



ORIGINAL ARTICLE

Citation: Jo, Y., Lee, M., Shin, H., & Hur, W.-M. (2026). Shielding frontline service employees from customer incivility: The roles of service robot support and knowledge. *Oeconomia Copernicana*, 17(2), 707–745. <https://doi.org/10.24136/oc.4337>

Contact to corresponding author: Won-Moo Hur, wmhur@inha.ac.kr

Article history: Received: 19.05.2026; Accepted: 24.06.2026; Published online: 30.06.2026

Yujeong Jo

Hanyang University, South Korea

 orcid.org/0009-0003-4154-5787

MinKyung Lee

Sogang University, South Korea

 orcid.org/0000-0001-5036-453X

Hakseung Shin

Hanyang University, South Korea

 orcid.org/0000-0002-9209-7430

Won-Moo Hur

Inha University, South Korea

 orcid.org/0000-0002-8042-2603

Shielding frontline service employees from customer incivility: The roles of service robot support and knowledge

JEL Classification: O33; M15; M12; D23; J24

Keywords: *service robot knowledge; customer incivility; work engagement; conservation of resources theory; artificial intelligence (AI)*

Copyright © Instytut Badań Gospodarczych / Institute of Economic Research (Poland)

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Research background: Progress in artificial intelligence (AI) and robotics is reshaping the service landscape and driving technological innovation. Service robots are increasingly introduced to improve performance and support frontline employees in mitigating emotional and physical strains. However, evidence remains limited on whether service robots truly protect employees from stressors such as customer incivility. Drawing on the conservation of resources (COR) theory, this study addresses this gap by conceptualizing service robots as context-dependent technological resources and examines how their efficacy depends on organizational support and employee knowledge in robot-enabled environments.

Purpose of the article: This study examined how customer incivility depletes frontline employees' resources and when these adverse effects can be mitigated in human–robot contexts. We assessed the mediating role of work engagement between customer incivility and in-role service performance and customer-helping behavior, and the moderating effects of service robot support and robot knowledge.

Methods: We collected data from 200 frontline employees in South Korea, a region with rapid service robot integration. We utilized a two-wave survey design with a two-month interval to minimize common method variance. Hypotheses were tested via path analysis in Mplus using bootstrapping (N = 5,000).

Findings & value added: Work engagement mediated the negative relationships between customer incivility and both in-role service performance and customer-helping behavior. We observed a significant three-way interaction among customer incivility, service robot support, and service robot knowledge on work engagement. When both service robot support and robot knowledge were high, the negative effects of customer incivility on work engagement and indirect outcomes were weakest. This study advances research on technology-enabled work by demonstrating that service robots function as context-dependent technological resources. Our findings highlight the importance of robot support and employee robot-related knowledge in buffering resource depletion and enhancing resilience in robot-enabled environments.

Introduction

Rapid advancements in artificial intelligence (AI) and robotics are fundamentally transforming the service landscape and reshaping employees' skills and well-being (Cramarenco *et al.*, 2023). Beyond enhancing operational efficiency, service robots are increasingly being integrated into roles that support service employees in managing the emotional and physical demands that arise during customer interactions (Shin *et al.*, 2025; Yang & Wu, 2026; Yu *et al.*, 2026). Yet, the successful adoption of such innovations is not solely a matter of technological deployment (Balcerzak *et al.*, 2026)—it is equally contingent on the knowledge that employees develop, apply, and leverage in robot-enabled work environments (Le & Cayrat, 2025; Paluch *et al.*, 2022; Saiyed *et al.*, 2026). Accordingly, understanding how

employee knowledge shapes the outcomes of service robot innovation constitutes a pressing and underexplored question at the intersection of innovation management and knowledge application.

Recent studies have widely discussed the potential of technological advancements to alleviate emotional labor and reduce customer-related stress (Gong, 2025; Shin *et al.*, 2025). However, empirical evidence regarding the extent to which service robots shield employees from interpersonal stressors remains limited. In particular, in human–robot coworking service environments, it remains unclear whether employees who interact with service robots are genuinely protected from customer-induced stress or whether customer incivility continues to undermine their job performance. Addressing this question is not only theoretically significant but also practically urgent, as organizations worldwide are investing heavily in service robot innovation without fully understanding how employee knowledge mediates the translation of these technological investments into performance outcomes.

