also investigate the antecedents in certain frontline jobs that would lead to this dual well-being impact.

For the *Sideline* challenge, there is value in exploring the nature of the long-standing value exchange between the FLE and the managerial employee. Financially, this may include understanding what tasks (not jobs) would experience greatest economic benefit for service robot augmentation versus substitution. At a purpose level, future research may seek to understand how the introduction of service robots affects the culture of the organisation for FLEs and understand how service robots may challenge a FLE's status within their organisation. Research has shown that individuals are willing to define their interests and goals as being similar or the same to their organisation, conditional that they gain resources and status from the organisation (Jarvenpaa and Staples, 2001). Thus, it is valuable to understand which resources and statuses should be protected to ensure FLE commitment to service robot implementation.

For the *Indifference* challenge, existing research tends to focus on the customer's reactions to service robots. Considering the community impact on both the customer and the managerial employee, there is value in understanding what the customer's needs require to be met to inform their acceptance of service robot engagement. Previous research has identified that customers interact with service robots predominantly through their performed functions (e.g. room service and baggage handling) (Fuentes-Moraleda *et al.*, 2020). However, there is room to explore beyond such a utilitarian viewpoint to consider the social-emotional needs of

Table 5. Future research agenda

Challenge	Relationship	What we know	Future research questions
Intrusion	Customer, FLE, and service robot	(1) Longstanding human connection within the customer-FLE relationship is altered due to service robots, thus disrupts the state of social well-being equilibrium (2) Interconnected social and purpose FLE well-being is disrupted by service robot job performance, altering the state of purpose well-being equilibrium (3) FLEs have to counterbalance the constraints of service robot job performance	(1) *Sources of social well-being between customer and FLE* • How does a customer's need for human interaction from a frontline employee relate to high touch and low touch service environments when interacting with a service robot? • How does a customer's need for human interaction from a frontline employee change across service environments? • What types of FLE task and contextual job performance are related to FLE social well-being within service delivery? • What forms of FLE task and contextual performance are related to customer social well-being? • What task and contextual performance of service robots disrupts customer social well-being? • What task and contextual performance of service robots disrupts FLE social well-being? (2) *Job performance and FLE purpose well-being* • How is power balanced in service delivery between the frontline employee and service robot when serving a customer? • How should service scripts be designed to optimise frontline employee recovery for the customer due to service robot failure? • How do service robots challenge the authority of frontline employees in front of the customer in their service delivery? • What are the antecedents of impacted purpose well-being from social interaction with a customer when performing service delivery with a service robot? (3) *Realising effective distribution of job performance between service robot and frontline employee* • How are service robot constraints in task performance mitigated by the frontline employee? • How are service robot constraints in contextual performance mitigated by the frontline employee? • How does a customer's perception of the frontline employee change after a service robotic failure? • What is the customer's desired distribution of task performance between the frontline employee and service robot? • What is the customer's desired distribution of contextual performance between the frontline employee and service robot?

(*continued*)

Table 5.

Challenge	Relationship	What we know	Future research questions
Sideline	FLE, managerial employee, service robot	(1) The longstanding exchange of financial well-being is imbalance as service robots challenge the longstanding economic exchange between the FLE and managerial employee (2) FLE purpose well-being equilibrium is imbalanced as service robots disrupt the social-cultural organisational environment	(1) *Financial well-being equilibrium exchange between FLE and managerial employee* • What FLE tasks would experience greatest economic benefit for service robot augmentation versus substitution with frontline employees? • How might workplace human resources departments, policies and procedures be restructured to best support service robot implementation and positive well-being outcomes for frontline employees? • What stage of organisational maturity would it be economically beneficial to implement service robots with frontline employees? • How does increased liability for the employee impact the organisation upon service robot failure? (2) *Sources of purpose well-being for FLE* • How do service robots challenge frontline employee perceptions of the managerial employees? • How must frontline employees upskill to maintain relevance for organisations when in competition with a service robot? • How is the sideline dilemma experienced differently for service employees whose roles are augmented versus substituted by the organisation? • How do service robots challenge the traditional relationship between frontline employees and the managerial employee? • How do service robots challenge frontline employees' status within their organisation? • How does organisational culture change for the frontline employee due to the introduction of service robots? • What are the ethical principles that can be used to guide robot development and implementation in the workplace to ameliorate challenges for frontline employees? • How might frontline employees experience liability from a managerial employee due to a service robot failure in service delivery?

(*continued*)

Table 5.

