Beyond Replacement: Human-Machine Collaboration in the Age of AI

Werner H. Kunz[1], Laszlo Sajtos[2], and Carlos Flavián [3]

[1] College of Management, University of Massachusetts, Boston, Massachusetts, USA

[2] Department of Marketing, School of Business, University of Auckland, Auckland, New Zealand

[3] Marketing and Market Research, Facultad de Economia y Empresa, Universidad de Zaragoza, Zaragoza, Spain

OCRID
Werner H. Kunz - 0000-0001-6264-183X
Laszlo Sajtos - 0000-0002-7851-9561
Carlos Flavián – 0000-0001-7118-9013

Please cite:

Kunz, Werner H., Laszlo Sajtos, and Carlos Flavián (2025), "Beyond Replacement: Human-Machine Teamwork/Collaboration in the Age of AI," *Journal of Service Management*, 36 (forthcoming). https://doi.org/10.1108/JOSM-04-2025-0194

Beyond Replacement: Human-Machine Collaboration in the Age of AI

Abstract

Purpose: The purpose is to advance the understanding of human-machine collaboration in service industries, conceptualizing a framework that structures the research space and proposing a research agenda to guide future studies on optimizing collaboration dynamics, outcomes, and ethical governance.

Design/methodology/approach: The authors use an AI-based systematic literature based on the SERVSIG Literature Alert database to identify articles related to human-machine collaboration. Insights from these papers were analyzed to (a) trace the evolution of human-machine collaboration research, (b) formulate an integrative framework spanning foundational resources through outcomes, and (c) develop a future research agenda.

Findings: The paper develops an integrative framework describing the foundation, process, and outcomes of human-machine (H-M) teamwork in service settings. It also introduces a set of new articles from the special issue.

Originality: Unlike earlier work focusing on either human replacement or narrow task automation, this paper proposes a teamwork perspective, showing how AI and human are working together and combining capabilities to achieve outcome together. It maps diverse empirical studies to a comprehensive framework, demonstrating its applicability and enriching theoretical rigor with real-world evidence.

Social implications: The paper underscores the ethical considerations (e.g., data biases, privacy, and transparency) and broader societal concerns (e.g., job displacement, social inequality) and uniquely positions ethics as a cross-cutting theme (product, consumer, societal levels), moving beyond siloed ethical discussions in earlier work.

Keywords: Human-Machine Collaboration, Teamwork, H-M, AI, Ethics, Service Employee

Introduction

Artificial intelligence (AI) is leading a significant wave of innovation through automation and robotics, transforming key industries such as healthcare, education, communication, entertainment, and hospitality. AI-driven robots are now better at sensing their surroundings by collecting and analyzing large sets of data, which helps them learn and adapt continuously (Wirtz *et al.*, 2018). These improvements enable robots to interact more effectively with people,

featuring natural dialogue, expressive gestures, and personalized responses that aim to enhance user experience and operational efficiency.

While early research predominantly focused on task- or intelligence-based replacement of human work with robots (e.g., Huang and Rust, 2018), recent studies have expanded this perspective to capture processes that emphasize collaboration between humans and machines (e.g., Le *et al.*, 2025). Robots, which excel in performing mechanical and analytical tasks, complement human capabilities in ways that create synergies benefiting a wide range of stakeholders, including employees and customers. This collaboration has the potential to enhance productivity and enrich customer experiences, contributing to the broader evolution of work environments. With an increased focus on human-machine collaboration, researchers are beginning to delve deeper into employees' perspectives to uncover critical implications for both individuals and organizations. These insights are shaping our understanding of the future of work, offering guidance on how human and robotic agents can work in tandem to achieve optimal outcomes.

The primary objective of this article is to provide a comprehensive and original framework for understanding human-machine (H-M) teamwork in service settings. This framework addresses a critical gap in the literature and offers a foundation for future research and practical applications. H-M teamwork is reflected by a deep, ongoing collaboration between a human and an AI system with clearly defined roles and responsibilities, who combine their capabilities to achieve an outcome together. This article not only introduces a novel conceptualization of the future of work through an integrative framework and proposes a research agenda for scholars to pursue but also serves as a contextual foundation for the seven articles included in this special issue. In contrast to previous research that focused on a single aspect of collaborations

(intelligence, interdependence, etc.), this human-machine teamwork conceptualization identifies the foundational resources necessary for H-M teamwork, critical aspects of the process (including interaction dynamics, task delegation, and employee engagement), key outcomes (business, customer, and employee), and, finally, the overarching role of ethics at the product, consumer, and societal levels. We employ this framework to analyze and understand the current state of research on this topic. By addressing key issues related to human-machine collaboration across technical, organizational, and human dimensions, this article seeks to provide actionable insights into the potential of human-machine partnerships while synthesizing current knowledge and identifying critical research gaps. Such research is expected to pave the way for innovative, customer-centered service solutions that leverage the unique strengths of both human and robotic agents creating synergistic outcomes that neither could achieve independently. Ultimately, exploring these dynamics in service settings offers valuable insights into how organizations can harmonize AI-driven systems with human ingenuity, fostering progress in customer experiences and societal outcomes alike while highlighting the ethical considerations that span the entire human-machine collaboration possibilities.

The rest of the article is structured as follows: first, we present a literature overview and methodology; second, we discuss the evolution of the human-machine collaboration research field; third, we introduce our integrative framework; fourth, we analyze the contributions of the special issue articles; and finally, we propose an agenda for future research.

Literature Overview Human-Machine (H-M) collaboration.

Methodology: To gain an understanding of the service literature on human-machine collaboration, we conducted an AI-aided systematic literature review. For the literature search, we utilized the SERVSIG Literature Alert database (Kunz *et al.*, 2019; Kunz and Walsh, 2020;

De Keyser and Kunz, 2022). In this database, we identified papers based on the co-occurrence of the following keyword groups in the abstract and title: group 1 included robot, chatbot, AI, artificial, and assistant; group 2 included collaboration, team, augmentation, co-creation, and partner. All articles that contained at least one keyword in each keyword group were manually screened to determine their relevance to the field of human-machine collaboration. This process identified 72 articles (see web appendix table A1 for a detailed overview of the article, methodology, and main findings). In the next stage, we used Elicit.com to read out the PDFs of the identified articles. In addition to standard results (e.g., major findings of the article, methodology, sample), we specifically asked for insights regarding key resources for successful H-M collaboration, success factors in the process of H-M collaboration, and insights about the outcomes of H-M collaboration. The results were analyzed and synthesized with the help of the ChatGPT o1 model. Based on this, we could develop an understanding of the evolution of the field and develop a framework that describes the research space for human-machine collaboration.

Evolution of the Human-Machine Collaboration Research Field

The academic service literature on human-machine collaboration has evolved significantly in recent years, moving from a focus on basic applications to more complex considerations of its impact on service interactions, value co-creation, and ethical implications. In addition to the significant growth of the field over time, it can be shown that the ratio of conceptual and qualitative articles is shifting toward a greater emphasis on quantitative empirical articles (see figure 1). This shift reflects a maturing field, with researchers moving from theoretical conceptualizations to empirical testing of hypotheses. Emerging trends include a focus on

collaborative intelligence (Shanks *et al.*, 2024), ethical AI deployment (Kunz and Wirtz, 2024), and the exploration of human-AI synergies in various service contexts (Le *et al.*, 2025).

In its early stages, research focused on comparing human and machine competencies (e.g., efficiency, empathy) and categorizing AI's functional roles. Studies often prioritized organizational efficiency and customer-facing applications, with a future-oriented lens predicting AI's potential to augment service delivery (Alkire *et al.*, 2024).

However, this period largely framed AI as a tool for replacement rather than collaboration, with limited attention to interdependencies between humans and machines. As interest grew, the literature shifted toward integration and co-creation, emphasizing hybrid systems where humans and AI jointly deliver value (Henkel *et al.*, 2020; De Keyser and Kunz, 2022). Researchers began exploring how AI enhances emotional and social dimensions of service (e.g., empathetic chatbots, Bagozzi *et al.*, 2022), trust-building effects on customers (McLeay *et al.*, 2021), and fosters resource sharing between stakeholders. New theoretical frameworks, including adopting technology-centric frameworks and service science to explain AI's systemic role in value co-creation, highlight the need to reconceptualize collaboration as dynamic, networked activity systems rather than static task divisions (Bock *et al.*, 2020).

Recent literature has deepened its focus on collaborative intelligence, addressing ethical risks (e.g., privacy, fairness, security, Wirtz *et al.*, 2023). Current trends prioritize, among others, human-AI collaboration dynamics (Blaurock *et al.*, 2024; Le *et al.*, 2025), workforce upskilling (Spohrer, 2024), and AI's role in personalized service (Kim *et al.*, 2022), alongside emotional impacts (Han *et al.*, 2023b) and employee well-being (Ma and Ye, 2022).

← insert figure 1 about here →

Framework of Human-Machine Teamwork

Based on the literature review, we developed a framework that describes the research space for human-machine teamwork (see figure 2). Key concepts of the framework are summarized in table 1. This framework differentiates the literature into three stages (foundation, process, and outcome of human-machine teamwork), where the last stage has implications for the subsequent cycle. Overarching the entire process are ethical and societal issues. In the following, we discuss the insights from these different components of the framework.

← insert figure 2 about here →

← insert table 1 about here →

Foundation for H-M Teamwork: The first stage refers to the resources needed for effective human-machine collaboration in service, including technological, human, organizational, and leadership resources.

Technical Resources: Central aspects from a technical side include AI algorithms, models, and platforms for tasks like data analysis, decision-making, and language processing, along with necessary IT resources like cloud services and hardware (Kot and Leszczyński, 2022). Further, these systems require large, well-structured datasets for training and operation, supported by robust storage, management, and processing infrastructure (Alkire *et al.*, 2024). Additionally, it is paramount to collect this data ethically and transparently for clear and explicit purposes (Bock *et al.*, 2020).

Another central requirement is system connectivity, which allows AI to access resources for self-learning and interact with IoT devices to gather data and perform actions (Alkire *et al.*, 2024). Effective human-machine collaboration requires intuitive user interfaces (UI) for

seamless interaction with AI systems and reduces cognitive load, which enhances the user experience (Gnewuch *et al.*, 2024).

Organizational Resource: For effective implementation, both tangible (e.g., tech infrastructure) and intangible resources (e.g., knowledge and skills) must be organizationally integrated (Kot and Leszczyński, 2022). This implies connecting the AI with relevant organizational data, systems, and processes. Further, organizations need to be adaptable and flexible in how they integrate AI into their systems and practices, as the processes are constantly evolving and not linear. This also requires standardizing service workflows to incorporate AI smoothly (Mele *et al.*, 2021; Kim *et al.*, 2022), as well as adapting appropriate workspaces for human-machine collaboration, including safe interaction distances and environment design (Meyer *et al.*, 2020; Tuomi *et al.*, 2021).

Human Resources: Organizations should offer training programs to help employees work effectively with AI. These programs should cover both technical and soft skills for human-machine collaboration. Special focus is needed for emotional intelligence (Ivanov, 2023), AI literacy (Du and Xie, 2021), and practical AI tool use (Vorobeva *et al.*, 2022; Hur and Shin, 2024). Further, employees must learn to interpret AI outputs and collaborate on decisions (Mele *et al.*, 2021; Kim *et al.*, 2022). Last but not least, mitigate fears about job insecurity and perceived threats to autonomy through transparent communication and empowerment (Flavián *et al.*, 2022; Paluch *et al.*, 2022; Hur and Shin, 2024).

Leadership Resource: Company leadership needs to establish clear goals and strategies for how AI will be used to enhance service delivery. They must champion AI integration ethically and strategically (Tahir *et al.*, 2024). This includes a plan for gradual or phased AI integration to minimize disruptions, address employee fears, and maintain trust (Paluch *et al.*, 2022).

A central task for leadership is fostering a culture of collaboration between humans and AI, which is crucial for successful integration (Kondapaka *et al.*, 2023). This means creating a workplace where employees see AI as a partner rather than a threat (Le *et al.*, 2025). Central here is providing social support, ensuring the psychological safety of the users, and encouraging employees to experiment with AI solutions and clear communication to facilitate acceptance (Paluch *et al.*, 2022).

Process of H-M Teamwork: This stage focuses on dynamically optimizing interactions and relationships between humans and technology through enhancing capabilities, allocating tasks, and employee engagement. in the process of teamwork.

Collaboration & Interaction Dynamics: To ensure efficient service delivery, the workflow design needs to enable both the AI and the human to enhance each other's capabilities and performance, creating a synergistic relationship (Blaurock *et al.*, 2024) that is characterized by warmth, trust, and empathy (Leiño Calleja *et al.*, 2023).

A central role play collaboration cues (Le *et al.*, 2025). Coordination cues are vital for clearly communicating how humans and AI/robots coordinate their tasks. Continuously update which tasks go to AI vs. human staff, optimizing efficiency and adaptability (Han *et al.*, 2023a; Han *et al.*, 2023b). Supervisory cues signal who is in charge (human or AI). The presence of a human supervisor can be more impactful when the human is involved in the latter part of an interaction, while a non-hierarchical structure can reassure customers about the quality of service (Blaurock *et al.*, 2024). Team goal cues can significantly enhance customer satisfaction and perceptions of team cohesion by communicating a shared objective between humans and AI/robots. Integrating these elements, organizations can create effective

collaborations that leverage the strengths of both humans and AI, leading to improved service quality and satisfaction for both employees and customers (Le *et al.*, 2025).

Task delegation: Successful human-machine collaboration requires clear role definitions to balance AI efficiency with human autonomy, creativity, and emotional nuance (Paluch *et al.*, 2022). Effective human-machine task delegation classifies roles based on task complexity and context. Prior studies advocate assigning AI to repetitive, data-driven tasks (e.g., analytics, routine processes) and reserving humans for emotionally intelligent, creative, or high-stakes decisions (Gnewuch *et al.*, 2024). Other research shows, that AI excels in early operational phases (e.g., data collection or standardized queries), while humans intervene in relational interactions, ethical judgments, or complex problem-solving (Spring *et al.*, 2022). Finally, human oversight in AI systems is critical to ensure ethical operations, maintain customer trust, and prevent frustration due to overly automated interactions (Marti *et al.*, 2024). Keeping a "human in/on the loop" fosters transparency and accountability and offers a safety net against potential AI errors or unethical outcomes (Kondapaka *et al.*, 2023).

Employee engagement: Effective employee engagement in workplaces integrating AI and robots hinges on fostering social support, transparency, and control. Providing managerial and peer support structures, involving employees in technology decisions, and managing workload stress mitigate technostress and protect job autonomy (Tuomi *et al.*, 2021; Hur and Shin, 2024). Clear communication about job changes, AI deployment rationale, and role clarity — avoiding hierarchical "master-servant" dynamics — is central and reduces resistance (Tojib *et al.*, 2023; Phillips *et al.*, 2025). Transparency in AI processes and granting employees control over workflows (process control) and outcomes (outcome control) enhance trust and responsibility (Blaurock *et al.*, 2024).

Outcome of H-M Teamwork: The last stage focuses on the result of the human-machine collaboration. This can be split up between various impact areas ranging from the business results via employee and customer impact to societal impact, with each area representing critical dimensions that must be equally considered for comprehensive understanding of H-M teamwork outcomes.

Business impact: Effective AI integration drives productivity, sales, and cost efficiency through human-AI collaboration (Le *et al.*, 2025), enhanced customer engagement (Hollebeek *et al.*, 2024), and chatbot deployment (Chen *et al.*, 2023). It also fosters competitive advantage via optimized service processes, data-driven customer insights, and identification of new market segments (Kot and Leszczyński, 2022). However, overreliance on AI risks brand reputation if human roles are abruptly replaced (McLeay *et al.*, 2021), necessitating a balanced approach between AI exploitation (e.g., cost reduction) and exploration (e.g., innovation) to align with ethical and organizational goals (Kondapaka *et al.*, 2023; Shanks *et al.*, 2024; Mele *et al.*, 2025). AI further enhances innovation by enabling transformative creative collaboration (Alkire *et al.*, 2024), predictive decision-making (Kondapaka *et al.*, 2023), and operational efficiency (Fukawa and Rindfleisch, 2023) while improving internal processes and customer-centric offerings (Kot and Leszczyński, 2022). These combined effects position firms to achieve strategic growth while mitigating risks.