Customer incivility refers to low-intensity negative interpersonal behaviors perpetrated by customers, including rude language, interrupting employees, or expressing complaints aggressively, which disregards or disrespects employees (Sommovigo *et al.*, 2025). In typical service settings, the asymmetric power afforded to customers can justify or tolerate uncivil behavior toward employees, creating a routine source of stress for service workers (Zhu *et al.*, 2019). Prior research has shown that customer incivility exacerbates emotional exhaustion (Hur *et al.*, 2016), increases turnover intention, and reduces job satisfaction (Alola *et al.*, 2019). Moreover, these negative experiences can spill over beyond the workplace (Zhu *et al.*, 2021), ultimately impairing employees' psychological well-being and overall work-related quality of life (El-Sherbeeny *et al.*, 2024; Baker & Kim, 2020). However, previous studies have primarily focused on establishing these detrimental effects, with limited attention paid to how technology-based resources, such as service robots, may buffer these negative processes.

In particular, existing research has emphasized human-centered and relational resources, including supervisor and coworker support (Baker & Kim, 2020; Im *et al.*, 2024; Zhu *et al.*, 2019), job crafting (Zahoor & Siddiqi, 2023), person–job fit (Shin *et al.*, 2024), individual-level traits such as resilience and religious beliefs (Al-Hawari *et al.*, 2020; Nguyen-Viet & Nguyen, 2026), and mindfulness (Gaan & Shin, 2024; Tam *et al.*, 2025), as key buffering mechanisms. While these studies have highlighted the importance of

socio-psychological resources in protecting employees from customer incivility, our understanding of how technology-based resources—particularly service robots—reshape resource depletion processes remains limited. Notably, when employees lack sufficient knowledge to understand and utilize technological resources, such technologies may function not as support mechanisms but rather as additional sources of cognitive burden and technostress (Liu & Kamioka, 2025). This suggests that employees' knowledge and capabilities may be more critical than the mere presence of technological systems.

This study addresses this gap through the lens of the conservation of resources (COR) theory. The COR theory posits that individuals are motivated to acquire, retain, protect, and foster resources that they deem valuable, and the depletion of key resources can accelerate further losses (Hobfoll, 2001). This study conceptualizes work engagement as a core psychological resource and argues that customer incivility depletes this resource, thereby undermining service performance and customer-helping behaviors. Simultaneously, this study conceptualizes service robot support as a job resource and service robot knowledge as a personal resource, proposing that their combination can effectively buffer the negative effects of customer incivility. In particular, service robot knowledge is viewed as not merely technical proficiency but a critical mechanism that enables employees to activate and effectively utilize technology-based resources in their work.

Furthermore, this study recognizes that technology-based resources do not always function positively. For instance, when employees possess high levels of robot-related knowledge but organizational-level robot support is insufficient, they may be required to independently manage system errors or technological limitations. This can increase technological complexity and overload, generating additional cognitive strain and stress (Agarwal *et al.*, 2025; Trougakos *et al.*, 2015). Consequently, technological stress compounds emotional strain from customer incivility rather than alleviating resource depletion. This highlights the fact that the effectiveness of technology-based resources depends on the alignment between organizational support and employee knowledge.

The central contribution of this study lies in identifying the boundary conditions under which technology-based resources can effectively buffer the resource depletion process—and, more critically, in illuminating the pivotal role of knowledge as the activating mechanism that determines whether technological innovation translates into tangible human resource

outcomes. Grounded in COR theory, this study focuses on the interaction between a job resource (service robot support) and a personal resource (service robot knowledge). In COR theory, personal resources are internal characteristics, such as skills or self-efficacy, that enable individuals to exert control over their environment and successfully leverage available job resources (Islam *et al.*, 2023; Kong *et al.*, 2026). In the service robot context, service robot support acts as an instrumental resource by providing a psychological space for recovery (Yue *et al.*, 2017). However, this job resource cannot be fully effective unless employees possess the requisite robot-related knowledge—a form of task-specific technological knowledge that governs how effectively individuals can harness innovation to their benefit.