Challenge	Relationship	What we know	Future research questions
Indifference	Customer, managerial employee, and service robot	(1) The state of community well-being equilibrium is altered between the customer and managerial employee due to the removal of human interaction by the service robot	(1) *Sources of community well-being within human interaction* • What are the qualities of the managerial employee's service environment when service robots are/are not appropriate for customers? • What is the importance of human representation of the organisation for the customer when interacting with a service robot? • What are the long-term impacts of unchecked challenges on managerial employee and customer well-being due to service robots? • How should service robots be deployed in luxury versus essential organisational service environments for customer acceptance? • How does a customer's brand perception of an organisation change after introducing service robots to the frontline environment?
Well-being Trilemma	Customer, FLE, managerial employee, service robot	(1) Service robots impact human well-being within the service triad through three core challenges for each dyadic human relationship	(1) *Interactions of human well-being within the service triad* • Which elements of well-being are more likely to be influenced by the trilemma • Is there a well-being hierarchy with the human service triad? • Does balancing the trilemma vary across different service industries? • What service management strategies and practices enable and constrain well-being across the service triad when service robots are deployed? • How might customers experiencing vulnerability respond to or create strategies for well-being to address the trilemma? • Which conditions might a challenge lead to positive well-being impacts for service actors, or which other elements of the servicescape are vulnerable to experience Intrusion upon service robot introduction (i.e, C2C interactions, decreased well-being through aesthetic changes, etc.)?

Source(s): Table by authors

the customer across different service contexts. This includes understanding what constitutes the "right" experience wherein customers deem service robots appropriate in application. For the organisation, there is value in understanding the flow-on customer behaviours that come with decreased firm interaction (e.g. compensatory customer eating).

There is an opportunity to explore balanced centricity for the overall Robotic-Human Service Trilemma. This includes understanding the effective practices organisations employ that balance the trilemma, as well as understanding the factors of achieving positive well-being for all three actors. Previous research has identified that tensions and alignment in actors' psychological needs contributes to multi-actor network well-being (Groven *et al.*, 2021). Thus, there is merit in understanding how the psychological needs of actors relate to the well-being of other actors, as well as the collective human service triad.

Recommendations for service managers

This review introduces the Robotic-Human Service Trilemma framework and reveals that whilst all actors experience well-being impacts, the FLE experiences more diverse impacts due to their deep customer and organisational relationships. Therefore, we present three recommendations for service managers in line with each challenge within the Robotic-Human Service Trilemma.

The *Intrusion* challenge indicates that service robot introduction leads to impacts on customer social well-being and intertwined social and purpose well-being for FLEs. In the case of the Henn-na Hotel, service robot failure required immense human intervention to resolve customer friction (Shead, 2019). The subsequently needed complaint mediation procedures required skills only human employees possess. Thus it is critical that FLEs be supported to effectively address service failures to maintain their interconnected social and purpose well-being via service scripts. Service scripts are organisationally supplied behavioural and verbal prescriptions for employees that aim to increase the probability that desirable behaviours and outputs are achieved (Nguyen *et al.*, 2014). Recovery service scripts such as that based on satire (whereby the service robot failure may be comically pitied and humanised) curated for the robot context, may enable FLEs to move the locus of responsibility away from the FLE (or even customer) to the service robot, mitigating negative well-being effects.

For the *Sideline* challenge, FLE purpose and financial well-being are impacted alongside the financial well-being of the managerial employee. As investment in robotic technology is the sole impact on managerial employee financial well-being, we suggest that practitioners increase their prioritisation of FLE well-being to mitigate well-being effects from organisational shifts. Looking to practice, the need to maintain human connection within FLE's day to day job is particularly evident. Fabio the robot was placed as a shopping assistant in a Scottish grocery store in 2017 (Lu *et al.*, 2020). Whilst Fabio was incapable of sensing social cues, it was ultimately relegated to more menial tasks as customers "love personal interaction and speaking to [the human] staff is a big part of that" (Knapton, 2018) and vice versa. Thus, practitioners may position FLEs as service delivery experts and assign them robot "interns" or "assistants" for training/monitoring (Letheren *et al.*, 2019), empowering their expertise and leveraging firm knowledge. By enabling FLEs as the trusted custodians of the service robot in an "intern" or "assistant" manner, the managerial employee's substantial monetary investment of the service robot is optimised and secured. This tactic also enhances FLE purpose well-being, whilst ensuring financial well-being is not impacted.