Customer impact: In human-machine service collaborations, context-specific robot anthropomorphism (e.g., matching consumer mindsets) and transparency about the human-machine team effort are crucial for fostering positive customer experiences (Han *et al.*, 2023a; Le *et al.*, 2025). Customers respond favorably to AI-driven personalization — such as tailored recommendations — leading to improved perceived value and stronger customer–firm

relationships (Kot and Leszczyński, 2022; Hollebeek *et al.*, 2024). Overly human-like robots can raise concerns about authenticity (Do *et al.*, 2023), and abrupt shifts from human to robot can diminish trust if not managed carefully (Paluch *et al.*, 2022). Overall, a balanced approach that leverages AI's data capabilities alongside human interaction reduces negative outcomes, supports emotional connections, and enhances service quality (Du and Xie, 2021; Blaurock *et al.*, 2024).

Customer experience in human-AI collaboration hinges on strategic personalization and visible cohesion between human and machine roles. Prior studies emphasize tailoring AI's anthropomorphism to context — for instance, avoiding over-humanized designs that risk discomfort (Han *et al.*, 2023b) — while deploying robots in roles that align with customer expectations (e.g., competitive vs. collaborative mindsets, Han *et al.*, 2023a). Transparent collaboration processes, such as showcasing human oversight or shared goals, enhance perceived service quality and trust (Wirtz *et al.*, 2023; Le *et al.*, 2025). AI-driven personalization improves satisfaction through tailored recommendations and efficient routine handling yet requires balancing with human engagement to maintain authenticity (Hollebeek *et al.*, 2024). While AI enhances data-driven customization (De Keyser *et al.*, 2019), overreliance on programmed emotional cues risks alienating customers who value genuine human interaction (McLeay *et al.*, 2021; Caruelle *et al.*, 2022). Success ultimately depends on framing AI as a cohesive team member — augmenting service without overshadowing human empathy or agency.

Employee impact: AI's impact on employee workload exhibits duality: while automation reduces routine tasks (Meyer *et al.*, 2020), hybrid systems disclosing human involvement can paradoxically increase workloads due to heightened customer expectations (Du and Xie, 2021; Gnewuch *et al.*, 2024; Leiño Calleja *et al.*, 2025). Job satisfaction hinges on transparency and

employee control — collaborative AI systems that empower workers to enhance responsibility and fulfillment, whereas opaque systems erode perceived work meaning (Blaurock *et al.*, 2024). Resistance often stems from replacement fears or diminished autonomy, necessitating training programs to build competency and trust (Meyer *et al.*, 2020; Ma and Ye, 2022). Proactive implementation must balance AI's efficiency with safeguards for employee agency, addressing both workload volatility and psychological needs to mitigate risks like disengagement or sabotage (Paluch *et al.*, 2022).

Finally, the feedback loop in the framework (see figure 2) should integrate insights from the results of human-machine interactions as a foundation for future human-machine teamwork.

Ethical and societal Issues: One overarching element of all three stages is the societal and ethical issues of human-machine collaboration. They can be differentiated between product-level, customer-level, or societal-level concerns. These concerns are interconnected and require a holistic approach to address effectively, as decisions made at one level can have cascading effects on the others.

Product-Level Concerns: AI systems pose significant ethical challenges, including data biases that perpetuate discrimination in sensitive domains due to flawed training data and opaque "black box" algorithms that undermine transparency and trust, necessitating Explainable AI (XAI) frameworks (Du and Xie, 2021; Ivanov, 2023). Ethical design must align AI with human values, addressing dilemmas like autonomous decision-making in scenarios such as self-driving cars while ensuring accountability for AI actions, mainly when systems act against stakeholder interests. Advanced AI also raises moral questions about the rights of conscious machines, including labor regulations and value-sharing (Du and Xie, 2021; Esmaeilzadeh and Vaezi,

2022). Proactive integration of these considerations — bias mitigation, transparency, and ethical alignment — is critical to fostering responsible AI deployment.

Consumer-Level Concerns: The deployment of AI requires addressing ethical concerns around privacy, security, and autonomy while fostering trust through transparency and accountability. AI's reliance on consumer data heightens risks of breaches and misuse, necessitating privacy-by-design safeguards to protect sensitive information (Du and Xie, 2021; Hollebeek *et al.*, 2024). Emotional manipulation risks emerge as AI mimics human emotions, threatening authentic customer interactions (Huang and Rust, 2018; Esmaeilzadeh and Vaezi, 2022; Huang *et al.*, 2024). Trust hinges on transparent AI processes, including clear disclosure of AI involvement and collaborative human-machine team cues (Du and Xie, 2021; Gnewuch *et al.*, 2024), while preserving consumer autonomy against AI-mediated decision-making (Du and Xie, 2021; Mele *et al.*, 2021). Strategic preparation, such as signaling collaborative cues in human-machine teams (Le *et al.*, 2025) and addressing corporate digital responsibility (CDR) — including fairness, privacy, and balancing firm-consumer interests — are vital to mitigate ethical risks and optimize service delivery (Kondapaka *et al.*, 2023; Wirtz *et al.*, 2023). Proactive governance of these dynamics is essential to navigate AI's societal trade-offs and harness its potential responsibly.

Societal-Level Concerns: The rapid integration of AI and robotics into workplaces presents profound societal challenges, including job displacement and heightened income inequality due to automation (Lu *et al.*, 2020; Dixon *et al.*, 2021; Ma and Ye, 2022), alongside risks of social deprivation as AI-driven services reduce human interaction and compassion (Čaić *et al.*, 2018; Meyer *et al.*, 2020). Differential access to human versus automated services may exacerbate social inequality, privileging affluent customers (Alkire *et al.*, 2024), while workplace

transformations — such as human-AI collaboration in the fifth industrial revolution — demand redefined roles and accountability to preserve work meaning (Dixon *et al.*, 2021; Blaurock *et al.*, 2024; Mele *et al.*, 2025). Hybrid service agents blur human-technology boundaries, yet disclosing human involvement can increase employee workload by shifting customer communication preferences (Gnewuch *et al.*, 2024). Ethical concerns extend to data control (Hollebeek *et al.*, 2024), cyborg integration (Garry and Harwood, 2019), and existential risks from uncontrolled AI (Du and Xie, 2021; Alkire *et al.*, 2024). Strategic governance, ethical frameworks, and equitable service design are critical to mitigate these challenges and balance technological advancement with societal well-being.

These ethical societal issues highlight the need for a multi-faceted approach to the development and implementation of AI in service, involving researchers, policymakers, businesses, and the public to ensure a responsible and equitable future.

Contributions of the Special Issue to the Research Field.

The articles of this special issue make essential contributions to various areas of this framework (see figure 2 and table 2):

Mele *et al*. (2025) conducted a two-year longitudinal study to explore how the introduction of robotic technology, specifically chatbots, transforms work practices in customer care. Using expansive learning theory and a systems perspective, the research analyzed an international health product company's transition into human-machine collaboration (HRC). The findings highlighted the formation of a human-machine activity system organized around shared goals, tools, and rules, evolving through expansive learning to address contradictions between human workflows and robotic capabilities. Mele's work combines the area of Organizational Resources (i.e. system-level integration and adaptability) with Collaboration & Interaction Dynamics (i.e.

shared goals and activity systems) and business impact (i.e. service innovation and improved customer care practices). Their longitudinal approach enriches our framework's feedback loop element, demonstrating how contradictions between human and machine work patterns drive organizational learning and system evolution — extending beyond the static resource configurations emphasized in previous literature (Kot and Leszczyński, 2022). This foundational study provides a comprehensive understanding of how organizations adapt to human-machine collaboration over time, setting the stage for more focused investigations of specific aspects within this evolving ecosystem.

Phillips *et al*. (2025) conducted a mixed-methods study examining how frontline employees (FLEs) respond to and manage their well-being when service robots alter traditional employee-customer relationships (termed the "intrusion challenge"). Their findings revealed that while robots initially impact various dimensions of employee well-being (social, purpose, physical, and community), FLEs actively use robots as a task allocation strategy to maintain their well-being, with results showing that using robots instead of human colleagues had positive well-being outcomes. This article aligns with the employee elements of the framework regarding human resources, employee engagement, task delegation, and employee impact. The article fills a critical gap in our understanding of employee agency in human-machine teamwork, demonstrating how employees strategically leverage robots to enhance rather than diminish their well-being — advancing beyond the passive adaptation perspective dominant in previous research (Ma and Ye, 2022). Building upon the organizational transformation insights from Mele et al. (2025), this study shifts focus to the individual employee level, revealing how frontline workers actively shape their relationship with technology rather than merely adapting to it.

Shanks *et al*. (2025) developed a framework for evaluating the economic feasibility of service robots by reviewing empirical research on cost drivers and consumer willingness-to-pay (WTP), primarily in healthcare contexts, and by conducting an exploratory study on how cobotic teams affect WTP. The authors developed a cost-benefit analyses (CBA) identifying key cost drivers and benefits, emphasizing situational profitability influenced by context and usage frequency. Their experimental findings revealed that cobotic teams — particularly with robots in leadership roles — can enhance consumer WTP compared to human-only teams, driven by perceived usefulness, emotional engagement, and anthropomorphism. The study bridges gaps in understanding robot efficiency and proposes future research directions for service robot adoption. This article makes distinctive contributions to multiple components of our framework (Figure 2): "Collaboration & Interaction Dynamics" (e.g., human-machine team configurations) as well as "Business Impact" (e.g., productivity) and "Customer Impact" (e.g., willingness-to-pay, authenticity perception). This paper challenges the traditional assumptions about leadership roles in human-machine teams, revealing that robot-led teams can outperform human-led teams in certain contexts — a finding that contrasts with earlier literature emphasizing human supervisory control. While Phillips et al. (2025) examined employee perspectives, Shanks et al. (2025) complementarily explores the economic and customer dimensions, providing a more holistic view of human-machine collaboration outcomes.

Leiño Calleja *et al*. (2025) investigated customer and frontline employee (FLE) perceptions of hybrid human-machine teams (HHRTs) in service contexts, focusing on how automated social presence (ASP) cues (e.g., robot speech/identity) in frontline robots (FLRs) influence customers' evaluations of teamwork quality, FLE competence, and warmth. They found that higher ASP enhanced perceived teamwork quality, indirectly boosting FLE competence/warmth. Corrective

interrogation (FLEs correcting robots or vice versa) amplified ASP's positive effects for customers, though FLEs viewed corrections as harmful to teamwork — a "hybrid team evaluation paradox." This work primarily fits within Collaboration & Interaction Dynamics in our framework, but also touches on Customer Impact (e.g., perceived competence and warmth) and Employee Impact (e.g., FLE perceptions of correction behaviors). The "hybrid team evaluation paradox" reveals a significant tension between optimizing customer versus employee outcomes, suggesting that interaction designs beneficial for one stakeholder may undermine another — a complexity not fully captured in the existing literature on collaboration cues (Le *et al.*, 2025). This study extends the economic considerations of Shanks et al. (2025) by delving deeper into the social and perceptual dynamics of human-robot teams, highlighting important trade-offs between customer and employee experiences.

Fiestas Lopez Guido *et al*. (2025) empirically explored the influence of "master-servant" dynamics in human-machine collaboration (HRC) on customer perceptions of realistic threat, trust, and their intention to use humanoid social robots (HSRs) in retail. The study revealed that customers perceive greater threats and reduced trust when HSRs assume superior (master) roles over human employees (servants). These effects are amplified by speciesism (preference for humans over non-humans), which increases the negative impact of the perceived threat and diminishes trust's positive role, ultimately lowering customers' adoption intentions for HSRs in retail settings. The study contributes to the understanding of hierarchical role dynamics in hybrid service encounters and fits well in the area of "Collaboration & Interaction Dynamics" and "Customer Impact" (i.e., trust, perceived authenticity, and adoption intentions). Their findings on speciesism introduce a novel moderating factor in ethical section of our framework, extending previous work on consumer acceptance (Han *et al.*, 2023a) by highlighting how deeply held

beliefs about human-machine hierarchies can fundamentally alter adoption outcomes. This research complements the work of Leiño Calleja et al. (2025) by further examining hierarchical dynamics, but with a specific focus on how power relationships between humans and robots influence customer perceptions and adoption intentions.

Yang *et al*. (2025) investigated how employee-AI interaction fluency influences employee service performance in different delivery service contexts using mind perception theory and self-efficacy theory. The study found that interaction fluency enhances in-role performance (via perceived empathy and competence) in high-partnership contexts (e.g., smart helmets) and out-of-role performance (via competence alone) in low-partnership contexts (e.g., in-vehicle AI). High self-efficacy employees displayed a weaker link between interaction fluency and perceived competence. The study directly addresses two critical components in our framework (Figure 2): "Collaboration & Interaction Dynamics" through its examination of interaction fluency, and "Employee Impact" by revealing context-specific pathways to enhanced performance outcomes. Their context-dependent findings challenge the universality of our framework's process components, suggesting that partnership intensity fundamentally alters how interaction dynamics translate to performance outcomes — a nuance not captured in previous research on employee-AI collaboration (Hur and Shin, 2024). Building on earlier studies in this special issue that examined employee well-being (Phillips et al., 2025) and team dynamics (Leiño Calleja et al., 2025), Yang et al. (2025) provides valuable insights into how the specific nature of human-AI partnerships affects employee performance across different contexts.

Le and Cayrat (2025) introduced the concept of “artificial companionship” to explore how AI agents (e.g., ChatGPT) act as supportive partners for service employees, alleviating work-related stress through four roles: instrumental (task aid), informative (knowledge sharing), caring

(emotional support), and intimate (personalized interaction). Using a mixed-methods approach grounded in social support theory, the authors developed a conceptual framework and validated propositions via a qualitative employee survey. The article aligns collaboration & interaction dynamics with customer and employee impact, specifically addressing Employee Well-being. Their conceptualization of "artificial companionship" expands the understanding of human-machine relationships beyond task-oriented collaboration to include emotional and social dimensions — challenging the predominantly functional perspective in existing literature (Blaurock *et al.*, 2024) and suggesting new pathways for enhancing employee outcomes. This final contribution synthesizes many themes explored throughout the special issue, from organizational transformation (Mele et al., 2025) to employee well-being (Phillips et al., 2025) and interaction dynamics (Yang et al., 2025), by reconceptualizing AI as not merely a tool or teammate but as a companion that can provide multidimensional support to employees. Together, these seven studies provide a comprehensive examination of human-machine collaboration that maps directly onto our theoretical framework (Figure 2)—spanning from foundational resources through processes to outcomes—and integrating diverse stakeholder perspectives. Collectively, they not only demonstrate the richness of this emerging field but also validate the interconnected nature of the framework components while highlighting critical directions for future research.

← insert table 2 about here →

Agenda for Future Research

Our literature review highlights a diverse landscape in human-machine collaboration. However, there remains much to explore, and we propose potential research questions for further investigation based on the underlying framework (see table 3).

Foundations for H-M Teamwork: We need more critical insights into how organizations can truly operationalize the resource needs (e.g., training, strategic planning, robust infrastructures) in ways that protect employee well-being, maintain consumer trust, and uphold ethical standards. For instance, many articles emphasize training in AI literacy, empathy, and emotional labor (Vorobeva *et al.*, 2022; Hur and Shin, 2024). However, how organizations can measure the long-term efficacy of this training (e.g., ongoing skill retention, dynamic reskilling) remains unclear. Further, employees vary in technical proficiency, social skills, and comfort with automation — suggesting a need for personalized development pathways.