This focus on knowledge is particularly germane to contemporary debates on digital transformation and the future of work. As service organizations adopt increasingly sophisticated robotic technologies, a critical gap has emerged between the availability of technological innovation and employees' capacity to benefit from it (Christ-Brendemühl & Schaarschmidt, 2020). Knowledge—specifically, employees' understanding of how to operate, collaborate with, and derive value from service robots—functions as the critical bridge between technological investment and human performance outcomes. Without sufficient knowledge, the presence of service robots may inadvertently increase cognitive demands or trigger “technostress,” potentially exacerbating rather than mitigating resource loss. This phenomenon underscores the importance of viewing knowledge not merely as a personal attribute, but as a strategic organizational resource that must be actively cultivated alongside technological innovation to realize its full potential (Liu & Kamioka, 2025).

Therefore, this study investigates the process through which customer incivility affects service performance and customer helping behavior via work engagement and examines the conditions under which technology-based resources—service robot support and service robot knowledge—attenuate or amplify this process. Specifically, this study tests the mediating role of work engagement in the relationship between customer incivility and service outcomes, examines whether service robot support moderates the negative effect of customer incivility on work engagement, and assesses a three-way interaction between customer incivility, service robot support, and robot-related knowledge to identify the conditions under which technological innovation resources operate effectively.

The findings integrate the protective and conditional roles of technology-based resources and highlight employee knowledge as a key mechanism linking technological innovation to human performance. In doing so, this study extends the literature on customer incivility and provides practical implications for how organizations can strategically develop employee knowledge to maximize the effectiveness of service robot innovation. To this end, a two-wave time-lagged survey was conducted among full-time frontline service employees working with service robots in South Korea. This study further emphasizes the importance of employee knowledge as a central mechanism connecting technological innovation and human performance, offering implications for organizational behavior and human resource management research, as well as digital transformation practices.

The remainder of this paper is organized as follows: Section 2 reviews the literature and develops the hypotheses; Section 3 describes the methodology; Section 4 presents the empirical results; and Section 5 discusses the theoretical and practical implications and limitations and concludes the paper.

Literature review and hypothesis development

Conservation of resources theory

COR theory posits a motivational framework for explaining individual behavior, assuming that people strive to acquire, maintain, protect, and enhance the resources they value (Hobfoll, 2001). Resources encompass a wide range of forms, including physical objects, conditions, personal characteristics, and energy, and are not only defined at the individual level but also exhibit supra-cultural properties shaped by social and cultural contexts (Zhu *et al.*, 2021). COR theory provides a useful lens for understanding the impact of customer incivility on employees (Alola *et al.*, 2019; Xie *et al.*, 2023).

According to COR theory, stress arises in situations of resource loss, threat of resource loss, or failure to gain resources following resource investment, with resource loss exerting far more potent psychological and behavioral effects than resource gain (Hobfoll, 2001). From this perspective, incidents of customer incivility can deplete employees' psychological resources, such as self-efficacy (Hur *et al.*, 2022b), self-esteem (Sommovigo *et*

al., 2025), and affective states (Alola *et al.*, 2019; Xie *et al.*, 2023), potentially reducing job engagement and resilience over time (Jang *et al.*, 2020).

COR theory further emphasizes that resources do not exist in isolation but are interconnected, forming 'resource caravans' that move collectively (Hobfoll, 2001). Individuals generally possess multiple linked resources, and conversely, resource deficiencies tend to co-occur. Resource caravans act as protective buffers that help individuals and groups recover from losses and respond to stressors. Individuals use optimization and compensation strategies in response to resource losses or threats (Hobfoll, 2012). Optimization involves maximizing an individual's remaining resources to minimize loss, whereas compensation entails supplementing deficits or inadequacies with alternative resources to maintain functionality. Through proactive coping, individuals and groups acquire, maintain, and enhance resources in advance, thereby mitigating potential losses by adjusting the fit between resources and environmental demands.