The *Indifference* challenge leads to customer and managerial employee community well-being impacts, with both the relationship and well-being damaged if connection is not fostered. Thus, service robots should be introduced as "complements" to pre-established

human interaction, until increased levels of service robot interaction (replacing FLEs) are deemed appropriate. This approach was successfully implemented at Lowe's (American chain of home improvement stores) in 2016, where the roaming "LoweBot" allows shoppers to search for items, be guided to their requested items and answer simple customer questions. The goal of the LoweBot was to "augment the work of store associates and free them up to work on advising customers on products and delivering a more personalised service overall" (Taylor, 2016). In this case, Lowe's understood the necessary and desired level of human interaction at different points of their customers' shopping journey for the LoweBot to be valuable. Leveraging this, practitioners should seek to understand if specific levels of human interaction are associated with their brand (luxury hotel versus fast food chain) and use this insight to inform service quality-led implementation (Choi *et al.*, 2020). By understanding the desired level of human interaction with their brand, alignment as to what constitutes as the "right" service robot experience for the customer can be achieved.

Limitations

Despite our systematic approach, this literature review has a number of limitations. First, the article search process was conducted in July 2021 and accessed articles from January 2010 to July 2021. This search process was conducted again in October 2022 to capture additional articles published since the first search. Due to the fast-paced nature and rapid technological development in the service robotics field, there are many new studies and insights. Hence, we expect many more insights in a short period of time. Thus, there is value in frequent systematic reviews. Second, despite the rigorous methodology applied, it is possible that some articles were not included due to their use of terminology not commonly used in the literature and hence outside of the scope of this review (e.g. "embodied automated system"). Third, the insights are based on research that has already occurred (descriptive) and reflects the biases and interests of the field – including a focus on the hedonically-oriented service environments that were early adopters of service robots – such as hospitality and tourism. Given the highly conceptual nature of the field with simulations and laboratory research rather than field or observational studies, the analysis can only reflect research that *is* rather than research that *should* be. Future research should adopt methods that capture the effects of robots "in the wild" (i.e. service robots deployed in live service environments as opposed to controlled lab settings) to capture the complexity of real life as well as examine a wider range of service industries and contexts.

Conclusion

The topic of service robots continues to attract substantial and accelerating interest from scholars across disciplines, as evidenced by the number and diversity of publications in recent years, with many of these studies reflecting the complex challenges experienced by actors within the human service triad as robots are introduced to the service environment. The aims of this systematic literature review were to synthesise this extensive and dynamic body of literature and to identify key areas for future research. Using a systematic approach, the review analysed a total of 82 articles published between 2010 and 2022, addressing issues that include the capabilities, constraints and well-being effects of service robots within the human service triad. We introduced the Robotic-Human Service Trilemma and advanced an aligned research agenda to address issues within the human service triad and to propose how existing challenges and opportunities can be best managed. We hope that this work not only enhances theoretical understanding of service robots and their impacts on services and service actors, but also provides guidance for researchers and practitioners alike in examining and developing this nascent and promising field within services.

References

Belanche, D., Casaló, L.V., Flavián, C. and Schepers, J. (2020a), "Robots or frontline employees? Exploring customers' attributions of responsibility and stability after service failure or success", *Journal of Service Management*, Vol. 31 No. 2, pp. 267-289, doi: 10.1108/JOSM-05-2019-0156.

Belanche, D., Casaló, L.V., Flavián, C. and Schepers, J. (2020b), "Service robot implementation: a theoretical framework and research agenda", *Service Industries Journal*, Vol. 40 Nos 3-4, pp. 203-225, doi: 10.1080/02642069.2019.1672666.

Bolton, R.N., McColl-Kennedy, J.R., Cheung, L., Gallan, A., Orsingher, C., Witell, L. and Zaki, M. (2018), "Customer experience challenges: bringing together digital, physical and social realms", *Journal of Service Management*, Vol. 29 No. 5, pp. 776-808, doi: 10.1108/JOSM-04-2018-0113.

Borman, W.C. and Motowidlo, S.J. (1997), "Task performance and contextual performance: the meaning for personnel selection research", *Human Performance*, Vol. 10 No. 2, pp. 99-109, doi: 10.1207/s15327043hup1002_3.

Buhalis, D., Harwood, T., Bogicevic, V., Viglia, G., Beldona, S. and Hofacker, C. (2019), "Technological disruptions in services: lessons from tourism and hospitality", *Journal of Service Management*, Vol. 30 No. 4, pp. 484-506, doi: 10.1108/JOSM-12-2018-0398.

Čaić, M., Odekerken-Schröder, G. and Mahr, D. (2018), "Service robots: value co-creation and co-destruction in elderly care networks", *Journal of Service Management*, Vol. 29 No. 2, pp. 178-205, doi: 10.1108/JOSM-07-2017-0179.

Chen, T., Dodds, S., Finsterwalder, J., Witell, L., Cheung, L., Falter, M., Garry, T., Snyder, H. and McColl-Kennedy, J.R. (2021), "Dynamics of wellbeing co-creation: a psychological ownership perspective", *Journal of Service Management*, Vol. 32 No. 3, pp. 383-406, doi: 10.1108/JOSM-09-2019-0297.