The agreement that top management must champion AI initiatives ethically and strategically (Kondapaka *et al.*, 2023), but there is limited consensus on which leadership styles (transformational, participative, etc.) are most effective in different service contexts. While many studies highlight the importance of transparent communication and involvement in technology decisions (Paluch *et al.*, 2022), little is known about maintaining engagement once AI is firmly in place.

Process of H-M Teamwork: More knowledge is needed to better understand how organizations can fine-tune role allocations, support employee well-being, and orchestrate AI-human interactions to optimize both efficiency and the human touch. While many articles propose general guidelines to assign AI repetitive/analytical tasks and humans emotional/creative tasks, little research explores contextual factors (e.g., industry type, consumer mindset, or task complexity) that might alter these guidelines. Further, many studies highlight a "human in the loop," but detailed processes for maintaining oversight (e.g., audit intervals, real-time dashboards, escalation protocols) remain underexplored.

Multiple articles emphasize the need for social support and emotional labor training (Tuomi *et al.*, 2021; Hur and Shin, 2024), but employees vary widely in attitudes, stress thresholds, and tech readiness. Further, deep acting is valuable for service recovery (Shi *et al.*, 2023), yet the long-term emotional burden on employees repeatedly dealing with AI errors or bridging AI-human communication remains unclear.

Outcome of H-M Teamwork: We need a deeper understanding of how improvements can be sustainably achieved for the business, employees, and customers by switching to a human-machine collaboration model. For instance, research repeatedly indicates that AI-driven automation can free employees to handle higher-value tasks (Wirtz *et al.*, 2018; Spring *et al.*, 2022). However, few longitudinal studies exist on how these productivity gains evolve over time or how they vary by context. Further, some studies highlight new roles such as "AI trainers" (Kot and Leszczyński, 2022) and emphasize continuous learning (Leone *et al.*, 2021). Yet we lack clarity on which organizational contexts (e.g., large vs. small firms, product vs. service industries) gain the most from these emergent roles.

While AI can boost employee creativity and reduce turnover (Tahir *et al.*, 2024; Phillips *et al.*, 2025), some studies also warn of role mismatches, distrust, or mental strain (Paluch *et al.*, 2022; Willems *et al.*, 2023). Little research addresses how these tensions unfold months or years after initial AI adoption. Positive outcomes include enhanced customer satisfaction and experience (Han *et al.*, 2023b; Marti *et al.*, 2024), but consumer trust can erode if AI's capabilities or limitations are not communicated transparently (Caruelle *et al.*, 2022). Many studies highlight AI's potential for speed and consistency, yet also caution about maintaining a "human touch" (Gnewuch *et al.*, 2024; Marti *et al.*, 2024). Limited research specifies where and when to prioritize either approach. Further, research suggests adjusting anthropomorphism or

emotional expression to match consumer psychology (Han *et al.*, 2023a), but few frameworks exist for real-time or large-scale personalization of robot interaction styles.

Ethical and Societal Issues: Finally, as illustrated above, there is an increasing awareness for the ethical and social issue that human-machine collaboration in service delivery implies. While ethical guidelines and privacy-by-design are recurring themes (Du and Xie, 2021; Wirtz *et al.*, 2023; Alkire *et al.*, 2024), practical approaches for embedding these frameworks into routine service operations — beyond high-level principles — are underexplored. We know that mishandling data or using AI deceptively can undermine the brand reputation and consumer trust (Du and Xie, 2021; Caruelle *et al.*, 2022). However, how to operationalize ethical guidelines or advanced privacy-preserving measures at scale remains underexplored. Further, some studies show AI adoption leads to deskilling in certain tasks while creating new, more human-centric roles (Dixon *et al.*, 2021; Xue *et al.*, 2022). Less is known about how managers can systematically plan for these transformations to avoid skill gaps or social inequities.

← insert table 1 about here →

References

Abou-Foul, M., Ruiz-Alba, J.L., and López-Tenorio, P.J. (2023), "The impact of artificial intelligence capabilities on servitization: The moderating role of absorptive capacity-A dynamic capabilities perspective," *Journal of Business Research*, 157, 113609.

Alkire, L., Bilgihan, A., Bui, M.M., Buoye, A.J., Dogan, S., and Kim, S. (2024), "RAISE: leveraging responsible AI for service excellence," *Journal of Service Management*, 35 (4), 490–511.

Bagozzi, R.P., Brady, M.K., and Huang, M.-H. (2022), "AI Service and Emotion," *Journal of Service Research*, 25 (4), 499–504.

Blaurock, M., Büttgen, M., and Schepers, J. (2024), "Designing Collaborative Intelligence Systems for Employee-AI Service Co-Production," *Journal of Service Research*, 10946705241238751.

Blümel, J.H., Zaki, M., and Bohné, T. (2024), "Personal touch in digital customer service: a conceptual framework of relational personalization for conversational AI," *Journal of Service Theory and Practice*, 34 (1), 33–65.

Bock, D.E., Wolter, J.S., and Ferrell, O.C. (2020), "Artificial intelligence: disrupting what we know about services," *Journal of Services Marketing*, 34 (3), 317–34.

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*, 29 (2), 178–205.
Caruelle, D., Shams, P., Gustafsson, A., and Lervik-Olsen, L. (2022), "Affective Computing in Marketing: Practical Implications and Research Opportunities Afforded by Emotionally Intelligent Machines," *Marketing Letters*, 33 (1), 163–69.
Chandra, B. and Rahman, Z. (2024), "Artificial intelligence and value co-creation: a review, conceptual framework and directions for future research," *Journal of Service Theory and Practice*, 34 (1), 7–32.
Chen, S., Li, X., Liu, K., and Wang, X. (2023), "Chatbot or human? The impact of online customer service on consumers' purchase intentions," *Psychology & Marketing*, 40 (11), 2186–200.
De Keyser, A., Köcher, S., Alkire (Née Nasr), L., Verbeeck, C., and Kandampully, J. (2019), "Frontline Service Technology infusion: conceptual archetypes and future research directions," *Journal of Service Management*, 30 (1), 156–83.
De Keyser, A. and Kunz, W.H. (2022), "Living and working with service robots: a TCCM analysis and considerations for future research," *Journal of Service Management*, 33 (2), 165–96.
Dixon, J., Hong, B., and Wu, L. (2021), "The Robot Revolution: Managerial and Employment Consequences for Firms," *Management Science*, 67 (9), 5586–605.
Do, K.T., Gip, H., Guchait, P., Wang, C.-Y., and Baaklini, E.S. (2023), "Empathetic creativity for frontline employees in the age of service robots: conceptualization and scale development," *Journal of Service Management*, 34 (3), 433–66.
Dodds, S., Russell–Bennett, R., Chen, T., Oertzen, A.-S., Salvador-Carulla, L., and Hung, Y.-C. (2022), "Blended human-technology service realities in healthcare," *Journal of Service Theory and Practice*, 32 (1), 75–99.
Du, S. and Xie, C. (2021), "Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities," *Journal of Business Research*, 129, 961–74.
Esmaeilzadeh, H. and Vaezi, R. (2022), "Conscious Empathic AI in Service," *Journal of Service Research*, 25 (4), 549–64.
Fiestas Lopez Guido, J.C., Popkowski-Leszczyc, P., Pontes, N., and Tuzovic, S. (2025), "The Impact of Master-Servant Relationships in Human-Robot Collaboration on Customer Perceptio-annotated," *Journal of Service Management*.
Figueiredo, A.S. and Pinto, L.H. (2021), "Robotizing shared service centres: key challenges and outcomes," *Journal of Service Theory and Practice*, 31 (1), 157–78.
Flavián, C., Pérez-Rueda, A., Belanche, D., and Casaló, L.V. (2022), "Intention to use analytical artificial intelligence (AI) in services – the effect of technology readiness and awareness," *Journal of Service Management*, 33 (2), 293–320.
Fukawa, N. and Rindfleisch, A. (2023), "Enhancing innovation via the digital twin," *Journal of Product Innovation Management*, 40 (4), 391–406.
Garry, T. and Harwood, T. (2019), "Cyborgs as frontline service employees: a research agenda," *Journal of Service Theory and Practice*, 29 (4), 415–37.
Gnewuch, U., Morana, S., Hinz, O., Kellner, R., and Maedche, A. (2024), "More Than a Bot? The Impact of Disclosing Human Involvement on Customer Interactions with Hybrid Service Agents," *Information Systems Research*, 35 (3), 936–55.
Han, B., Deng, X., and Fan, H. (2023a), "Partners or Opponents? How Mindset Shapes Consumers' Attitude Toward Anthropomorphic Artificial Intelligence Service Robots," *Journal of Service Research*, 26 (3), 441–58.

Han, E., Yin, D., and Zhang, H. (2023b), "Bots with Feelings: Should AI Agents Express Positive Emotion in Customer Service?," *Information Systems Research*, 34 (3), 1296–311.
Henkel, A.P., Bromuri, S., Iren, D., and Urovi, V. (2020), "Half human, half machine – augmenting service employees with AI for interpersonal emotion regulation," *Journal of Service Management*, 31 (2), 247–65.
Hess, N.J., Shanks, I., Mende, M., Van Doorn, J., Scott, M.L., and Grewal, D. (2025), "Viva Robonomics!? Cost-Benefit Analysis of Robots and Future Directions in Service and Robonomics Research," *Journal of Service Management*, 36.
Hollebeek, L.D., Menidjel, C., Sarstedt, M., Jansson, J., and Urbonavicius, S. (2024), "Engaging consumers through artificially intelligent technologies: Systematic review, conceptual model, and further research," *Psychology & Marketing*, 41 (4), 880–98.
Huang, L.L., Chen, R.P., and Chan, K.W. (2024), "Pairing up with anthropomorphized artificial agents: Leveraging employee creativity in service encounters," *Journal of the Academy of Marketing Science*, 52 (4), 955–75.
Huang, M.-H. and Rust, R.T. (2018), "Artificial Intelligence in Service," *Journal of Service Research*, 21 (2), 155–72.
Hur, W.-M. and Shin, Y. (2024), "Service employees' STARA awareness and proactive service performance," *Journal of Services Marketing*, 38 (4), 426–42.
Hyun, Y., Hlee, S., Park, J., and Chang, Y. (2022), "Discovering meaningful engagement through interaction between customers and service robots," *The Service Industries Journal*, 42 (13-14), 973–1000.
Ivanov, S. (2023), "The dark side of artificial intelligence in higher education," *The Service Industries Journal*, 43 (15-16), 1055–82.
Kim, J.H., Kim, M., Kwak, D.W., and Lee, S. (2022), "Home-Tutoring Services Assisted with Technology: Investigating the Role of Artificial Intelligence Using a Randomized Field Experiment," *Journal of Marketing Research*, 59 (1), 79–96.
Kondapaka, P., Khanra, S., Malik, A., Kagzi, M., and Hemachandran, K. (2023), "Finding a fit between CXO's experience and AI usage in CXO decision-making: evidence from knowledge-intensive professional service firms," *Journal of Service Theory and Practice*, 33 (2), 280–308.
Kot, M. and Leszczyński, G. (2022), "AI-activated value co-creation. An exploratory study of conversational agents," *Industrial Marketing Management*, 107, 287–99.
Kunz, W.H., Heinonen, K., and Lemmink, J.G.A.M. (2019), "Future service technologies: is service research on track with business reality?," *Journal of Services Marketing*, 33 (4), 479–87.
Kunz, W.H. and Walsh, G. (2020), "After the revolution – new chances for service research in a digital world," *Journal of Service Management*, 31 (3), 597–607.
Kunz, W.H. and Wirtz, J. (2024), "Corporate digital responsibility (CDR) in the age of AI: implications for interactive marketing," *Journal of Research in Interactive Marketing*, 18 (1), 31–37.
Le, K.B.Q. and Cayrat, C. (2025), "Howdy, Robo-Partner: exploring artificial companionship and its stress-alleviating potential for service employees," *Journal of Service Management*, 28.
Le, K.B.Q., Sajtos, L., and Fernandez, K.V. (2023), "Employee-(ro)bot collaboration in service: an interdependence perspective," *Journal of Service Management*, 34 (2), 176–207.
Le, K.B.Q., Sajtos, L., Kunz, W.H., and Fernandez, K.V. (2025), "The Future of Work: Understanding the Effectiveness of Collaboration Between Human and Digital Employees in Service," *Journal of Service Research*, 28 (1), 186–205.

Lei, S., Xie, L., and Peng, J. (2024), "Unethical Consumer Behavior Following Artificial Intelligence Agent Encounters: The Differential Effect of AI Agent Roles and its Boundary Conditions," *Journal of Service Research*, 10946705241278837.
Leiño Calleja, D., Schepers, J., and Nijssen, E.J. (2023), "Some agents are more similar than others: customer orientation of frontline robots and employees," *Journal of Service Management*, 34 (6), 27–49.
---- (2025), "Where Tech Meets Mindfulness Customer Perceptions towards Hybrid Human-Robot Teams, and the," *Journal of Service Management*, 36.
Leone, D., Schiavone, F., Appio, F.P., and Chiao, B. (2021), "How does artificial intelligence enable and enhance value co-creation in industrial markets? An exploratory case study in the healthcare ecosystem," *Journal of Business Research*, 129, 849–59.
Li, S., Peng, G., Xing, F., Zhang, J., and Zhang, B. (2021), "Value co-creation in industrial AI: The interactive role of B2B supplier, customer and technology provider," *Industrial Marketing Management*, 98, 105–14.
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*, 30 (3), 361–91.
Ma, C. and Ye, J. (2022), "Linking artificial intelligence to service sabotage," *The Service Industries Journal*, 42 (13-14), 1054–74.
Marti, C.L., Liu, H., Kour, G., Bilgihan, A., and Xu, Y. (2024), "Leveraging artificial intelligence in firm-generated online customer communities: a framework and future research agenda," *Journal of Service Management*, 35 (3), 438–58.
McLeay, F., Osburg, V.S., Yoganathan, V., and Patterson, A. (2021), "Replaced by a Robot: Service Implications in the Age of the Machine," *Journal of Service Research*, 24 (1), 104–21.
Mele, C., Russo Spena, T., Kaartemo, V., and Marzullo, M.L. (2021), "Smart nudging: How cognitive technologies enable choice architectures for value co-creation," *Journal of Business Research*, 129, 949–60.
Mele, C., Russo-Spena, T., Marzullo, M., and Ruggiero, A. (2022), "Boundary work in value co-creation practices: the mediating role of cognitive assistants," *Journal of Service Management*, 33 (2), 342–62.
Mele, C., Russo-Spena, T., Ranieri, A., and Di Bernardo, I. (2025), "A system and learning perspective on Human-Robot Collaboration," *Journal of Service Management*, 36.
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*, 4 (1), 21–34.
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*, 33 (2), 246–92.
Paluch, S., Tuzovic, S., Holz, H.F., Kies, A., and Jörling, M. (2022), "“My colleague is a robot” – exploring frontline employees' willingness to work with collaborative service robots," *Journal of Service Management*, 33 (2), 363–88.
Phillips, C., Odekerken-Schröder, G., Russell-Bennett, R., Steins, M., Mahr, D., and Letheren, K. (2025), "Service Robot-Employee Task Allocation Strategies Well-being within the Intrusion challenge," *Journal of Service Management*, 36.