Prior research has applied COR theory to clarify the negative effects of customer incivility on employees. Al-Hawari *et al.* (2020) proposed that customer incivility and abusive supervision increase emotional exhaustion, which undermines service performance and customer satisfaction. In this process, individual resilience buffers the relationship between resource loss and emotional exhaustion, with employees with low resilience exhibiting stronger negative effects. Sommovigo *et al.* (2019) found that repeated experiences of customer incivility lead to accumulated resource loss through emotional labor, ultimately impairing job satisfaction and psychological well-being. Similarly, Hur *et al.* (2022b) and related studies have presented a loss spiral model, demonstrating that customer incivility depletes personal resources, such as self-efficacy and self-esteem, thereby decreasing work engagement and performance. However, prior research has largely overlooked the conflicting effects of multidimensional contextual factors, particularly technology-based resources, while focusing on resource loss induced by customer incivility. The literature presents a tension in how service robots are conceptualized: On the one hand, they are regarded as valuable job resources that alleviate employees' workload; on the other hand, they are viewed as potential sources of cognitive overload in the form of technostress arising from adaptation to new technologies (Sharif *et al.*, 2025; Zhang *et al.*, 2025). Against this theoretical inconsistency regarding whether technology functions as a resource or an additional stressor, this study seeks to clarify that service robots function as genuine protective

resources only when organizational support and employees' technological knowledge are jointly present and aligned.

Accordingly, this study addresses these gaps. By conceptualizing work engagement as a core psychological resource and empirically examining how customer incivility diminishes engagement, this study extends the focus beyond emotional exhaustion to include behavioral performance outcomes, specifically in-role performance and customer helping behaviors. Furthermore, this study integrates technology-based resources, namely, service robot support, within a resource caravan framework as a conditional buffering mechanism. This theoretical integration highlights a pathway through which repetitive work demands can be mitigated, thereby enabling employees to allocate their limited resources to productive engagement.

Mediation role of work engagement between customer incivility and employee behaviors

Work engagement is a positive and fulfilling work-related state that reflects the investment of psychological energy and dedication in one's tasks, including vigor, dedication, and absorption (Schaufeli *et al.*, 2017). COR theory (Hobfoll, 1989, 2001) posits that individuals are motivated to acquire, maintain, and protect valued resources and that psychological stress occurs when these resources are threatened or lost. Resources include personal assets, such as physical strength, self-efficacy, and self-esteem, as well as social resources, including support from colleagues and supervisors and feedback in the workplace (Zhu *et al.*, 2021).

Customer incivility is a critical occupational stressor that can trigger resource loss. Emotional resources are depleted when employees regulate their emotions and maintain courtesy in interactions with rude customers, while cognitive and psychological resources are consumed when handling customer requests and resolving problems (Grandey *et al.*, 2004). Considering the unpredictable nature of customer incivility, employees must remain vigilant to protect their resources, which leads to additional resource expenditure (Hobfoll *et al.*, 2018). Such cumulative resource loss reduces work engagement and, if repeated, can form a loss spiral that progressively diminishes engagement levels (Hwang *et al.*, 2022).

Employees can fully invest in their work only when sufficient psychological availability is maintained (Kahn, 1990). Repeated low-intensity

stressors, such as customer incivility, gradually deplete emotional and cognitive resources. Resource-depleted employees adopt defensive strategies to avoid further losses, which naturally leads to decreased work engagement. Consequently, depletion of an employee's engagement reservoir may impair positive task-related behaviors, including high-quality service delivery and discretionary customer helping behaviors.