Chi, O.H., Denton, G. and Gursoy, D. (2020), "Artificially intelligent device use in service delivery: a systematic review, synthesis, and research agenda", *Journal of Hospitality Marketing and Management*, Vol. 29 No. 7, pp. 757-786, doi: 10.1080/19368623.2020.1721394.

Choi, S., Liu, S.Q. and Mattila, A.S. (2019), "How may I help you?" Says a robot: examining language styles in the service encounter", *International Journal of Hospitality Management*, Vol. 82 No. 2019, pp. 32-38, doi: 10.1016/j.ijhm.2019.03.026.

Choi, Y., Choi, M., Oh, M. and Kim, S. (2020), "Service robots in hotels: understanding the service quality perceptions of human-robot interaction", *Journal of Hospitality Marketing and Management*, Vol. 29 No. 6, pp. 613-635, doi: 10.1080/19368623.2020.1703871.

Choi, S., Mattila, A.S. and Bolton, L.E. (2021), "To err is human(-oid): how do consumers react to robot service failure and recovery?", *Journal of Service Research*, Vol. 24 No. 3, pp. 354-371, doi: 10.1177/1094670520978798.

Chuah, S., Aw, E. and Yee, D. (2021a), "Unveiling the complexity of consumers' intention to use service robots: an fsQCA approach", *Computers in Human Behavior*, Vol. 123 No. 2021, 106870, doi: 10.1016/j.chb.2021.106870.

Chuah, S., Aw, E. and Cheng, C. (2021b), "A silver lining in the COVID-19 cloud: examining customers' value perceptions, willingness to use and pay more for robotic restaurants", *Journal of Hospitality Marketing and Management*, Vol. 31 No. 1, pp. 49-76, doi: 10.1080/19368623.2021.1926038.

Clark, B.B., Robert, C. and Hampton, S.A. (2016), "The technology effect: how perceptions of technology drive excessive optimism", *Journal of Business and Psychology*, Vol. 31 No. 2016, pp. 87-102, doi: 10.1007/s10869-015-9399-4.

CSIRO (2019), *The Energy Trilemma - What Matters the Most to Consumers?*, CSIRO, Canberra.

Diener, E., Suh, E.M., Lucas, R.E. and Smith, H.L. (1999), "Subjective well-being: three decades of progress", *Psychological Bulletin*, Vol. 125 No. 2, pp. 276-302, doi: 10.1037/0033-2909.125.2.276.

Dunoff, J.L. and Pollack, M.A. (2017), "The judicial trilemma", *The American Journal of International Law*, Vol. 111 No. 2, pp. 225-276, doi: 10.1017/ajil.2017.23.

Etemad-Sajadi, R. and Sturman, M.C. (2022), "How to increase the customer experience by the usage of Remote control robot Concierge Solutions", *International Journal of Social Robotics*, Vol. 14 No. 2022, pp. 429-440, doi: 10.1007/s12369-021-00800-x.

Finsterwalder, J. and Kuppelwieser, V.G. (2020a), "Intentionality and transformative services: wellbeing co-creation and spill-over effects", *Journal of Retailing and Consumer Services*, Vol. 52 No. 2020, 101922, doi: 10.1016/j.jretconser.2019.101922.

Finsterwalder, J. and Kuppelwieser, V.G. (2020b), "Equilibrating resources and challenges during crises: a framework for service ecosystem well-being", *Journal of Service Management*, Vol. 31 No. 6, pp. 1107-1129, doi: 10.1108/JOSM-06-2020-0201.

Fuentes-Moraleda, L., Díaz-Pérez, P., Orea-Giner, A., Muñoz- Mazón, A. and Villacé-Molinero, T. (2020), "Interaction between hotel service robots and humans: a hotel-specific Service Robot Acceptance Model (sRAM)", *Tourism Management Perspectives*, Vol. 26, 100751, doi: 10.1016/j.tmp.2020.100751.

Gallup (2008), "How does the gallup-sharecare well-being index work?", available at: https://www.gallup.com/175196/gallup-healthways-index-methodology.aspx (accessed 12 May 2021).

Garry, T. and Harwood, T. (2019), "Cyborgs as frontline service employees: a research agenda", *Journal of Service Theory and Practice*, Vol. 29 No. 4, pp. 415-437, doi: 10.1108/JSTP-11-2018-0241.