Phillips, C., Russell–Bennett, R., Odekerken-Schröder, G., Mahr, D., and Letheren, K. (2023), "The Robotic-Human Service Trilemma: the challenges for well-being within the human service triad," *Journal of Service Management*, 34 (4), 770–805.
Rancati, G. and Maggioni, I. (2023), "Neurophysiological responses to robot–human interactions in retail stores," *Journal of Services Marketing*, 37 (3), 261–75.
Robinson, S., Orsingher, C., Alkire, L., De Keyser, A., Giebelhausen, M., Papamichail, K.N., Shams, P., and Temerak, M.S. (2020), "Frontline encounters of the AI kind: An evolved service encounter framework," *Journal of Business Research*, 116, 366–76.
Shanks, I., Mende, M., Van Doorn, J., Hess, N.J., Scott, M.L., and Grewal, D. (2025), "Automate to Elevate!? Cost-Benefit Analysis of Robots and Future Directions in Services Marketing Research," *Journal of Service Management*, 36.
Shanks, I., Scott, M.L., Mende, M., Van Doorn, J., and Grewal, D. (2024), "Cobotic service teams and power dynamics: Understanding and mitigating unintended consequences of human-robot collaboration in healthcare services," *Journal of the Academy of Marketing Science*, 52.
Shi, Y., Zhang, R., Ma, C., and Wang, L. (2023), "Robot service failure: the double-edged sword effect of emotional labor in service recovery," *Journal of Service Theory and Practice*, 33 (1), 72–88.
Söderlund, M. (2023), "Service robots and artificial morality: an examination of robot behavior that violates human privacy," *Journal of Service Theory and Practice*, 33 (7), 52–72.
Spohrer, J. (2024), "AI Upskilling and Digital Twins: A Service Science Perspective on the Industry 4.0 to Industry 5.0 Shift," in Susu Nousala and Gary Metcalf and David Ing, eds. Singapore: Springer Nature Singapore Singapore.
Spring, M., Faulconbridge, J., and Sarwar, A. (2022), "How information technology automates and augments processes: Insights from Artificial-Intelligence-based systems in professional service operations," *Journal of Operations Management*, 68 (6-7), 592–618.
Tahir, M.A., Da, G., Javed, M., Akhtar, M.W., and Wang, X. (2024), "Employees' foe or friend: artificial intelligence and employee outcomes," *The Service Industries Journal*, 1–32.
Tojib, D., Sujan, R., Ma, J., and Tsarenko, Y. (2023), "How does service robot anthropomorphism affect human co-workers?," *Journal of Service Management*, 34 (4), 750–69.
Trincado-Munoz, F.J., Cordasco, C., and Vorley, T. (2024), "The dark side of AI in professional services," *The Service Industries Journal*, 1–20.
Tuomi, A., Tussyadiah, I.P., and Stienmetz, J. (2021), "Applications and Implications of Service Robots in Hospitality," *Cornell Hospitality Quarterly*, 62 (2), 232–47.
Vorobeva, D., El Fassi, Y., Costa Pinto, D., Hildebrand, D., Herter, M.M., and Mattila, A.S. (2022), "Thinking Skills Don't Protect Service Workers from Replacement by Artificial Intelligence," *Journal of Service Research*, 25 (4), 601–13.
Willems, K., Verhulst, N., De Gauquier, L., and Brengman, M. (2023), "Frontline employee expectations on working with physical robots in retailing," *Journal of Service Management*, 34 (3), 467–92.
Wirtz, J., Kunz, W.H., Hartley, N., and Tarbit, J. (2023), "Corporate Digital Responsibility in Service Firms and Their Ecosystems," *Journal of Service Research*, 26 (2), 173–90.
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*, 29 (5), 907–31.
Xiao, L. and Kumar, V. (2021), "Robotics for Customer Service: A Useful Complement or an Ultimate Substitute?," *Journal of Service Research*, 24 (1), 9–29.

Xue, M., Cao, X., Feng, X., Gu, B., and Zhang, Y. (2022), "Is College Education Less Necessary with AI? Evidence from Firm-Level Labor Structure Changes," *Journal of Management Information Systems*, 39 (3), 865–905.
Yang, S., Guo, Y., Chen, Y., Li, Y., zhou, s., and Jiang, h. (2025), "Understanding service performance of frontline employees from employee-AI interaction perspective," *Journal of Service Management*, 36.
Yun, J.H., Lee, E.J., and Kim, D.H. (2021), "Behavioral and neural evidence on consumer responses to human doctors and medical artificial intelligence," *Psychology & Marketing*, 38 (4), 610–25.

Author Biographies

Werner H. Kunz (PhD) is Professor of Marketing and Director of the digital media lab at the University of Massachusetts Boston. His research interests are in service technology, incl. AI, service robots, and company innovativeness. His work has been published, amongst others, in the *Journal of Service Research, Journal of Retailing, International Journal of Research in Marketing,* and *Computational Statistics* and was awarded multiple times. Among many honors, he is the inaugural recipient of the Bo Edvardsson "Industry Impact in Services" Award.

Laszlo Sajtos (PhD), Associate Professor at the University of Auckland Business School, researches the impact of emergent technologies on service management. His work is published in top journals including the International Journal of Research in Marketing, Journal of Service Research, and Journal of Interactive Marketing, among others.

Carlos Flavian (PhD) is Professor of Marketing at the University of Zaragoza (Spain). His research focused on consumer behavior has been published in journals specialized in marketing (e.g. J. Bus. Res.; J. Interact. Mark.), new technologies (e.g. Inf. Manag.; Electron. Mark.), Psychology (e.g. Psychol. Mark; J. Environ. Psychol.) and Tourism (e.g. Tour. Manag.; Int. J. Contemp. Hosp. Manag.). He is Editor-in-Chief of the Spanish Journal of Marketing-ESIC and Associate Editor of The Service Industries Journal.

Figures

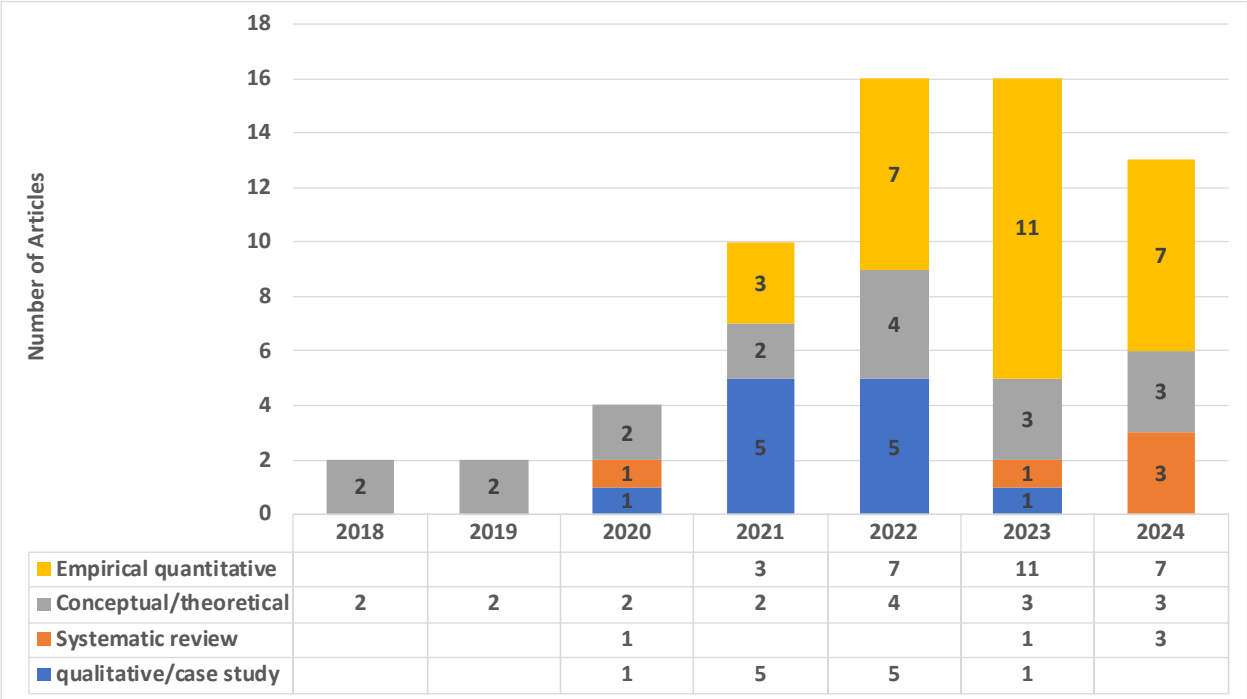

Figure 1: Evolution of the Human-Machine Collaboration Research Field

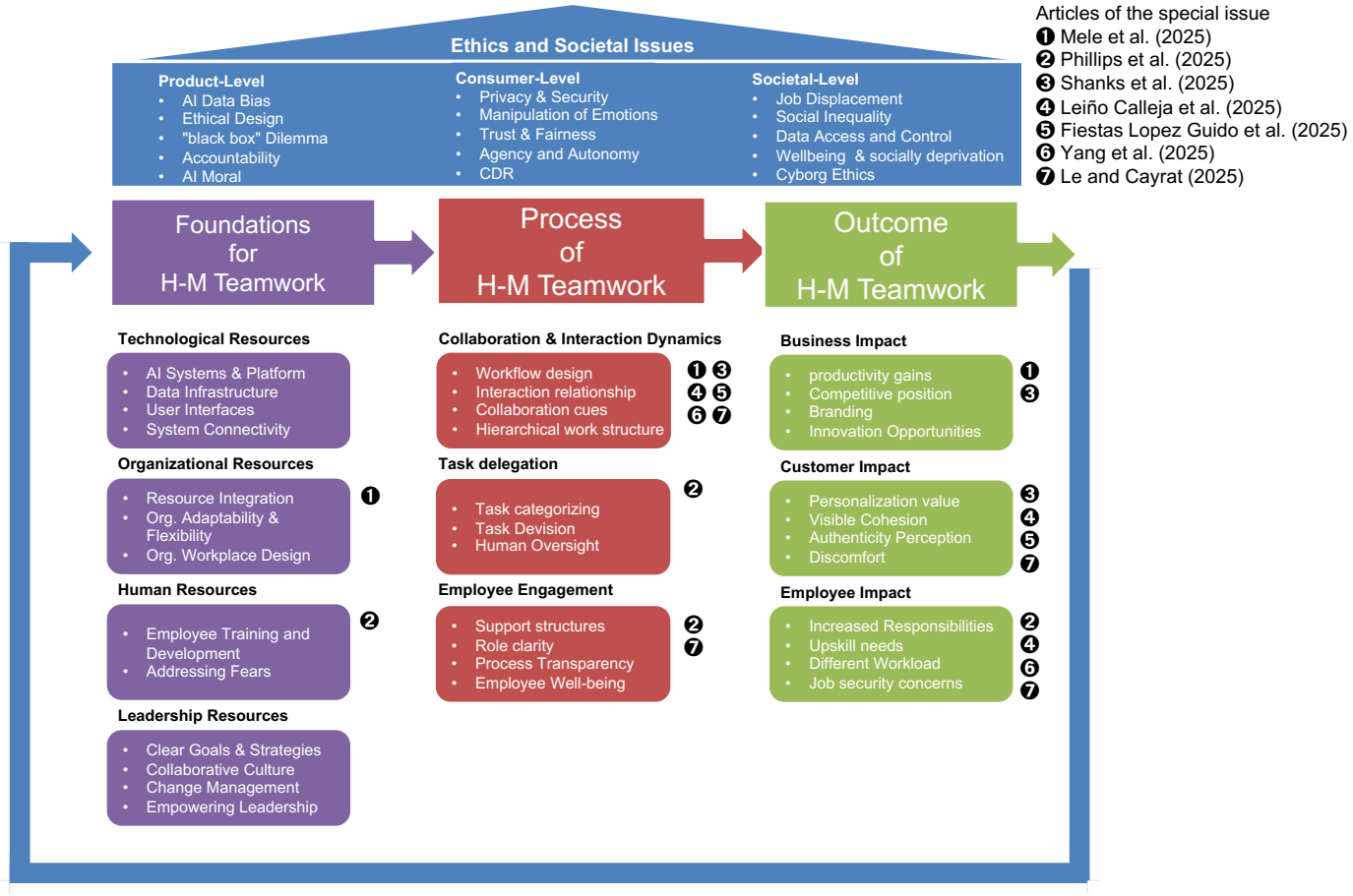

Figure 2: Research Space of Human-Machine Teamwork

Tables

Table 1: Key Concepts in Human-Machine Teamwork

Foundation Elements
Human-Machine Teamwork: Human-machine teamwork is reflected by a deep, ongoing collaboration between a human and an AI system to achieve an outcome together with clearly defined roles and responsibilities, who combine their capabilities to achieve an outcome together.
Human Employee (HE): Human workers who collaborate with digital or robotic counterparts in service delivery contexts, bringing emotional intelligence, creativity, and social skills to the partnership.
Digital Employee/Robot (DE): AI-enabled machines or software systems that collaborate with human employees, excelling in mechanical and analytical tasks while continuously learning from data collection and environmental sensing.
Technical Resources: The technological infrastructure necessary for human-machine collaboration, including AI algorithms, data management systems, connectivity solutions, and intuitive user interfaces that reduce cognitive load.
Organizational Resources: The structural elements needed for effective implementation of human-machine teamwork, including system integration capabilities, adaptable workflows, and standardized service processes that incorporate AI smoothly.
Human Resources: The human capabilities and support systems required for successful collaboration, including AI literacy training, emotional intelligence development, and initiatives to mitigate fears about job insecurity.
Leadership Resources: Strategic direction and cultural elements provided by management, including clear goals for AI integration, phased implementation plans, and fostering a collaborative culture where employees view AI as partners rather than threats.
Foundation Elements
Human Employee (HE): Human workers who collaborate with digital or robotic counterparts in service delivery contexts, bringing emotional intelligence, creativity, and social skills to the partnership.
Digital Employee/Robot (DE): AI-enabled machines or software systems that collaborate with human employees, excelling in mechanical and analytical tasks while continuously learning from data collection and environmental sensing.
Technical Resources: The technological infrastructure necessary for human-machine collaboration, including AI algorithms, data management systems, connectivity solutions, and intuitive user interfaces that reduce cognitive load.
Organizational Resources: The structural elements needed for effective implementation of human-machine teamwork, including system integration capabilities, adaptable workflows, and standardized service processes that incorporate AI smoothly.
Human Resources: The human capabilities and support systems required for successful collaboration, including AI literacy training, emotional intelligence development, and initiatives to mitigate fears about job insecurity.
Leadership Resources: Strategic direction and cultural elements provided by management, including clear goals for AI integration, phased implementation plans, and fostering a collaborative culture where employees view AI as partners rather than threats.
Process Elements

Collaboration & Interaction Dynamics: The patterns of engagement between humans and machines, characterized by coordination cues (who does what), supervisory cues (who is in charge), and team goal cues (shared objectives) that signal cohesion to customers.

Task Delegation: The strategic assignment of responsibilities between humans and machines based on task complexity, context, and relative strengths, with humans typically handling emotionally intelligent, creative, or high-stakes decisions.

Employee Engagement: The level of involvement and commitment of human employees in workplaces integrating AI, influenced by social support structures, transparency about technology decisions, and control over workflows and outcomes.

Outcome Elements

Business Impact: The effects of human-machine collaboration on organizational performance, including productivity gains, competitive advantage through optimized service processes, and enhanced innovation capabilities.

Customer Impact: The influence of human-machine teamwork on customer perceptions and experiences, including reactions to personalization, trust in service delivery, and authenticity concerns when interacting with highly anthropomorphized robots.

Employee Impact: The consequences of human-machine collaboration for workers, including changes in workload (both reduction of routine tasks and potential increases due to customer expectations), job satisfaction, and resistance to technology.

Ethical and Societal Considerations

Product-level ethical concerns: Ethical issues related to the AI systems themselves, including data biases that perpetuate discrimination, algorithmic transparency challenges, and questions about accountability for AI actions.

Consumer-Level Ethical Concerns: Ethical considerations regarding how AI affects customers, including privacy risks, potential emotional manipulation as AI mimics human emotions, and preserving consumer autonomy in AI-mediated decisions.

Societal-Level Ethical Concerns: Broader implications of AI integration, including job displacement concerns, potential exacerbation of social inequality through differential access to human versus automated services, and risks of reduced human interaction.

Artificial Companionship: A concept describing how AI agents can serve as supportive partners for service employees, alleviating work-related stress through instrumental (task aid), informative (knowledge sharing), caring (emotional support), and intimate (personalized interaction) roles.