Studies have demonstrated that work engagement mediates the relationship between customer incivility and various performance outcomes. For instance, Hwang *et al.* (2022) reported that work engagement mediates the relationship between customer incivility and job crafting; Mostafa (2022) found mediation between customer incivility and service-oriented organizational citizenship behaviors, while Jang *et al.* (2020) and Zhu *et al.* (2019) empirically confirmed mediation between customer incivility and proactive service performance or extra-role customer service. However, existing research has yet to comprehensively examine the mediating role of work engagement on intra- and extra-role performance outcomes. Recent studies indicate that frontline service employees (FSEs) who experience customer incivility ultimately face emotional resource depletion, which decreases work engagement (Jin *et al.*, 2025; Khanam & Tarab, 2025). Accordingly, this study investigates the negative impact of customer incivility on service performance and customer helping behavior.

Hypothesis 1: FSEs' work engagement mediates the negative relationship between experiences of customer incivility and service performance.

Hypothesis 2: FSEs' work engagement mediates the negative relationship between experiences of customer incivility and customer helping behavior.

Three-way interaction between service robot support, service robot knowledge, and customer incivility

According to COR theory, acquiring supplementary resources can mitigate the adverse effects of resource loss (Hobfoll, 2001). Technological support, such as service robots, can function as a supplemental resource by alleviating repetitive and depleting work demands, thereby protecting employees' core psychological energy and sustaining their work engagement (Gong, 2025). For example, in hotel and restaurant settings, when robots handle functional tasks, such as delivery and basic customer service,

employees can focus more on high-value tasks, including emotional labor and customer interactions (Shin *et al.*, 2025). When employees perceive service robots as providing reliable support, they can integrate them into existing resource caravans, enhancing their resilience against stressors by buffering the negative impact of resource depletion.

Previous research has shown that person–job fit serves as a buffering factor that mitigates the psychological rumination caused by customer incivility (Shin *et al.*, 2024). Similarly, studies on job crafting have demonstrated that job design and social–structural resources can act as buffers, reducing the emotional exhaustion resulting from customer incivility (Zahoor & Siddiqi, 2023). Research on employee resilience (Al-Hawari *et al.*, 2020) and managerial support (Baker & Kim, 2020) indicates that individual resilience or supervisory support can buffer the negative effects of customer incivility on emotional exhaustion and performance. At the organizational level, studies on collective mindfulness (Gaan & Shin, 2024) and organizational control (Hur *et al.*, 2022b) have demonstrated the buffering effects of organizational resources.

Extending this research stream, perceived service robot support represents a technologically embedded buffering resource that operates directly during service encounters. Unlike dispositional or relational buffers, perceived robot support reduces employees' immediate exposure to emotionally taxing customer interactions by offloading repetitive, confrontational, and high-demand tasks. From a COR perspective, such support helps conserve employees' finite emotional and cognitive resources and creates opportunities for short-term disengagement from stressors, which is essential for resource recovery. Accordingly, perceived service robot support is expected to function as a critical moderator, weakening the negative relationship between customer incivility and work engagement.

Hypothesis 3: FSEs' perceived service robot support moderates the negative relationship between experiences of customer incivility and work engagement. This relationship is less pronounced when perceived service robot support is high than when it is low.

COR theory further emphasizes that resource loss is most severe in the absence of protective resources (Hobfoll, 2012). Extending this line of reasoning, this study assumes that the effectiveness of technology-based resources is determined not only by their presence but also by the alignment

between organizational support and individuals' capability to utilize them. In particular, robot-related knowledge is conceptualized as more than a simple personal resource; it functions as a form of functional competence that enables the understanding and effective use of technology. From the COR perspective, it operates not only as a psychological resource but also as an enabling mechanism that determines the usability of technology-based resources (Halbesleben *et al.*, 2014).

When both service robot support and robot-related knowledge are high, employees can seamlessly understand and utilize technological systems, whereas organizational support simultaneously reduces technological uncertainty and operational burden. Under such conditions, the potential of technological resources is fully activated and the cognitive load is minimized, thereby effectively buffering the resource depletion triggered by customer incivility. This implies that when resources are sufficiently "activated," they can function as protective resources that effectively interrupt COR-based resource loss processes (Ma *et al.*, 2021). By contrast, when both service robot support and robot-related knowledge are low, employees are unable to fully leverage technological resources and must cope with customer demands using limited personal resources. This state of resource scarcity intensifies the negative effects of customer incivility and may accelerate the loss spiral through continuous resource depletion (Hwang *et al.*, 2022).