Giraldo, M., Garcia-Tello, L. and Rayburn, S.W. (2020), "Street vending: transformative entrepreneurship for individual and collective well-being", *Journal of Services Marketing*, Vol. 34 No. 6, pp. 757-768, doi: 10.1108/JSM-08-2019-0322.

Greenwalk, A.G., McGhee, D.E. and Schwartz, J.L.K. (1998), "Measuring individual differences in implicit cognition: the implicit association test", *Journal of Personality and Social Psychology*, Vol. 74 No. 6, pp. 1464-1480, doi: 10.1037/0022-3514.74.6.1464.

Grewal, D., Kroschke, M., Mende, M., Roggeveen, A.L. and Scott, M.L. (2020), "Frontline Cyborgs at your service: how human enhancement technologies affect customer experiences in retail, Sales, and service settings", *Journal of Interactive Marketing*, Vol. 51 No. 1, pp. 9-25, doi: 10.1016/j.intmar.2020.03.001.

Groven, F., Odekerken-Schröder, G., Zwakhalen, S. and Hamers, J. (2021), "Network well-being from a balanced centricity perspective", *Journal of Services Marketing*, Vol. 35 No. 9, pp. 1-14, doi: 10.1108/JSM-11-2020-0466.

Gursoy, D., Chi, O.H., Lu, L. and Nunkoo, R. (2019), "Consumers acceptance of artificially intelligent (AI) device use in service delivery", *International Journal of Information Management*, Vol. 49 No. 2019, pp. 157-169, doi: 10.1016/j.ijinfomgt.2019.03.008.

Heffron, R.J., McCauley, D. and Sovacool, B.K. (2015), "Resolving society's energy trilemma through the Energy Justice Metric", *Energy Policy*, Vol. 87 No. 2015, pp. 168-176, doi: 10.1016/j.enpol.2015.08.033.

Henkel, A.P., Čaić, M., Blaurock, M. and Okan, M. (2020), "Robotic transformative service research: deploying social robots for consumer well-being during COVID-19 and beyond", *Journal of Service Management*, Vol. 31 No. 6, pp. 1131-1148, doi: 10.1108/JOSM-05-2020-0145.

Hoang, C. and Tran, H.A. (2022), "Robot cleaners in tourism venues: the importance of robot-environment fit on consumer evaluation of venue cleanliness", *Tourism Management*, Vol. 93 December 2022, 104611, doi: 10.1016/j.tourman.2022.104611.

Holthöwer, J. and van Doorn, J. (2022), "Robots do not judge: service robots can alleviate embarrassment in service encounters", *Journal of the Academy of Marketing Science*. doi: 10.1007/s11747-022-00862-x.

Huang, M.H. and Rust, R.T. (2021), "Engaged to a robot? The role of AI in service", *Journal of Service Research*, Vol. 24 No. 1, pp. 30-41, doi: 10.1177/1094670520902266.

International Federation of Robotics (2021), "World robotics 2021 - service robots", International Federation of Robotics, report, Frankfurt, available at: https://ifr.org/ifr-press-releases/news/robot-sales-rise-again (accessed July 2021).

Ivanov, S. (2020), "The impact of automation on tourism and hospitality jobs", *Information Technology and Tourism*, Vol. 22 No. 2020, pp. 205-215, doi: 10.1007/s40558-020-00175-1.

Ivanov, S., Gretzel, U., Berezina, K., Sigala, M. and Webster, C. (2019), "Progress on robotics in hospitality and tourism: a review of the literature", *Journal of Hospitality and Tourism Technology*, Vol. 10 No. 4, pp. 489-521, doi: 10.1108/JHTT-08-2018-0087.

Jarvenpaa, S.L. and Staples, D.S. (2001), "Exploring perceptions of organizational ownership of information and expertise", *Journal of Management Information Systems*, Vol. 18 No. 1, pp. 151-183, doi: 10.1080/07421222.2001.11045673.

Knapton, S. (2018), "Fabio the robot sacked from supermarket after alarming customers", *The Telegraph*, 22 January, available at: https://www.telegraph.co.uk/science/2018/01/21/fabio-robot-sacked-supermarket-alarming-customers/ (accessed July 2021).

Kuppelwieser, V. and Finsterwalder, J. (2016), "Transformative service research and service dominant logic: quo Vaditis?", *Journal of Retailing and Consumer Services*, Vol. 28 No. 2016, pp. 91-98, doi: 10.1016/j.jretconser.2015.08.011.

Larivière, B., Bowen, D., Andreassen, T.W., Kunz, W., Sirianni, N.J., Voss, C., Wünderlich, N. and De Keyser, A. (2017), "'Service Encounter 2.0': an investigation into the roles of technology, employees and customers", *Journal of Business Research*, Vol. 79 No. 2017, pp. 238-246, doi: 10.1016/j.jbusres.2017.03.008.