Table 2: Mapping special issue articles to framework components and research gaps addressed

#	Article	Primary framework components	Secondary framework components	Gap addressed
1	Mele *et al.* (2025)	Organizational Resources; Collaboration Dynamics	Business Impact	Longitudinal system evolution
2	Phillips *et al.* (2025)	Human Resources, Employee Engagement; Task Delegation	Employee Impact	Employee agency in human-machine teamwork
3	Hess *et al.* (2025)	Collaboration Dynamics; Business Impact	Customer Impact	Economic feasibility of robot leadership roles
4	Leiño Calleja *et al.* (2025)	Collaboration Dynamics	Customer & Employee Impact	Stakeholder perception asymmetries
5	Fiestas Lopez Guido *et al.* (2025)	Collaboration Dynamics	Customer Impact; Ethical Issues	Role of speciesism in adoption
6	Yang *et al.* (2025)	Collaboration Dynamics	Employee Impact	Context-dependency of interaction effects
7	Le and Cayrat (2025)	Employee Engagement; Well-being	Collaboration Dynamics; Customer Impact	Social-emotional AI relationships

Table 3: research agenda for human-machine collaboration

Research Area
Foundations for H-M Teamwork
Technical Resources
• *What are the technical and organizational barriers to integrating AI with legacy systems or IoT devices in real-time service workflows, and how can they be mitigated?* • *What mechanisms enable continuous learning in AI systems without requiring excessive retraining resources or causing performance degradation?* • *How can user interfaces be personalized for different levels of technical literacy in human–machine teamwork, and in what ways can multimodal interfaces (e.g., voice or gesture) reduce cognitive load and enhance collaboration fluency with AI systems?* • *How do investments in advanced technical infrastructure translate to tangible outcomes (e.g., productivity gains, employee satisfaction) across different industries?*
Human Resources
• *Which metrics most effectively capture employees' AI-related skill retention and adaptability over time?* • *How can training programs be dynamically updated to reflect rapid technological changes in AI capabilities?* • *How can personalized learning paths be designed to accommodate employees with diverse skill levels and AI attitudes?* • *What are the long-term effects of human-machine collaboration on employees' work well-being, job satisfaction, and career development?*
Leadership resources
• *Which leadership styles best foster empowerment among frontline employees during AI rollouts?* • *Which leadership training interventions accelerate employee acceptance?* • *What theoretical frameworks can better explain the dynamics of human-machine collaboration leadership in service industries?*
Organizational resources
• *How do organizational factors (e.g., firm size, culture, industry) moderate the effectiveness of different leadership styles in AI adoption?* • *How can agile project management approaches be tailored to maintain employee motivation and reduce "change fatigue" with continuous AI updates?* • What role do relational bonds (social, structural, financial) play in shaping organizational integration of robots in service settings?

Process of H-M Teamwork

Collaboration & Interaction Dynamics

- *How do industry- or culture-specific norms (e.g., hospitality vs. banking) affect which tasks are better suited for AI versus humans?*
- *When do nuanced hybrid approaches (i.e., partial handover of emotional tasks to AI) outperform a strict "routine vs. creative" division?*
- *Which factors (e.g., AI accuracy, brand positioning) determine whether a firm should present AI as a primary or secondary actor in service encounters?*
- *How does the physical appearance or anthropomorphism of service robots influence employees' willingness to collaborate and their task allocation strategies?*
- *What are the effects of different levels of automation (e.g., assistive vs. autonomous) on employee-robot collaboration quality and sustainability?*

Task Delegation and Employee Engagement

- *How can governments and firms collaborate to offer reskilling programs that align with emerging AI roles, especially for lower-skilled workers?*
- *How do frontline employees adapt their task allocation strategies when collaborating with robots under resource constraints or high-pressure situations?*
- *How can organizations dynamically adapt emotional labor strategies to reflect varying mental health/technostress levels among frontline employees?*
- *What role do peer mentoring or "employee AI ambassadors" play in fostering acceptance and reducing stress among more skeptical staff members?*
- *Does frequent "human override" of AI decisions intensify frontline employees' emotional strain or lead to role conflict?*
- *Which HR policies (e.g., rotating employees between AI and non-AI tasks) mitigate emotional exhaustion without compromising service quality?*

Outcome of H-M Teamwork

Business Impact

- *Which performance metrics best capture the sustained productivity improvements (or declines) after AI integration, beyond short-term cost savings?*
- *How do shifts in task allocation (routine vs. strategic) alter organizational capacity for continuous innovation?*
- *Under what market or cultural conditions do the productivity gains plateau or reverse (e.g., "automation fatigue")?*
- *How do firm size, sector, or workforce composition influence the success of newly created AI-related roles?*
- *How can organizations monitor "AI assimilation" phases to detect early signs of employee disengagement or job insecurity?*

Customer Impact

- *What communication strategies are most effective in adjusting customer expectations when AI is still learning or occasionally erring?*
- *How should service firms adapt from a "trial novelty" phase to a stable "everyday AI" phase to maintain high customer engagement?*
- *Do different customer segments (e.g., tech-savvy vs. tech-cautious) require distinct AI maturity "stages" to optimize satisfaction and loyalty?*
- *Under what conditions does automation's consistency overshadow the need for human warmth in different customer journeys (e.g., routine vs. emotionally charged tasks)?*
- *Does partial anthropomorphism (e.g., text-based empathy in chatbots) suffice to build trust compared to fully "humanlike" AI solutions — and does it reduce the risk of the "uncanny valley"?*
- *Are there boundary conditions (like service type, cultural factors) under which mindsets do not significantly affect acceptance of anthropomorphic AI?*
- *To what extent can AI dynamically "shift" its style mid-interaction if it detects changing emotional states or subtle cues of a consumer's mindset?*

Ethical and Societal Issues

- *What level of detail is optimal for explaining AI-driven decisions to diverse stakeholders (customers, employees) without causing confusion or distrust?*
- *How can real-time "explainable AI" interfaces be designed to support employees who must convey algorithmic outcomes to end-users?*
- *In which situations do simpler, less "black box" AI solutions outperform more advanced but opaque algorithms in building long-term trust?*
- *Which methods (e.g., "ethics boards," cross-functional committees) are most effective at detecting or preventing privacy violations in real time?*
- *How can organizations balance data minimization with AI's hunger for big data to maintain consistent service quality without over-collecting information?*
- *In what ways do different societal contexts (e.g., developed vs. emerging markets) influence whether AI adoption leads to net employment gains or losses?*
- *Which governance models (centralized vs. distributed oversight committees) are most effective in ensuring accountability and transparency across various service settings?*
- *Which real-time monitoring tools can detect AI-driven privacy breaches (e.g., over-collection of user data) and halt them before reputational damage occurs?*

Web-Appendix

Table A1: Literature table of identified literature

Authors	Title	Study Design	Key Findings in general
Wirtz *et al.* (2018)	Brave new world: service robots in the frontline	Conceptual/theoretical paper	- Service robots are defined and contrasted with human employees, with insights into task dominance. - The service robot acceptance model (sRAM) is advanced to understand consumer perceptions. - Ethical issues such as privacy and dehumanization are significant concerns. - Service robots provide consistent, error-free service and can mimic emotions effectively. - They are expected to impact market dynamics but not provide long-term competitive advantage. - A high percentage of customer interactions are predicted to be automated by 2020. - Ethical challenges like privacy and social deprivation need addressing.
Huang and Rust (2018)	Artificial Intelligence in Service	Conceptual/theoretical paper	- AI development follows a predictable order from mechanical to empathetic intelligence. - AI job replacement occurs at the task level, starting with lower intelligence tasks. - Analytical skills will become less important as AI takes over these tasks, increasing the importance of intuitive and empathetic skills. - AI presents both opportunities for innovation and threats to employment. - Education should focus on developing intuitive skills as AI advances in analytical tasks. - Soft skills will be crucial for future employability. - AI's ultimate path could be either replacement or integration with human workers. - Firms should design strategies that integrate human and machine capabilities. - Intuitive and empathetic skills are lasting advantages for human workers.
De Keyser *et al.* (2019)	Frontline Service Technology infusion: conceptual archetypes and future research directions	Conceptual/theoretical paper	- The paper updates existing classifications of Frontline Service Technology (FST) infusion with new archetypes focused on augmentation and substitution roles. - Smart technologies and connected objects are transforming traditional service encounters and introducing new interaction forms. - Conversational agents, XR, and blockchain technologies are relevant across most archetypes, impacting service delivery and experience. - The updated archetypes provide a framework for organizing literature and guiding managerial strategies in technology integration. - The paper emphasizes the significant impact of these technologies on the customer-FLE-technology triad within the service pyramid.
Garry and Harwood (2019)	Cyborgs as frontline service employees: a research agenda	Conceptual/theoretical paper	- Cyborg characteristics significantly alter service interactions compared to traditional human interactions. - "Melding" is proposed as a new category of technological impact on frontline employees. - Cyborg FLEs offer a unique context for exploring business impacts, presenting both opportunities and challenges. - Cyborgs can leverage big and small data to enhance customer interactions. - Cyborgs can use intuitive and emotional intelligence to improve service quality.

			- Cyborgs play a complex role as coordinators in service ecosystems. - Cyborgs can overcome challenges of technology substitution in customer interactions. - Ethical considerations pose significant concerns for cyborg integration.
Bock *et al.* (2020)	Artificial intelligence: disrupting what we know about services	Conceptual/theoretical paper	- AI is dramatically impacting marketing and services, necessitating a reevaluation of existing service theories. - Traditional service theories are inadequate for predicting AI-related phenomena, requiring substantial modifications or new theories. - Service AI is defined as technology that provides value through flexible adaptation, challenging existing assumptions about service provision and cocreation. - Ethical issues related to AI in services need new frameworks to prevent misconduct.
Lu *et al.* (2020)	Service Robots, Customers, and Service Employees: What Can We Learn from the Academic Literature and Where are the Gaps?	Systematic review	- Service robots enhance productivity and job satisfaction by taking over routine tasks. - They streamline service processes, reducing service time and improving quality. - Human-robot collaboration is beneficial for complex tasks. - Employees need to upskill, focusing on soft skills like empathy and creativity. - Negative impacts include customer discomfort with humanoid robots and employee job insecurity. - Current research is fragmented and focuses on initial adoption stages.
Meyer *et al.* (2020)	Frontline Employees' Acceptance of and Resistance to Service Robots in Stationary Retail - An Exploratory Interview Study	Empirical qualitative study	- The study identifies five key categories affecting FLEs' acceptance and resistance to service robots: loss of status, tension, required commitment, role incongruency, and advocation. - Service robots can foster retail innovation but may lead to resistance if not managed properly. - Retailers need to enable, engage, and empower FLEs by providing resources, fostering emotional attachment, and granting decision-making authority. - Understanding FLEs' perceptions is crucial for developing strategies that enhance job satisfaction and sales performance. - The research contributes to existing theories by identifying new aspects not fully covered by them. - The study acknowledges limitations, such as the need for further empirical validation and focus on a specific region.
Robinson *et al.* (2020)	Frontline encounters of the AI kind: An evolved service encounter framework	Conceptual/theoretical paper	- AI is transforming service encounters by enabling new interaction types where either the customer or FLE can be AI. - A framework categorizes interactions into interhuman, interspecific, and interAI encounters. - The concept of "counterfeit service encounters" raises ethical concerns about trust and transparency. - AI can replace human FLEs in routine and complex tasks, potentially improving efficiency. - AI enhances customer experiences by providing faster and more accurate responses. - AI introduction may lead to a more interesting work environment for human FLEs. - Counterfeit encounters may negatively impact trust and have societal implications.
Dixon *et al.* (2021)	The Robot Revolution: Managerial and	Empirical quantitative study	- Robot adoption increases total employment in robot-adopting firms but decreases managerial employment. - Robots reduce the need for supervision, leading to a decline in managerial positions.

	Employment Consequences for Firms		- Decision-making authority is both centralized and decentralized with robot adoption. - Performance-based pay linked to individual performance increases with robot adoption. - Robots are primarily adopted to improve product and service quality, not to reduce labor costs. - Workforce composition shifts with a decrease in middle-skilled jobs and an increase in low- and high-skilled positions. - Organizational practices change, with decentralization of training decisions and centralization of production technology choices.
Du and Xie (2021)	Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities	Conceptual/theoretical paper	- The paper evaluates ethical challenges in AI-enabled products and suggests CSR as a means to shape ethical AI. - It identifies multi-functionality, interactivity, and intelligence stage as key dimensions with ethical implications. - High interactivity in AI products can lead to privacy, cybersecurity, and autonomy issues. - AI negatively impacts individual autonomy and wellbeing, contributing to digital addiction. - A conceptual framework for AI-related CSR is proposed to address ethical issues and gain legitimacy. - CSR activities are influenced by product characteristics, company factors, and institutional environments.
Figueiredo and Pinto (2021)	Robotizing shared service centres: key challenges and outcomes	Empirical qualitative study, Case study	- RPA implementation in SSCs leads to both job displacement and creation of new roles like robot developers and managers. - RPA optimizes processes, reduces errors, and increases data processing capacity. - Job displacement is gradual, with less specialized workers being replaced by more technologically skilled ones. - RPA implementation is influenced by coercive, normative, and mimetic isomorphism. - The impact on employment is complex, involving both job cuts and upskilling requirements. - Challenges include measuring economic impact and managing workplace tensions.
Leone *et al.* (2021)	How does artificial intelligence enable and enhance value co-creation in industrial markets? An exploratory case study in the healthcare ecosystem	Case study	- Leveraging different types of AI and specific value co-creation mechanisms is crucial for service innovation in B2B healthcare. - An integrative framework shows how AI-based solutions enhance customer-centric solutions and improve patient care. - Rigorous protocols, reliable models, and a customer-centric approach are key to promoting value co-creation. - Integration of perceptive and responsive mechanisms is necessary for better customer-centric offers and flexible revenue models. - Horizontal collaborations improve AI competencies and offer sophisticated solutions. - Integration of AI types with value co-creation mechanisms and market knowledge is necessary for creating value. - Iterative inter-organizational relationships help capture complex needs for AI-based solutions. - Proper management of AI technologies requires attention to data management and knowledge distillation.
Li *et al.* (2021)	Value co-creation in industrial AI:	Case study	- Four types of value are co-created in industrial AI: strategic co-planning, functional value, joint organizational learning, and customer experience value.

	The interactive role of B2B supplier, customer and technology provider		- System management capabilities are crucial for addressing technical challenges in AI development. - Commercialization-based capabilities enhance marketing and production activities through AI. - Interpersonal capabilities are vital for building trust and maintaining relationships in AI integration. - Dynamic interaction between value types and capabilities requires a flexible approach for successful AI implementation. - Value co-creation in industrial AI is a collective process involving collaboration among stakeholders. - AI facilitates value creation among suppliers, AI vendors, and customers, enhancing supply chain integration. - Different capabilities are needed at various stages of AI implementation to maximize benefits.
McLeay *et al.* (2021)	Replaced by A Robot: Service Implications In The Age of the Machine	Empirical quantitative study	- Augmenting or substituting human employees with FLSRs has both positive and negative consequences. - FLSRs enhance perceived innovativeness in customer interactions. - Substituting human employees with FLSRs damages the ethical/societal reputation of service providers. - Customer characteristics influence perceptions of FLSRs. - Humanoid FLSRs negatively affect perceived innovativeness-responsibility fit compared to self-service machines. - FLSRs are more successful in asset-builder contexts than service-provider contexts. - Augmentation is less damaging to ethical reputation than substitution. - Understanding customer evaluations of FLSRs is crucial for service providers.
Mele *et al.* (2021)	Smart nudging: How cognitive technologies enable choice architectures for value co-creation	Case study, Empirical qualitative study	- Smart nudges facilitated by cognitive technologies contribute to value co-creation. - Four types of cognitive technology solutions are identified: smart wearables, intelligent tools, conversational agents/social robots, and intelligent platforms. - These technologies create choice architectures that enhance resource accessibility, engagement, and agency. - Cognitive technologies improve decision-making by providing real-time resources and extending engagement. - Social robots and platforms reduce information asymmetries and engage users effectively. - Cognitive technologies support resource integration and augment human agency. - Smart nudges influence behavior by being sensitive to decision-making processes. - Cognitive technologies shape contexts and amplify self-understanding and control. - Smart nudging enhances agency and boosts value co-creation.
Tuomi *et al.* (2021)	Applications and Implications of Service Robots in Hospitality	Empirical qualitative study	- Service robots support or substitute employees in hospitality settings. - Robots are effective for simple, repetitive tasks, enhancing efficiency and allowing humans to focus on complex tasks. - They improve process management, quality control, and cost savings. - The novelty of robots can differentiate businesses but may not be sustainable long-term. - Robots struggle with dynamic conditions, leading to potential service failures. - Integration of robots changes employment roles, requiring new skills. - There is a lack of strategic oversight in handling robot-related service failures.