More importantly, an asymmetric effect emerges under mixed conditions. When robot-related knowledge is high but organizational service robot support is low, employees are likely to act as informal troubleshooters who must independently resolve the errors, limitations, and operational issues of service robots. This expanded role increases both technological responsibility and task demands, which may, in turn, increase cognitive strain and stress responses through technological overload and complexity (Tarafdar *et al.*, 2007). Conversely, when service robot support is high but robot-related knowledge is low, employees may be unable to fully understand or effectively utilize the provided technological resources, thereby increasing uncertainty in technology use. In other words, the mere presence of technological resources does not guarantee their protective effects. Rather, their effectiveness is conditioned by individual capabilities. Consequently, even when organizational support is sufficient, the expected buffering effect may be weakened because of constrained resource utilization (Balcerzak *et al.*, 2026; Kong *et al.*, 2026).

This study suggests that the effects of technology-based resources vary depending on how organizational support and individual knowledge levels are combined. This refines the core proposition of the COR theory that resource effects are determined not by mere possession but by usability. Furthermore, it demonstrates that technology adoption does not always lead to positive outcomes; instead, its effects depend on the degree of alignment between organizational conditions and individual capabilities (Balcerzak *et al.*, 2026). Accordingly, service robot support and robot-related knowledge are expected to function as key moderators conditionally influencing the negative effects of customer incivility on employees' job engagement. This relationship is hypothesized to be the strongest when both service robot support and robot-related knowledge are low.

Hypothesis 4: FSEs' perceived service robot support and knowledge moderate the negative relationship between experiences of customer incivility and work engagement. This relationship is most pronounced when both service robot support and robot-related knowledge are low.

Despite the growing body of research examining technology-enabled environments, several empirical and methodological limitations remain unresolved. First, prior studies rely on cross-sectional and single-wave survey designs, which raise concerns regarding common method variance (CMV), particularly when psychological perceptions and behavioral outcomes are measured simultaneously (Podsakoff *et al.*, 2012). Second, existing research often overlooks contextual heterogeneity across service settings in which service robots are implemented, potentially biasing the estimation of technology-related interaction effects. Because organizational support systems, technological infrastructure, and employee capabilities may differ substantially across industries, the effectiveness of technology-based resources may not be uniformly manifested across contexts (Shin *et al.*, 2024; Agarwal *et al.*, 2025). These limitations suggest the need for a more rigorous research design capable of capturing the context-dependent nature of technology-enabled resources. Accordingly, the present study adopts a time-lagged survey design and incorporates industry-level controls to improve internal validity and more accurately examine the joint moderating effects of service robot support and robot-related knowledge.

Method

Sample and procedure

The participants were recruited from a professional online research panel in South Korea, specifically targeting full-time FSEs. We applied several screening criteria to ensure the quality and relevance of the sample. Participants were required to have at least one year of experience in their current role and direct experience working alongside service robots. The sample represented a diverse range of service industries, including retail, finance, hospitality, and food services. Before the survey, all participants were informed of the study objectives and provided consent with strict guarantees of anonymity and the right to withdraw voluntarily.

Data were collected in two distinct phases with a two-month interval (November 2023 to January 2024) to minimize common method bias and examine time-lagged relationships. At Time 1 (T1), 300 of the 399 initially recruited employees completed the survey, providing data on customer incivility, service robot support, service robot knowledge, work engagement, and demographics. Two months later (Time 2; T2), we contacted these individuals again to measure their service performance and customer helping behaviors. Responses from both waves were integrated using unique email identifiers, resulting in a final longitudinal sample of 200 participants (50.1% retention rate).