Ledger (2021), "What is the blockchain trilemma?", Ledger Academy.

Leo, X. and Huh, Y.E. (2020), "Who gets the blame for service failures? Attribution of responsibility toward robot versus human service providers and service firms", *Computers in Human Behavior*, Vol. 113 No. 2020, 106520, doi: 10.1016/j.chb.2020.106520.

Leo, W., Laud, G. and Chou, C. (2019), "Service system well-being: conceptualising a holistic concept", *Journal of Service Management*, Vol. 30 No. 6, pp. 766-792, doi: 10.1108/JOSM-01-2019-0036.

Letheren, K., Russell-Bennett, R., Mulcahy, R.F. and McAndrew, R. (2019), "Rules of (household) engagement: technology as manager, assistant and intern", *European Journal of Marketing*, Vol. 53 No. 9, pp. 1934-1961, doi: 10.1108/EJM-10-2017-0759.

Lin, I.Y. and Mattila, A.S. (2021), "The value of service robots from the hotel Guest's perspective: a mixed-method approach", *International Journal of Hospitality Management*, Vol. 94 No. 2021, 102876, doi: 10.1016/j.ijhm.2021.102876.

Lu, V.N., Wirtz, J., Kunz, W.H., Paluch, S., Gruber, T., Martins, A. and Patterson, P.G. (2020), "Service robots, customers and service employees: what can we learn from the academic literature and where are the gaps?", *Journal of Service Theory and Practice*, Vol. 30 No. 3, pp. 361-391, doi: 10.1108/JSTP-04-2019-0088.

Mahr, D., Čaić, M. and Oderkerken-Schröder, G. (2019), "Value of social robots in services: social cognition perspective", *Journal of Services Marketing*, Vol. 33 No. 4, pp. 463-478, doi: 10.1108/JSM-02-2018-0080.

Marinova, D., de Ruyter, K., Huang, M.H., Meuter, M.L. and Challagalla, G. (2017), "Getting smart: learning from technology-empowered frontline interactions", *Journal of Service Research*, Vol. 20 No. 1, pp. 29-42, doi: 10.1177/1094670516679273.

Mende, M. and van Doorn, J. (2015), "Coproduction of transformative services as a pathway to improved consumer well-being: findings from a longitudinal study on financial counseling", *Journal of Service Research*, Vol. 18 No. 3, pp. 351-368, doi: 10.1177/1094670514559001.

Mende, M., Scott, M.L., van Doorn, J., Grewal, D. and Shanks, I. (2019), "Service robots rising: how humanoid robots influence service experiences and Elicit compensatory consumer responses", *Journal of Marketing Research*, Vol. 56 No. 4, pp. 535-556, doi: 10.1177/0022243718822827.

Meyer, P., Jonas, J.M. and Roth, A. (2020), "Frontline employees' acceptance of and resistance to service robots in stationary retail - an exploratory Interview study", *Journal of Service Management Research*, Vol. 4 No. 1, pp. 21-34, doi: 10.15358/2511-8676-2020-1-21.

Mingotto, E., Montaguti, F. and Tamma, M. (2021), "Challenges in re-designing operations and jobs to embody AI and robotics in services. Findings from a case in the hospitality industry", *Electronic Markets*, Vol. 31 No. 2021, pp. 493-510, doi: 10.1007/s12525-020-00439-y.

Musharraf, M. (2021), "What is the blockchain trilemma?", *Ledger Academy*, 15 November, available at: https://www.ledger.com/academy/what-is-the-blockchain-trilemma (accessed October 2023).

Nguyen, H., Groth, M., Walsh, G. and Hennig-Thurau, T. (2014), "The impact of service scripts on customer citizenship behavior and the moderating role of employee customer orientation", *Psychology and Marketing*, Vol. 31 No. 12, pp. 1096-1109, doi: 10.1002/mar.20756.

Obstfeld, M., Shambaugh, J.C. and Taylor, A.M. (2005), "The trilemma in history: tradeoffs among exchange rates, monetary policies, and capital mobility", *Review of Economics and Statistics*, Vol. 87 No. 3, pp. 423-438, doi: 10.1162/0034653054638300.

Odekerken-Schröder, G., Mele, C., Russo-Spena, T., Mahr, D. and Ruggiero, A. (2020), "Mitigating loneliness with companion robots in the COVID-19 pandemic and beyond: an integrative framework and research agenda", *Journal of Service Management*, Vol. 31 No. 6, pp. 1149-1162, doi: 10.1108/JOSM-05-2020-0148.