Xiao and Kumar (2021)	Robotics for Customer Service: A Useful Complement or an Ultimate Substitute?	Conceptual/theoretical paper	- The paper proposes a framework to study the effects of robotics in customer service, focusing on antecedents and consequences. - Robotics can enhance service quality by reducing variations in service experience. - Robots are best suited for routine, repetitive tasks and are expected to complement human workers. - Integration of robots requires ongoing human training and supervision. - Robots excel in efficiency and accuracy but lack creativity and empathy. - Firms should embrace robotics as a complement to human labor.
Yun *et al.* (2021)	Behavioral and neural evidence on consumer responses to human doctors and medical artificial intelligence	Empirical quantitative study	- Consumers express positive intentions towards medical AI when it uses personalized conversation, but neural responses reveal implicit apathy. - Human doctors are perceived as more prosocial, with consistent willingness to follow their recommendations regardless of conversation type. - Personalized conversation reduces explicit resistance to medical AI but does not alter implicit neural apathy. - Replacing human doctors with medical AI is impractical due to the lack of emotional connection in AI interactions.
Bagozzi *et al.* (2022)	AI Service and Emotion	Conceptual/theoretical paper	- AI in service can perform routine, analytical, and empathetic tasks. - AI interactions generate basic, self-conscious, and moral emotions. - AI is transforming the service economy into a feeling economy with empathy as a critical component. - AI's empathetic capabilities have significant theoretical and managerial implications. - AI can act as an agent for both customers and firms in service interactions. - Positive emotional experiences with AI enhance mental and physical health. - Negative emotional experiences with AI can harm well-being. - Emotions are crucial for engaging with AI and sustaining interaction. - AI has the potential to improve lives and businesses beyond satisfaction.
Caruelle *et al.* (2022)	Affective Computing in Marketing: Practical Implications and Research Opportunities Afforded by Emotionally Intelligent Machines	Conceptual/theoretical paper	- Affective computing is gaining interest due to its potential commercial applications. - Major firms are investing in affective computing to enhance customer experiences. - Affective computing can transform marketing by providing insights into consumer emotions and reducing the need for human emotional management. - A framework for affective computing in marketing includes empathic, collaborative, and interactive uses. - Empathic computing aids in understanding consumer emotions for market research. - Collaborative computing assists employees in responding to consumer emotions. - Interactive computing enriches consumer-bot interactions with emotional intelligence. - Understanding consumer emotions is crucial for marketing, and affective computing will transform this process.
Dodds *et al.* (2022)	Blended human-technology service realities in healthcare	Conceptual/theoretical paper	- The paper identifies key mechanisms (shared control, emotional-social and cognitive complexity) and influencing factors (agency, meaningful interactions, DART) affecting well-being in blended human-technology service realities. - It introduces a conceptual framework with three types of service realities: human-dominant, balanced, and technology-dominant.

			- Shared control is emphasized as a critical mechanism for enhancing well-being. - Positive impacts include increased satisfaction, trust, reduced anxiety; negative impacts include reduced consumer power and increased distance. - Agency is proposed as a factor to mitigate negative impacts and enhance shared control. - Emotional-social and cognitive complexity are important considerations in these interactions. - Potential tensions due to agency risks and information asymmetries are acknowledged. - Service robots have potential benefits but also challenges in terms of acceptance and understanding.
Esmaeilzadeh and Vaezi (2022)	Conscious Empathic AI in Service	Conceptual/theoretical paper	- AI consciousness leads to empathic human-machine relationships. - Empathic AI improves service outcomes and accountability. - Conscious empathic AI increases adoption and use in services. - Conscious empathic AI provides more accountable services. - Conscious AI allows genuine interactions beyond anthropomorphism. - Conscious empathic AI enhances customer experiences and adoption. - Conscious empathic AI transforms human perceptions and interactions with AI.
Flavián *et al.* (2022)	Intention to use analytical artificial intelligence (AI) in servicesthe effect of technology readiness and awareness	Empirical quantitative study	- Technological optimism increases the intention to use robo-advisors, while insecurity decreases it. - Surprisingly, technological discomfort promotes the adoption of robo-advisors. - Service awareness significantly increases the acceptance of robo-advisors. - Awareness is particularly important for younger customers and women. - The name "AI-advisor" creates higher use intention than "robo-advisor" among those aware of the service. - Older customers have lower intentions to use robo-advisors. - Men and women are equally inclined to use robo-advisors. - Previous investment experience does not affect the intention to use robo-advisors.
Hyun *et al.* (2022)	Discovering meaningful engagement through interaction between customers and service robots	Empirical quantitative study	- Perceived hospitability and robot performance competence are essential for both experiential and instrumental outcomes. - Perceived coolness enhances experiential outcomes but not instrumental ones. - Perceived robot safety is crucial for instrumental outcomes but not experiential ones. - Experiential and instrumental outcomes increase the intention to use service robots. - Viability of human-robot team service positively affects the intention to use service robots. - Personal innovativeness moderates the impact of perceived robot safety and performance competence on instrumental outcomes. - Socio-functional elements are key to creating meaningful engagement with service robots.
Kim *et al.* (2022)	Home-Tutoring Services Assisted with Technology: Investigating the Role of Artificial Intelligence Using a Randomized Field Experiment	Randomized controlled trial	- AI-generated reports significantly improve students' academic performance by aiding tutors in adapting to students' needs. - Some tutors exhibit AI aversion, which can moderate the effectiveness of AI on outcomes. - Tutors with high education and experience levels show AI aversion but do not benefit less in terms of student performance. - Tutors with high workloads use AI but do not see expected improvements, suggesting issues like technology overload. - Understanding and addressing difficulties in using AI is crucial for maximizing its benefits.

			- There is a negative correlation between the propensity to view AI reports and the benefit derived, indicating those less inclined to use them may benefit more. - External factors and environments significantly influence the effectiveness of AI technology.
Kot and Leszczyński (2022)	AI-activated value co-creation. An exploratory study of conversational agents	Case study	- Conversational agents significantly differ from other technologies in their value-in-use dimensions. - AI-activated value is dynamic, context-dependent, and often unclear. - Conversational agents replace human employees in customer service but are perceived as artificial. - Successful implementation requires substantial client commitment. - Conversational agents transform organizational resources and processes. - The value co-created by conversational agents evolves rapidly. - The AI black box problem makes AI-activated value difficult to predict and understand.
Ma and Ye (2022)	Linking artificial intelligence to service sabotage	Empirical quantitative study	- AI awareness among frontline employees directly leads to service sabotage. - Organization-based self-esteem partially mediates the relationship between AI awareness and service sabotage. - Perceived organizational support moderates the effect of AI awareness on service sabotage, reducing its negative impact. - The introduction of AI negatively impacts the psychology of frontline employees, leading to dissatisfaction and negative behaviors. - Training and learning can mitigate the stress and negative attitudes caused by AI introduction.
Mele *et al.* (2022)	Boundary work in value co-creation practices: the mediating role of cognitive assistants	Empirical qualitative study, Case study	- Cognitive assistants act as boundary objects that bridge actors, resources, and activities in healthcare. - They facilitate four main actions: automated dialoguing, augmented sharing, connected learning, and multilayered trusting. - These actions lead to two value co-creation practices: empowering ageing actors in medical care and engaging them in a healthy lifestyle. - Cognitive assistants enhance communication by transforming medical language into patient-friendly terms. - They increase access to knowledge and capabilities, fostering resource integration and value co-creation.
Odekerken-Schröder *et al.* (2022)	Service robots: value co-creation and co-destruction in elderly care networks	Empirical qualitative study	- The study identifies six roles for socially assistive robots in elderly care networks: enabler, intruder, ally, replacement, extended self, and deactivator. - Robots can support physical, psychosocial, and cognitive health, with roles having both value co-creating and co-destroying potential. - The introduction of robots should balance their positive impacts (e.g., unburdening caregivers) against potential negative effects (e.g., privacy invasion). - The research provides strategic guidelines for stakeholders to manage the introduction of robotic technology in care settings.
Odekerken-Schröder *et al.* (2022)	The service triad: an empirical study of service robots, customers and	Empirical quantitative study followed by	- Anthropomorphism and social presence enhance both utilitarian and hedonic values of service robots. - Utilitarian value significantly impacts customer repatronage intentions more than hedonic value. - High-quality interactions with human employees can augment the perceived value of service robots. - Hedonic value's impact on repatronage is context-dependent, being significant in experimental settings

	frontline employees	Field experiment	but not in field studies. - Service robots can substitute human interactions if their utilitarian value is optimized.
Paluch *et al.* (2022)	"My colleague is a robot"exploring frontline employees' willingness to work with collaborative service robots	Empirical qualitative study	- Interaction with service robots involves a multistage appraisal process based on adoption-related perceptions. - Important attributes influencing appraisal include employee, robot, and job characteristics. - Four personas (supporter, embracer, resister, saboteur) illustrate varied employee attitudes towards robot collaboration. - Autonomy of robots is seen as a threat due to potential disregard for social rules and hierarchies. - Positive outcomes include increased reliability, efficiency, and task delegation. - Negative aspects involve trust issues, isolation from lack of human interaction, fear of job replacement, and data privacy concerns. - A trade-off exists between employees' desire for control and robot autonomy, impacting collaboration willingness.
Spring *et al.* (2022)	How information technology automates and augments processes: Insights from Artificial-Intelligence-based systems in professional service operations	Case study	- AI-based systems automate and augment professional work, improving performance and enabling new service offerings. - AI primarily handles back-office tasks, enhancing efficiency without reducing client interaction. - AI restructures processes, improving speed and quality rather than just reducing costs. - AI facilitates innovation and service extension, expanding business capabilities. - AI systems are applied to narrowly defined problems, indicating targeted use. - AI increases professional-client interaction by freeing up professionals' time for advisory work. - Quality performance is enhanced through AI, improving service delivery. - AI adoption is exploratory, aimed at leveraging technology for operational benefits.
Vorobeva *et al.* (2022)	Thinking Skills Don't Protect Service Workers from Replacement by Artificial Intelligence	Empirical quantitative study	- The presence of AI increases negative outcomes for employees engaging in thinking tasks due to adverse effects on perceived ability. - These detrimental effects occur when employees compare their abilities with AI. - Employees engaged in thinking tasks experience more negative feelings, reduced perceived ability, increased fear of replacement, and lower job performance. - Conversely, jobs requiring feeling intelligence may have a brighter future with less negative impact from AI. - AI serves as a comparison standard affecting feelings and job performance. - The shift towards feeling tasks in the Feeling Economy may reduce fear of AI replacement and improve job performance.
Xue *et al.* (2022)	Is College Education Less Necessary with AI? Evidence from Firm-Level Labor Structure Changes	Empirical quantitative study	- AI applications are positively associated with overall employment and increase the employment of nonacademically-trained workers. - AI applications lead to a decline in demand for academically-trained workers, indicating a deskilling effect. - The positive impact of AI on employment is more significant in the service sector than in manufacturing. - AI's influence on labor structures involves both augmentation and deskilling effects.

Abou-Foul *et al.* (2023)	The impact of artificial intelligence capabilities on servitization: The moderating role of absorptive capacity-A dynamic capabilities perspective	Empirical quantitative study	- AI capabilities positively impact servitization, enhanced by absorptive capacity. - Advancing AI in internal processes, resource optimization, and social innovation is key to servitization. - AI significantly enhances customer value propositions. - Combining process and resource optimization with societal good enhances collaboration and service provision. - Absorptive capacity strengthens the relationship between AI capabilities and servitization. - Societal good is crucial for advancing servitization. - AI capabilities in societal good, resource optimization, and process optimization are sufficient for servitization.
Chen *et al.* (2023)	Chatbot or human? The impact of online customer service on consumers' purchase intentions	Empirical quantitative study	- Matching customer service type with product type positively affects purchase intentions. - AI chatbots are more effective for search products, while humans are better for experience products. - The matching effect is mediated by processing fluency and perceived service quality. - The effect is significant only when consumer demand certainty is low. - The findings are confirmed through both simulated and actual interaction experiments. - The study provides practical insights for optimizing AI chatbot and human employee allocation in e-commerce.
Do *et al.* (2023)	Empathetic creativity for frontline employees in the age of service robots: conceptualization and scale development	Empirical quantitative study, with elements of empirical qualitative study and field experiment	- The study introduces "empathetic creativity" as a multidimensional construct essential for FLEs to remain competitive against service robots. - Empathetic creativity enhances empathetic intelligence, a key human advantage over robots. - A 13-item scale was developed to measure empathetic creativity, aiding future research and practice. - Training FLEs to improve empathetic creativity through effort is emphasized, as it can be cultivated over time. - Empathetic creativity is linked to positive job outcomes like helping behavior and service recovery performance. - AI's current limitations in achieving empathetic intelligence are acknowledged, with decades needed for potential robot advancement.
Fukawa and Rindfleisch (2023)	Enhancing innovation via the digital twin	Conceptual/theoretical paper, with case study elements	- Digital twins enhance innovation by enabling monitoring, making, enhancing, and replicating processes. - They integrate with AI, big data, and 3D printing to overcome data challenges and reduce human interaction. - The digital twin market is expanding rapidly, with significant interest from leading firms. - Digital twins are still in early development and not fully integrated into broader innovation strategies.
Han *et al.* (2023a)	Partners or Opponents? How Mindset Shapes Consumers' Attitude Toward Anthropomorphic Artificial	Empirical quantitative study	- Competitive mindset consumers respond less favorably to anthropomorphic AI robots compared to non-anthropomorphic ones. - Collaborative mindset consumers respond more favorably to anthropomorphic AI robots compared to non-anthropomorphic ones. - Perceived psychological closeness mediates these effects, with competitive mindsets decreasing and collaborative mindsets increasing closeness.

	Intelligence Service Robots		- Interaction distance moderates these effects; placing robots far from consumers attenuates both negative and positive impacts.
Han *et al.* (2023b)	Bots with Feelings: Should AI Agents Express Positive Emotion in Customer Service?	Empirical quantitative study	- The paper explores the role of emotion expressed by AI service agents, a new research area. - Positive emotions from human agents improve service quality and satisfaction, but not from AI agents. - Dual pathways (affective and cognitive) affect service evaluations, with expectation-disconfirmation being crucial. - AI-expressed emotions can cause emotional contagion but may violate customer expectations, negating benefits. - Relationship norm orientation moderates effects; communal-oriented individuals respond more positively to AI-expressed emotions. - AI-expressed emotions may be beneficial in communal contexts but could backfire in exchange-oriented contexts.
Ivanov (2023)	The dark side of artificial intelligence in higher education	Conceptual/theoretical paper	- AI in higher education presents significant negative aspects such as biases, plagiarism, factual inaccuracies, micromanagement, manipulation, surveillance, overreliance, lack of transparency, skill loss, and privacy concerns. - These negative impacts often stem from human decisions in AI design and implementation. - HEIs must carefully choose their approach to algorithmic decision-making to maintain human control and transparency. - Despite potential drawbacks, adopting AI is essential for HEIs to remain competitive. - The negative impacts of AI should not deter its use in HEIs. - AI's effects extend beyond HEIs, impacting society at large.
Kondapaka *et al.* (2023)	Finding a fit between CXO's experience and AI usage in CXO decision-making: evidence from knowledge-intensive professional service firms	Empirical qualitative study	- The study emphasizes the need for balancing CXOs' experiences with AI applications for successful technology implementation. - A strategic resource can be created through the co-creation of value by CXOs and AI. - Human involvement is crucial in AI implementation, especially regarding ethical considerations. - A proposed framework integrates AI and human competencies, addressing ethical and privacy concerns. - Change management programs can facilitate harmonious collaboration between AI and humans. - AI adoption requires organizational restructuring around digital technologies.
Le *et al.* (2023)	Employee-(ro)bot collaboration in service: an interdependence perspective	Conceptual/theoretical paper	- The FLERI framework integrates structural and behavioral interdependence aspects in human-robot teams, a novel approach in service literature. - FLERI visibility through cooperative behaviors is crucial for customers to evaluate teamwork effectiveness. - FLERI might reduce perceived autonomy of employees and robots, potentially affecting service quality negatively. - The FLERI framework serves as a guide for designing hybrid human-robot teams in service settings. - Implementing FLERI is expected to enhance customer satisfaction by improving service experience.