The final group was 60% male, with an average age of 35.24 years ($SD = 7.62$) and a mean tenure of 4.59 years ($SD = 3.78$). The industry distribution included retail (43.0%), food service (36.5%), hospitality (11.5%), and banking (9.0%). Most respondents (79.0%) held a bachelor's degree. A one-way ANOVA was performed to compare T2 respondents ($N = 200$) with non-respondents ($N = 100$), addressing potential attrition bias. The results showed significant differences in gender ($F = 4.93, p < .05$) and job tenure ($F = 4.78, p < .05$), leading us to include these variables as covariates in subsequent analyses. Although the attrition bias tests showed significant differences in gender and tenure between T1 and T2, their impacts on the final results were negligible. Gender significantly predicted T1 work engagement ($b = -.19, p < .05$), with female participants reporting higher engagement, but it had no significant effect on T2 service performance ($b = -.08, p > .05$) or customer helping behavior ($b = -.07, p > .05$). This indicates that attrition did not systematically bias the primary outcome variable. To en-

sure statistical rigor, gender and tenure were included as control variables across all paths, thus confirming the robustness of the hypothesized model. Based on G*Power 3.1.9.7, our final sample of 200 exceeded the recommended range of 153–184 required to achieve a power of .95 and a medium effect size (Cohen, 1988; Faul *et al.* 2009).

Measures

We followed the back-translation protocol established by Brislin (1970) to ensure the linguistic and conceptual equivalence of the instruments. Most variables were assessed using a 5-point Likert scale, ranging from “strongly disagree” (1) to “strongly agree” (5), whereas a different scaling method was applied to the customer incivility measure (refer to the Appendix for the complete list of items). All variables possessed a reliability score greater than .70 (Nunnally, 1978).

Customer Incivility. Customer incivility was measured using 10 items from Wilson and Holmvall’s (2013) scale. Response options ranged from 1 (never) to 5 (very often). A sample item is “How often have customers continued to complain despite your efforts to assist them?” Cronbach’s alpha for this scale was .94.

Service robot support. We measured service robot support by modifying six items of the instrumental support scale (Settoon & Mossholder, 2002; Tews *et al.*, 2013) (e.g., “My service robots assist me with heavy workloads”), substituting the term “my coworkers” with “my service robots.” Before the study, we conducted a pre-test to obtain feedback from five service industry experts and three scholars (not including the authors) who reviewed the perceived service robot support scale to test and enhance the study’s face validity. Cronbach’s alpha for this scale was .86.

Service robot knowledge. Five items on service robot knowledge were adapted from Chiu *et al.*’s (2021) scale by substituting the term “AI” with “my service robots.” The theoretical justification for this adaptation lies in the conceptualization of service robots as embodied AI; that is, the core operational capacity of service robots fundamentally relies on AI systems (Wirtz *et al.*, 2018). In this study, “knowledge” specifically refers to the employees’ functional and interactional knowledge—that is, their understanding of how to interact with the robot, utilize its functions for service delivery, and handle basic problem-solving in front of customers, rather than technical programming or engineering knowledge. Before the study, we

conducted a pre-test to obtain feedback from five service industry experts and three scholars (not including the authors) who reviewed the perceived service robot support scale to test and enhance the study's face validity. A sample item is, "I know pretty much about service robots." Cronbach's alpha for this scale was .87.

Work engagement. Consistent with previous studies (e.g., Hwang *et al.*, 2022; Osmanovic *et al.*, 2024), work engagement was assessed using three items from Schaufeli *et al.*'s (2017) ultrashort measure of work engagement (Utrecht Work Engagement Scale-3; UWES-3). The UWES-3 represents the full work engagement scale (UWES-9), as demonstrated by Schaufeli *et al.* (2017), who reported a high correlation (.80–.85) between the UWES-3 and the UWES-9 in a multi-country study. A sample item is "At my work, I feel bursting with energy." Cronbach's alpha for this scale was .82.

Service performance. We evaluated service performance using four items from Liao and Chuang's (2004) service performance scale. Sample answers include "I was friendly and helpful to customers." Cronbach's alpha for this scale was .80.

Customer Helping Behavior. We evaluated customer helping behavior utilizing a three-item instrument developed by Yue *et al.* (2017). A representative item is, "I voluntarily assist customers even if it means going beyond my job requirements." The scale demonstrated acceptable internal consistency, with a Cronbach's alpha of .77.