Odekerken-Schröder, G., Mennens, K., Steins, M. and Mahr, D. (2022), "The service triad: an empirical study of service robots, customers and frontline employees", *Journal of Service Management*, Vol. 33 No. 2, pp. 246-292, doi: 10.1108/josm-10-2020-0372.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S., Chou, R., Glanville, J., Grimshaw, J., Hróbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo-Wilson, E., McDonald, S., McGuiness, L., Stewart, L., Thomas, J., Tricco, A., Welch, V., Whiting, P. and Moher, D. (2021), "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews", *The BMJ*, Vol. 372, p. 71, doi: 10.1136/bmj.n71.

Paluch, S. and Wirtz, J. (2020), "Artificial intelligence and robots in the service encounter", *Journal of Service Management Research*, Vol. 4 No. 1, pp. 3-8, doi: 10.15358/2511-8676-2020-1-3.

Paluch, S., Wirtz, J. and Kunz, W.H. (2020), "Service robots and the future of service", in Bruhn, M., Kirchgeorg, M., Barth, S. and Burmann, C. (Eds), *Marketing Weiterdenken - Zunkunftspfade dur eine marktorienttierte Unterernehmensfuring*, 2nd ed., Spring Gabler-Verlag. doi: 10.1007/978-3-658-31563-4_21.

Parasuraman, A. (2000), "Technology readiness index (TRI): a multiple-item scale to measure readiness to embrace new technologies", *Journal of Service Research*, Vol. 4, pp. 307-320, doi: 10.1177/109467050024001.

Prentice, C. and Nguyen, M. (2021), "Robotic service quality – scale development and validation", *Journal of Retailing and Consumer Services*, Vol. 62 No. 2021, 102661, doi: 10.1016/j.jretconser.2021.102661.

Qiu, H., Li, M., Shu, B. and Bai, B. (2020), "Enhancing hospitality experience with service robots: the mediating role of rapport building", *Journal of Hospitality Marketing and Management*, Vol. 29 No. 3, pp. 247-268, doi: 10.1080/19368623.2019.1645073.

Reis, J., Melão, N., Salvadorinho, J., Soares, B. and Rosete, A. (2020), "Service robots in the hospitality industry: the case of Henn-na hotel, Japan", *Technology in Society*, Vol. 63 No. 2020, 101423, doi: 10.1016/j.techsoc.2020.101423.

Rizzo, J.R., House, R.J. and Lirtzman, S. (1970), "Role conflict and ambiguity in complex organizations", *Administrative Science Quarterly*, Vol. 15, pp. 150-163, Sage Publications, doi: 10.2307/2391486.

Rousseau, D.M., Manning, J. and Denyer, D. (2008), "Evidence in management and organizational science: assembling the field's full weight of scientific knowledge through syntheses", *Academy of Management Annals*, Vol. 2 No. 1, pp. 475-515, doi: 10.1080/19416520802211651.

Ryan, R.M. and Deci, E.L. (2001), "On happiness and human potentials: a review of research on hedonic and eudaimonic well-being", *Annual Review of Psychology*, Vol. 52 No. 1, pp. 141-166, doi: 10.1146/annurev.psych.52.1.141.

Schepers, J. and Streukens, S. (2022), "To serve and protect: a typology of service robots and their role in physically safe services", *Journal of Service Management*, Vol. 33 No. 2, pp. 197-209, doi: 10.1108/JOSM-11-2021-0409.

Schoenmaker, D. (2011), "The financial trilemma", *Economics Letters*, Vol. 111 No. 1, pp. 57-59, doi: 10.1016/j.econlet.2011.01.010.

Seyitoğlu, F. and Ivanov, S. (2020), "Service robots as a tool for physical distancing in tourism", *Current Issues in Tourism*, Vol. 24 No. 12, pp. 1631-1634, doi: 10.1080/13683500.2020.1774518.

Shead, S. (2019), "World's first robot hotel fires half of its robots", *Forbes16*, January, available at: https://www.forbes.com/sites/samshead/2019/01/16/worlds-first-robot-hotel-fires-half-of-its-robots/ (accessed July 2021).

Simon, O., Neuhofer, B. and Egger, R. (2020), "Human-robot interaction: conceptualising trust in frontline teams through LEGO® Serious Play®", *Tourism Management Perspectives*, Vol. 35 No. 2020, 100692, doi: 10.1016/j.tmp.2020.100692.

Steinbuks, J. and Hertel, T. (2014), "Confronting the food-energy-environment trilemma: global land use in the long run", Policy Research Working Paper, The World Bank Development Research Group.