			- Despite benefits, FLERI could have negative implications, such as reduced autonomy and decreased service quality.
Leiño Calleja *et al.* (2023)	Some agents are more similar than others: customer orientation of frontline robots and employees	Empirical quantitative study	- FLEs are perceived as more customer-oriented than FLRs due to higher competence and warmth evaluations. - A relational interaction style can reduce the perceived competence gap between FLRs and FLEs. - Transitioning from FLE to FLR during the customer journey negatively impacts FLR evaluations. - Under certain conditions, FLRs can be perceived as competent and warm as human employees. - Robots are perceived as having agency, which is a positive finding for their role in customer service. - Using FLRs in a consistent manner across stages can mitigate negative perceptions. - Avoid transitioning customers from human employees to robots during the journey to prevent negative impacts.
Phillips *et al.* (2023)	The Robotic-Human Service Trilemma: the challenges for well-being within the human service triad	Systematic review	- The Robotic-Human Service Trilemma consists of three challenges: intrusion, sideline, and indifference. - FLEs face an increased task burden due to the constraints of service robots. - There is a paradox where service robots increase rather than decrease workload for FLEs. - Social-emotional capabilities of service robots are often overestimated. - Effective integration requires a blend of augmentation and substitution roles for service robots. - The introduction of service robots disrupts the well-being equilibrium within the human service triad.
Rancati and Maggioni (2023)	Neurophysiological responses to robot-human interactions in retail stores	Field experiment	- Interaction with service robots increases customer immersion during welcome and surprise moments. - Immersion positively affects visit duration, but this effect is weaker with robot interactions. - Participants interacting with robots have shorter visit durations compared to those with human sales associates. - Robots enhance efficiency but may reduce immersion in key moments like store introduction and storytelling. - Human sales associates are essential for developing customer loyalty and increasing store visit duration.
Shi *et al.* (2023)	Robot service failure: the doubleedged sword effect of emotional labor in service recovery	Empirical quantitative study	- Deep acting by employees increases customer satisfaction after robot service failures. - Surface acting by employees decreases customer satisfaction and is less effective than no emotional labor. - Customer satisfaction is influenced by whether the failure is attributed to the robot or the employee. - Attributing failure to employees results in harsher judgments and lower satisfaction, especially with surface acting. - Attributing failure to robots makes surface acting ineffective but not damaging. - Past experience with robots can lead to greater tolerance for service failures.
Söderlund (2023)	Service robots and artificial morality: an examination of robot behavior that violates human privacy	Empirical quantitative study	- Robot privacy violations negatively impact their evaluation by humans, mediated by perceived morality and humanness. - Robots respecting privacy are rated higher in morality, humanness, and overall evaluation. - Humans react to robots similarly to humans, especially in moral contexts. - Service robots can be perceived as having a level of morality, affecting their acceptance. - Designing robots with privacy-preserving norms is crucial for better acceptance. - Findings have implications for companies designing and implementing service robots.

Tojib *et al.* (2023)	How does service robot anthropomorphism affect human co-workers?	Empirical quantitative study	- The effect of service robot anthropomorphism on employee resistance and morale is mediated by perceived job-security threat. - AI type moderates this mediation, with mechanical AI increasing perceived job-security threat for highly anthropomorphic robots. - Service robots transform employee roles into enablers, innovators, and coordinators rather than fully substituting them. - The competency of robots, not just anthropomorphism, drives employee reactions. - Robots capable of fully transforming roles are perceived as more threatening to job security. - Firms need to clarify the intended role of service robots to mitigate negative employee reactions.
Willems *et al.* (2023)	Frontline employee expectations on working with physical robots in retailing	Empirical qualitative study, Empirical quantitative study (mixed-methods approach)	- Retail FLEs expect robots to alleviate certain job demands but not replenish job resources. - The introduction of robots is seen as a zero-sum game, with mixed impacts on job engagement and well-being. - Robots are expected to reduce physically heavy work and mentally repetitive tasks. - Concerns exist about reduced job security and career opportunities due to robots. - Fear of job loss to robots is prevalent among FLEs. - Effective communication is needed to highlight how robots complement human workers.
Alkire *et al.* (2024)	RAISE: leveraging responsible AI for service excellence	Conceptual/theoretical paper	- Generative AI (GenAI) democratizes access to advanced AI capabilities, impacting the service industry significantly. - The rapid spread of AI technologies presents both opportunities and challenges, necessitating responsible usage. - Ethical concerns such as misinformation, privacy, and security risks are critical issues that need addressing. - The RAISE framework is proposed to integrate AI responsibly into service industries through stakeholder collaboration. - The framework aligns AI deployment with global standards and societal well-being while promoting business success. - Emphasizes balancing profit generation with social good, advocating for an integrated approach. - Provides practical recommendations for adopting responsible and sustainable AI practices.
Blaurock *et al.* (2024)	Designing Collaborative Intelligence Systems for Employee-AI Service Co-Production	Empirical quantitative study	- Strong CI systems enhance perceived service improvement and outcome responsibility. - Transparency, process control, and outcome control are key features for positive employee outcomes. - Reciprocal strength enhancement positively affects service improvement and responsibility but not meaning of work. - Engagement does not significantly impact employee outcomes. - CI systems have stronger effects on AI novices than experienced users.
Blümel *et al.* (2024)	Personal touch in digital customer service: a conceptual	Systematic review	- Personalizing empathy, small talk, humor, personal pronouns, and data-driven communication in text-based customer service positively impacts customer experience. - Greater freedom in communication enhances personalization and improves customer experience. - Understanding social cues and relational history is crucial for effective personalization.

	framework of relational personalization for conversational AI		- Human employees are perceived as more competent and warmer than chatbots, leading to higher patronage intentions. - AI's expression of positive emotions is less effective than human expressions due to expectation–disconfirmation.
Chandra and Rahman (2024)	Artificial intelligence and value co-creation: a review, conceptual framework and directions for future research	Systematic review	- The study identifies human behavior, cognition, and social interactions as common theoretical grounds for VCC and AI. - AI functionalities and customer characteristics are key antecedents in AI-facilitated VCC. - AI is categorized into mechanical, thinking, and feeling types, influencing functional, emotional, and social VCC. - AI enhances personalization and fosters psychological ownership, promoting collaboration through network effects. - Anthropomorphic AI systems build trust and familiarity, influencing customer decision-making and co-creation participation. - The study acknowledges limitations in its scope and methodology.
Gnewuch *et al.* (2024)	More Than a Bot? The Impact of Disclosing Human Involvement on Customer Interactions with Hybrid Service Agents	Field experiment, followed by controlled online experiment	- Disclosing human involvement leads to a more human-oriented communication style from customers. - This change is driven by impression management concerns. - Employee workload increases due to the more complex communication style. - Up-front disclosure has a stronger effect than step-in disclosure. - Disclosures lead to longer interactions and increased likelihood of seeking human involvement. - Negative sentiment may increase with disclosure.
Hollebeek *et al.* (2024)	Engaging consumers through artificially intelligent technologies: Systematic review, conceptual model, and further research	Systematic review	- AI-based consumer engagement (CE) enhances service accuracy and quality through learning capabilities. - AI technologies facilitate value co-creation by reducing perceived costs and offering personalized solutions. - AI reduces consumer effort in task execution, improving service quality assessments. - Potential negative impacts include reduced perceived value during service failures or unmet expectations. - AI interactions shift the nature of consumer engagement by altering resource investments. - Human-AI collaboration affects service viability, highlighting dynamic interaction dynamics.
Huang *et al.* (2024)	Pairing up with anthropomorphized artificial agents: Leveraging employee creativity in service encounters	Empirical quantitative study	- Anthropomorphized AAs paired with creative employees enhance service evaluations by increasing perceived creativity. - The effect of anthropomorphism is mediated by perceived entitativity and AA creativity. - The positive impact of anthropomorphism is reduced when dyads have low temporal stability, weak lay beliefs about group entitativity, or utilitarian consumption goals. - Anthropomorphized AA-human dyads can be as effective as human-human dyads and more cost-effective. - The research provides insights into optimizing human-machine interaction dynamics in service settings.

Hur and Shin (2024)	Service employees' STARA awareness and proactive service performance	Empirical quantitative study	- STARA awareness negatively impacts proactive service performance through decreased job autonomy. - High self-efficacy weakens the negative impact of STARA awareness on job autonomy. - Resilience alone does not significantly moderate the relationship between STARA awareness and job autonomy. - A combination of high self-efficacy and resilience buffers the negative effects of STARA awareness on job autonomy. - Job autonomy mediates the relationship between STARA awareness and proactive service performance.
Lei *et al.* (2024)	Unethical Consumer Behavior Following Artificial Intelligence Agent Encounters: The Differential Effect of AI Agent Roles and its Boundary Conditions	Empirical quantitative study (primary), Field experiment (secondary)	- Consumers are more likely to engage in unethical behavior with servant AI agents than partner AI agents due to increased anticipatory moral disengagement. - This effect is reduced among consumers with high moral identity, with human-like AI agents, and in contexts of high behavioral visibility. - Designing AI agents with human-like features can mitigate anticipatory moral disengagement. - Behavioral visibility influences consumers' perception of AI's ability to detect fraud. - Presenting AI agents as partners rather than servants can promote ethical interactions.
Marti *et al.* (2024)	Leveraging artificial intelligence in firm-generated online customer communities: a framework and future research agenda	Conceptual/theoretical paper	- AI enhances customer interaction and engagement by revolutionizing feedback mechanisms and overall engagement. - AI efficiently moderates content, maintaining a respectful community environment. - AI personalizes content by analyzing large datasets, enhancing user engagement and satisfaction. - AI efficiently handles customer queries without human intervention. - AI supports value co-creation and customer engagement in B2C and B2B contexts. - AI integration poses risks such as technological failures and security breaches. - AI can improve personalization but may lead to irritation if perceived as impersonal. - AI has the potential to improve customer loyalty through personalization and efficient communication.
Shanks *et al.* (2024)	Cobotic service teams and power dynamics: Understanding and mitigating unintended consequences of human-robot collaboration in healthcare services	Empirical quantitative study	- Consumers respond less favorably to robot-led teams due to perceived lower power and increased anxiety. - Allowing consumers to choose the robot can mitigate negative responses by increasing their sense of power. - Higher power distance beliefs among consumers reduce negative responses to robot-led teams. - Providing performance information about robots improves consumer perceptions and intentions. - Understanding and managing power dynamics is crucial for improving consumer acceptance of cobotic teams.
Tahir *et al.* (2024)	Employees' foe or friend: artificial intelligence and	Empirical quantitative study	- AI knowledge positively influences employee creativity. - AI knowledge negatively influences turnover intentions. - Self-enhancement motives mediate the effects of AI knowledge on creativity and turnover intentions.

	employee outcomes		- Responsible leadership moderates the relationship between AI knowledge and self-enhancement motives. - AI fulfills psychological needs that enhance creativity and reduce turnover. - Practical implications for leveraging AI in organizations are provided.
Trincado-Munoz *et al.* (2024)	The dark side of AI in professional services	Conceptual/theoretical paper	- AI has the potential to improve access to public goods like justice and healthcare. - Significant challenges include explainability, privacy, and human agency concerns. - These challenges can disrupt service provision and affect trust between clients and professionals. - Key issues leading to AI's dark sides are bias and explainability, privacy and governance, and agency. - Potential disruptions include reduced access to services, increased marginalisation, data breaches, and malicious behaviors. - The paradox of automation highlights that increased efficiency through AI can still be hampered by human factors. - Information asymmetry between professionals and clients is a key threat. - Unchecked AI adoption could lead to polarization in service offerings, with high-quality services becoming more expensive. - Checks and balances are needed to ensure a coordinated adoption process that does not stifle innovation.
Fiestas Lopez Guido *et al.* (2025)	The Impact of Master-Servant Relationships in Human-Robot Collaboration on Customer Perceptio-annotated	Empirical quantitative study	- Master-servant dynamics in HRC influence customer perceptions of threat and trust. - HSRs in master roles increase perceived realistic threat, especially among speciesists. - Trust in HSRs decreases when they act as masters, reducing usage intentions. - Speciesism moderates these effects, amplifying negative perceptions and reducing trust. - Customers prefer humans in dominant roles over robots in HRCs.
Le and Cayrat (2025)	Howdy, Robo-Partner: exploring artificial companionship and its stress-alleviating potential for service employees	Empirical qualitative study	- The paper introduces artificial companionship with four roles: instrumental, informative, caring, and intimate. - Artificial companionship can mitigate employee stress by enhancing resilience and fostering self-identity. - The framework extends social support theory to include AI-based companionship. - Current AI technology can fulfill three roles, with intimate companionship as a future possibility. - Misalignment between job demands and AI support types can lead to inefficiencies. - Caring companionship alone may not suffice for emotional support, suggesting hybrid systems are needed.
Le *et al.* (2025)	The Future of Work: Understanding the Effectiveness of Collaboration Between Human and Digital	Empirical quantitative study	- Making HE-DE collaboration visible enhances customer perception of team cohesiveness and process fluency, increasing satisfaction. - Coordination and team goal cues are strong stimulants for positive customer impressions. - Coordination cues consistently improve perceptions of process fluency and team cohesion. - Team goal cues reassure customers about collaborative efforts, enhancing perceptions of a cohesive and fluent process. - Supervisory cues have inconsistent impacts, suggesting context-dependent effectiveness.

	Employees in Service		- Frontline co-presence shows no significant impact but may still hold potential value. - Process transparency is crucial and is enhanced by communicating HE-DE collaboration cues.
Leiño Calleja *et al.* (2025)	Hybrid Human-Robot Teams in the Frontline: Automated Social Presence and the Role of Corrective Interrogation	Empirical quantitative study	- Increased ASP of FLRs leads to better customer evaluations of teamwork quality, enhancing perceptions of FLEs' competence and warmth. - Corrective interrogation by FLEs strengthens the positive impact of FLRs' ASP on teamwork quality. - There is a hybrid team evaluation paradox where FLEs view corrections negatively, but customers see them positively. - High-ASP FLRs are recommended for improving customer perceptions of FLEs. - Teamwork quality perceptions influence customer judgments of FLEs' competence and warmth. - Corrective interrogations help detect and correct errors, improving teamwork quality. - Customers do not penalize FLEs for mistakes if corrected by FLRs.
Mele *et al.* (2025)	A system and learning perspective on Human-Robot Collaboration	Case study	- Human-robot collaboration enhances customer care by creating a system organized around shared goals. - The system evolves through expansive learning, addressing contradictions between human practices and robotic capabilities. - Introduction of chatbots shifted work practices to a more advanced design, resolving service inefficiencies and reducing delays. - Integration introduced new tensions and pressures on employees, highlighting challenges in the transition. - New roles for employees emerged, indicating transformation in work practices and skill requirements. - Overall outcome includes improved efficiency and organizational transformation with new ways of working.
Phillips *et al.* (2025)	Service Robot-Employee Task Allocation Strategies: Well-being within the Intrusion	Case study, followed by Empirical quantitative study	- Service robots create a paradox for FLEs as both a demand and a resource. - Using robots for task allocation positively affects FLE work well-being. - FLEs actively manage their well-being by choosing task allocation strategies. - Service robots impact physical, purpose, social, and community well-being dimensions. - Despite challenges, service robots empower FLEs to maintain their well-being.
Shanks *et al.* (2025)	Automate to Elevate!? Cost-Benefit Analysis of Robots and Future Directions in Services Marketing Research	Empirical quantitative study (Field experiment)	- Consumer willingness to pay is influenced by the perceived usefulness and anthropomorphic features of service robots. - Cobotic teams can increase willingness-to-pay for human-only teams, especially when robots are in leadership roles. - Negative consumer reactions occur when robots assume leadership roles, highlighting the need to manage power dynamics. - Participants prefer human-led teams over cobotic teams in healthcare settings. - Offering premium upgrades to human-only teams presents revenue opportunities but raises ethical concerns about access.
Yang *et al.* (2025)	Understanding service performance of frontline	Empirical quantitative study	- Employee-AI interaction fluency directly and indirectly affects employee service performance through mind perceptions. - In smart helmet services, interaction fluency impacts in-role performance via perceived empathy and competence.

	employees from employee-AI interaction perspectiv-annotated	- In in-vehicle AI services, interaction fluency affects out-of-role performance, mediated by perceived competence. - High self-efficacy reduces the impact of interaction fluency on perceived competence. - Mind perceptions are crucial mediators in the relationship between interaction fluency and service performance.

Reference

Abou-Foul, M., Ruiz-Alba, J.L., and López-Tenorio, P.J. (2023), "The impact of artificial intelligence capabilities on servitization: The moderating role of absorptive capacity-A dynamic capabilities perspective," *Journal of Business Research*, 157, 113609.

Alkire, L., Bilgihan, A., Bui, M.M., Buoye, A.J., Dogan, S., and Kim, S. (2024), "RAISE: leveraging responsible AI for service excellence," *Journal of Service Management*, 35 (4), 490-511.

Bagozzi, R.P., Brady, M.K., and Huang, M.-H. (2022), "AI Service and Emotion," *Journal of Service Research*, 25 (4), 499-504.

Blaurock, M., Büttgen, M., and Schepers, J. (2024), "Designing Collaborative Intelligence Systems for Employee-AI Service Co-Production," *Journal of Service Research*, 10946705241238751.

Blümel, J.H., Zaki, M., and Bohné, T. (2024), "Personal touch in digital customer service: a conceptual framework of relational personalization for conversational AI," *Journal of Service Theory and Practice*, 34 (1), 33-65.

Bock, D.E., Wolter, J.S., and Ferrell, O.C. (2020), "Artificial intelligence: disrupting what we know about services," *Journal of Services Marketing*, 34 (3), 317-34.

Caruelle, D., Shams, P., Gustafsson, A., and Lervik-Olsen, L. (2022), "Affective Computing in Marketing: Practical Implications and Research Opportunities Afforded by Emotionally Intelligent Machines," *Marketing Letters*, 33 (1), 163-69.

Chandra, B. and Rahman, Z. (2024), "Artificial intelligence and value co-creation: a review, conceptual framework and directions for future research," *Journal of Service Theory and Practice*, 34 (1), 7-32.

Chen, S., Li, X., Liu, K., and Wang, X. (2023), "Chatbot or human? The impact of online customer service on consumers' purchase intentions," *Psychology & Marketing*, 40 (11), 2186-200.

De Keyser, A., Köcher, S., Alkire (Née Nasr), L., Verbeeck, C., and Kandampully, J. (2019), "Frontline Service Technology infusion: conceptual archetypes and future research directions," *Journal of Service Management*, 30 (1), 156-83.

Dixon, J., Hong, B., and Wu, L. (2021), "The Robot Revolution: Managerial and Employment Consequences for Firms," *Management Science*, 67 (9), 5586-605.

Do, K.T., Gip, H., Guchait, P., Wang, C.-Y., and Baaklini, E.S. (2023), "Empathetic creativity for frontline employees in the age of service robots: conceptualization and scale development," *Journal of Service Management*, 34 (3), 433-66.

Dodds, S., Russell–Bennett, R., Chen, T., Oertzen, A.-S., Salvador-Carulla, L., and Hung, Y.-C. (2022), "Blended human-technology service realities in healthcare," *Journal of Service Theory and Practice*, 32 (1), 75-99.

Du, S. and Xie, C. (2021), "Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities," *Journal of Business Research*, 129, 961-74.
Esmaeilzadeh, H. and Vaezi, R. (2022), "Conscious Empathic AI in Service," *Journal of Service Research*, 25 (4), 549-64.
Fiestas Lopez Guido, J.C., Popkowski-Leszczyc, P., Pontes, N., and Tuzovic, S. (2025), "The Impact of Master-Servant Relationships in Human-Robot Collaboration on Customer Perceptio-annotated," *Journal of Service Management*.
Figueiredo, A.S. and Pinto, L.H. (2021), "Robotizing shared service centres: key challenges and outcomes," *Journal of Service Theory and Practice*, 31 (1), 157-78.
Flavián, C., Pérez-Rueda, A., Belanche, D., and Casaló, L.V. (2022), "Intention to use analytical artificial intelligence (AI) in services – the effect of technology readiness and awareness," *Journal of Service Management*, 33 (2), 293-320.
Fukawa, N. and Rindfleisch, A. (2023), "Enhancing innovation via the digital twin," *Journal of Product Innovation Management*, 40 (4), 391-406.
Garry, T. and Harwood, T. (2019), "Cyborgs as frontline service employees: a research agenda," *Journal of Service Theory and Practice*, 29 (4), 415-37.
Gnewuch, U., Morana, S., Hinz, O., Kellner, R., and Maedche, A. (2024), "More Than a Bot? The Impact of Disclosing Human Involvement on Customer Interactions with Hybrid Service Agents," *Information Systems Research*, 35 (3), 936-55.
Han, B., Deng, X., and Fan, H. (2023a), "Partners or Opponents? How Mindset Shapes Consumers' Attitude Toward Anthropomorphic Artificial Intelligence Service Robots," *Journal of Service Research*, 26 (3), 441-58.
Han, E., Yin, D., and Zhang, H. (2023b), "Bots with Feelings: Should AI Agents Express Positive Emotion in Customer Service?," *Information Systems Research*, 34 (3), 1296-311.
Hollebeek, L.D., Menidjel, C., Sarstedt, M., Jansson, J., and Urbonavicius, S. (2024), "Engaging consumers through artificially intelligent technologies: Systematic review, conceptual model, and further research," *Psychology & Marketing*, 41 (4), 880-98.
Huang, L.L., Chen, R.P., and Chan, K.W. (2024), "Pairing up with anthropomorphized artificial agents: Leveraging employee creativity in service encounters," *Journal of the Academy of Marketing Science*, 52 (4), 955-75.
Huang, M.-H. and Rust, R.T. (2018), "Artificial Intelligence in Service," *Journal of Service Research*, 21 (2), 155-72.
Hur, W.-M. and Shin, Y. (2024), "Service employees' STARA awareness and proactive service performance," *Journal of Services Marketing*, 38 (4), 426-42.
Hyun, Y., Hlee, S., Park, J., and Chang, Y. (2022), "Discovering meaningful engagement through interaction between customers and service robots," *The Service Industries Journal*, 42 (13-14), 973-1000.
Ivanov, S. (2023), "The dark side of artificial intelligence in higher education," *The Service Industries Journal*, 43 (15-16), 1055-82.
Kim, J.H., Kim, M., Kwak, D.W., and Lee, S. (2022), "Home-Tutoring Services Assisted with Technology: Investigating the Role of Artificial Intelligence Using a Randomized Field Experiment," *Journal of Marketing Research*, 59 (1), 79-96.

Kondapaka, P., Khanra, S., Malik, A., Kagzi, M., and Hemachandran, K. (2023), "Finding a fit between CXO's experience and AI usage in CXO decision-making: evidence from knowledge-intensive professional service firms," *Journal of Service Theory and Practice*, 33 (2), 280-308.
Kot, M. and Leszczyński, G. (2022), "AI-activated value co-creation. An exploratory study of conversational agents," *Industrial Marketing Management*, 107, 287-99.
Le, K.B.Q. and Cayrat, C. (2025), "Howdy, Robo-Partner: exploring artificial companionship and its stress-alleviating potential for service employees," *Journal of Service Management*, 28.
Le, K.B.Q., Sajtos, L., and Fernandez, K.V. (2023), "Employee-(ro)bot collaboration in service: an interdependence perspective," *Journal of Service Management*, 34 (2), 176-207.
Le, K.B.Q., Sajtos, L., Kunz, W.H., and Fernandez, K.V. (2025), "The Future of Work: Understanding the Effectiveness of Collaboration Between Human and Digital Employees in Service," *Journal of Service Research*, 28 (1), 186-205.
Lei, S., Xie, L., and Peng, J. (2024), "Unethical Consumer Behavior Following Artificial Intelligence Agent Encounters: The Differential Effect of AI Agent Roles and its Boundary Conditions," *Journal of Service Research*, 10946705241278837.
Leiño Calleja, D., Schepers, J., and Nijssen, E.J. (2023), "Some agents are more similar than others: customer orientation of frontline robots and employees," *Journal of Service Management*, 34 (6), 27-49.
---- (2025), "Where Tech Meets Mindfulness Customer Perceptions towards Hybrid Human-Robot Teams, and the," *Journal of Service Management*, 36.
Leone, D., Schiavone, F., Appio, F.P., and Chiao, B. (2021), "How does artificial intelligence enable and enhance value co-creation in industrial markets? An exploratory case study in the healthcare ecosystem," *Journal of Business Research*, 129, 849-59.
Li, S., Peng, G., Xing, F., Zhang, J., and Zhang, B. (2021), "Value co-creation in industrial AI: The interactive role of B2B supplier, customer and technology provider," *Industrial Marketing Management*, 98, 105-14.
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*, 30 (3), 361-91.
Ma, C. and Ye, J. (2022), "Linking artificial intelligence to service sabotage," *The Service Industries Journal*, 42 (13-14), 1054-74.
Marti, C.L., Liu, H., Kour, G., Bilgihan, A., and Xu, Y. (2024), "Leveraging artificial intelligence in firm-generated online customer communities: a framework and future research agenda," *Journal of Service Management*, 35 (3), 438-58.
McLeay, F., Osburg, V.S., Yoganathan, V., and Patterson, A. (2021), "Replaced by a Robot: Service Implications in the Age of the Machine," *Journal of Service Research*, 24 (1), 104-21.
Mele, C., Russo Spena, T., Kaartemo, V., and Marzullo, M.L. (2021), "Smart nudging: How cognitive technologies enable choice architectures for value co-creation," *Journal of Business Research*, 129, 949-60.
Mele, C., Russo-Spena, T., Marzullo, M., and Ruggiero, A. (2022), "Boundary work in value co-creation practices: the mediating role of cognitive assistants," *Journal of Service Management*, 33 (2), 342-62.

Mele, C., Russo-Spena, T., Ranieri, A., and Di Bernardo, I. (2025), "A system and learning perspective on Human-Robot Collaboration," *Journal of Service Management*, 36.
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*, 4 (1), 21-34.
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*, 33 (2), 246-92.
Paluch, S., Tuzovic, S., Holz, H.F., Kies, A., and Jörling, M. (2022), "“My colleague is a robot” – exploring frontline employees' willingness to work with collaborative service robots," *Journal of Service Management*, 33 (2), 363-88.
Phillips, C., Odekerken-Schröder, G., Russell-Bennett, R., Steins, M., Mahr, D., and Letheren, K. (2025), "Service Robot-Employee Task Allocation Strategies Well-being within the Intrusion challenge," *Journal of Service Management*, 36.
Phillips, C., Russell–Bennett, R., Odekerken-Schröder, G., Mahr, D., and Letheren, K. (2023), "The Robotic-Human Service Trilemma: the challenges for well-being within the human service triad," *Journal of Service Management*, 34 (4), 770-805.
Rancati, G. and Maggioni, I. (2023), "Neurophysiological responses to robot–human interactions in retail stores," *Journal of Services Marketing*, 37 (3), 261-75.
Robinson, S., Orsingher, C., Alkire, L., De Keyser, A., Giebelhausen, M., Papamichail, K.N., Shams, P., and Temerak, M.S. (2020), "Frontline encounters of the AI kind: An evolved service encounter framework," *Journal of Business Research*, 116, 366-76.
Shanks, I., Mende, M., Van Doorn, J., Hess, N.J., Scott, M.L., and Grewal, D. (2025), "Automate to Elevate!? Cost-Benefit Analysis of Robots and Future Directions in Services Marketing Research," *Journal of Service Management*, 36.
Shanks, I., Scott, M.L., Mende, M., Van Doorn, J., and Grewal, D. (2024), "Cobotic service teams and power dynamics: Understanding and mitigating unintended consequences of human-robot collaboration in healthcare services," *Journal of the Academy of Marketing Science*, 52.
Shi, Y., Zhang, R., Ma, C., and Wang, L. (2023), "Robot service failure: the double-edged sword effect of emotional labor in service recovery," *Journal of Service Theory and Practice*, 33 (1), 72-88.
Söderlund, M. (2023), "Service robots and artificial morality: an examination of robot behavior that violates human privacy," *Journal of Service Theory and Practice*, 33 (7), 52-72.
Spring, M., Faulconbridge, J., and Sarwar, A. (2022), "How information technology automates and augments processes: Insights from Artificial-Intelligence-based systems in professional service operations," *Journal of Operations Management*, 68 (6-7), 592-618.
Tahir, M.A., Da, G., Javed, M., Akhtar, M.W., and Wang, X. (2024), "Employees’ foe or friend: artificial intelligence and employee outcomes," *The Service Industries Journal*, 1-32.
Tojib, D., Sujan, R., Ma, J., and Tsarenko, Y. (2023), "How does service robot anthropomorphism affect human co-workers?," *Journal of Service Management*, 34 (4), 750-69.

Trincado-Munoz, F.J., Cordasco, C., and Vorley, T. (2024), "The dark side of AI in professional services," *The Service Industries Journal*, 1-20.
Tuomi, A., Tussyadiah, I.P., and Stienmetz, J. (2021), "Applications and Implications of Service Robots in Hospitality," *Cornell Hospitality Quarterly*, 62 (2), 232-47.
Vorobeva, D., El Fassi, Y., Costa Pinto, D., Hildebrand, D., Herter, M.M., and Mattila, A.S. (2022), "Thinking Skills Don't Protect Service Workers from Replacement by Artificial Intelligence," *Journal of Service Research*, 25 (4), 601-13.
Willems, K., Verhulst, N., De Gauquier, L., and Brengman, M. (2023), "Frontline employee expectations on working with physical robots in retailing," *Journal of Service Management*, 34 (3), 467-92.
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*, 29 (5), 907-31.
Xiao, L. and Kumar, V. (2021), "Robotics for Customer Service: A Useful Complement or an Ultimate Substitute?," *Journal of Service Research*, 24 (1), 9-29.
Xue, M., Cao, X., Feng, X., Gu, B., and Zhang, Y. (2022), "Is College Education Less Necessary with AI? Evidence from Firm-Level Labor Structure Changes," *Journal of Management Information Systems*, 39 (3), 865-905.
Yang, S., Guo, Y., Chen, Y., Li, Y., zhou, s., and Jiang, h. (2025), "Understanding service performance of frontline employees from employee-AI interaction perspective," *Journal of Service Management*, 36.
Yun, J.H., Lee, E.J., and Kim, D.H. (2021), "Behavioral and neural evidence on consumer responses to human doctors and medical artificial intelligence," *Psychology & Marketing*, 38 (4), 610-25.