Taylor, H. (2016), "Lowe's introduces LoweBot, a new autonomous in-store robot", *CNBC*, 20 August, available at: https://www.cnbc.com/2016/08/30/lowes-introduces-lowebot-a-new-autonomous-in-store-robot.html (accessed July 2021).

The Robot Report (2020), "Robotic coffee master from OrionStar and cheetah mobile begins serving customers", 25 September, available at: https://www.therobotreport.com/robotic-coffee-master-from-orionstar-and-cheetah-mobile-begins-serving-customers/ (accessed July 2021).

Thomas, M.J., Lal, V., Baby, A.K., Rabeeh, V.P., M., James, A. and Raj, A.K. (2021), "Can technological advancements help to alleviate COVID-19 pandemic? A review", *Journal of Biomedical Informatics*, Vol. 117 No. 2021, 103787, doi: 10.1016/j.jbi.2021.103787.

Tojib, D., Ho, T.H., Tsarenko, Y. and Pentina, I. (2022), "Service robots or human staff? The role of performance goal orientation in service robot adoption", *Computers in Human Behavior*, Vol. 134 No. 2022, 107339, doi: 10.1016/j.chb.2022.107339.

Tuomi, A., Tussyadiah, I.P. and Stienmetz, J. (2021), "Applications and implications of service robots in hospitality", *Cornell Hospitality Quarterly*, Vol. 62 No. 2, pp. 232-247, doi: 10.1177/1938965520923961.

Um, T., Kim, T. and Chung, N. (2020), "How does an intelligence chatbot affect customers compared with self-service technology for sustainable services?", *Sustainability*, Vol. 12 No. 12, 5119, doi: 10.3390/su12125119.

Verleye, K., Jaakkola, E., Hodgkinson, I.R., Jun, G.T., Odekerken-Schröder, G. and Quist, J. (2017), "What causes imbalance in complex service networks? Evidence from a public health service", *Journal of Service Management*, Vol. 28 No. 1, pp. 34-56, doi: 10.1108/JOSM-03-2016-0077.

Viswesvaran, C. and Ones, D.S. (2000), "Perspectives on models of job performance", *International Journal of Selection and Assessment*, Vol. 8 No. 4, pp. 216-226, doi: 10.1111/1468-2389.00151.

Wirtz, J., Patterson, P.G., Kunz, W.H., Gruber, T., Lu, V.N., Paluch, S. and Martins, A. (2018), "Brave new world: service robots in the frontline", *Journal of Service Management*, Vol. 29 No. 5, pp. 907-931, doi: 10.1108/JOSM-04-2018-0119.

World Economic Forum (2020), "The future of jobs Report", 20 October, available at: https://www.weforum.org/reports/the-future-of-jobs-report-2020/digest (accessed July 2021).

Xu, S., Stienmetz, J. and Ashton, M. (2020), "How will service robots redefine leadership in hotel management? A Delphi approach", *International Journal of Contemporary Hospitality Management*, Vol. 32 No. 6, pp. 2217-2237, doi: 10.1108/IJCHM-05-2019-0505.

Yam, K.C., Bigman, Y.E., Tang, P.M., Ilies, R., De Cremer, D., Soh, H. and Gray, K. (2021), "Robots at work: people prefer - and forgive - service robots with perceived feelings", *Journal of Applied Psychology*, Vol. 106 No. 10, pp. 1557-1572, doi: 10.1037/apl0000834.

Yang, G.Z., Cambias, J., Cleary, K., Daimler, E., Drake, J., Dupont, P.E., Hata, N., Kazanzides, P., Martel, S., Patel, R.V. and Santos, V.J. (2017), "Medical robotics - regulatory, ethical, and legal considerations for increasing levels of autonomy", *Science Robotics*, Vol. 2 No. 4, doi: 10.1126/scirobotics.aam8638.

Yoganathan, V., Osburg, V.S., Kunz, W.H. and Toporowski, W. (2021), "Check-in at the Robo-desk: effects of automated social presence on social cognition and service implications", *Tourism Management*, Vol. 85, 104309, doi: 10.1016/j.tourman.2021.104309.

Yu, C. and Ngan, H. (2019), "The power of head tilts: gender and cultural differences of perceived human vs human-like robot smile in service", *Tourism Review*, Vol. 74 No. 3, pp. 428-442, doi: 10.1108/TR-07-2018-0097.

Zhong, L., Coca-Stefaniak, J.A., Morrison, A., Yang, L. and Deng, B. (2022), "Technology acceptance before and after COVID-19: no-touch service from hotel robots", *Tourism Review*, Vol. 77 No. 4, pp. 1062-1080, doi: 10.1108/TR-06-2021-0276.

Web Appendix
The supplementary material for this article can be found online.

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