Control Variables. Several demographic characteristics (age, gender, and job tenure) and affective traits (positive and negative affectivity) were included as covariates to ensure the robustness of our findings and account for potential confounding influences (Hur *et al.*, 2026). This decision was based on prior evidence suggesting their impact on work engagement (Hur *et al.*, 2024; Hwang *et al.*, 2025), service performance (Hur *et al.*, 2022a; 2022b), and helping behaviors (Lee *et al.*, 2023). Furthermore, to account for potential heteroskedasticity across different sectors, and consistent with previous methodologies (e.g., Kang *et al.*, 2023; Hur & Shin, 2024), we adjusted for industry-specific effects using three dummy variables representing retail, banking/finance, food/beverage, and hospitality/tourism industries. Participants' affective dispositions were captured using a six-item version of Watson *et al.*'s (1988) scale. A full list of the measurement items is provided in the Appendix.

Analytic strategy

We examined our hypothesized model using path analysis with the Mplus-based PROCESS macro (i.e., Models 1, 3, 4, 7, and 11) as developed by Stride *et al.* (2015), utilizing the standard maximum likelihood estimator. This approach enabled the simultaneous testing of direct, mediating, and moderated mediation effects. In accordance with Hayes (2022), all exogenous variables were mean-centered before the analysis to minimize multicollinearity. Furthermore, we used a bootstrapping procedure with 5,000 resamples to determine the statistical significance of the mediation and moderated mediation pathways (Hayes, 2022).

Results

Reliability and validity

Descriptive statistics and correlation matrices for all study variables are presented in Table 1. Skewness and kurtosis values ranged from $-.33$ to 2.89 and from -2.02 to 6.40 , respectively. All values fell within the accepted criteria for normality ($|\text{skewness}| < 3$ and $|\text{kurtosis}| < 10$; Kline, 2016), indicating that the distributions did not deviate substantially from normality. We performed a confirmatory factor analysis (CFA) using Mplus 8.10 to verify the psychometric integrity of the measurement model (Muthén & Muthén, 2017). We also used the item-to-construct balance method (Little *et al.*, 2002) to mitigate the risk of misestimating validity, particularly when the ratio of sample size to free parameters is low and a large number of measurement items are included (Bentler & Chou, 1987). Specifically, we made parcels with more than six items for variables, creating three-item parcels for the customer incivility and service robot support measures (Little *et al.*, 2002). The CFA results confirmed that the hypothesized eight-factor model, comprising customer incivility, service robot support, service robot knowledge, work engagement, service performance, customer helping behavior, and positive and negative affectivity, exhibited a robust fit to the data: ($\chi^2(296) = 420.57$, $p < .05$, comparative fit index [CFI] = .96, Tucker–Lewis index [TLI] = .95, root mean square error of approximation [RMSEA] = .05, standardized root mean square residual [SRMR] = .05). These indices support the sound psychometric properties of the scale. As

Table 1 shows, all variables exceeded the established thresholds of .70 for composite reliability and .50 for the average variance extracted (AVE), with composite reliability ranging from .77 to .94 and AVE from .51 to .85 (Fornell & Larcker, 1981). Additionally, discriminant validity was confirmed, with the average variance extracted for each construct surpassing the squared correlations between that construct and all others (Fornell & Larcker, 1981).

Our data were derived from self-reports; therefore, we addressed potential common method variance (CMV) issues (Podsakoff *et al.*, 2012). First, Harman's single-factor test demonstrated that the eight-factor model fit the data significantly better than a single-factor model, where all items loaded onto one factor ($\chi^2(324) = 2186.35$, $p < .05$, CFI = .36, TLI = .31, RMSEA = .17, SRMR = .16; $\Delta\chi^2(28) = 1765.78$, $p < .01$). Second, we introduced a latent common method factor (LCMF) into the baseline model. The LCMF accounted for less than 7% of the total variance, which is well below the 25% threshold typically observed in self-report studies (Williams *et al.*, 1989). These results suggest that CMV did not pose a significant threat to our findings.

Hypothesis testing

Hypotheses 1 and 2 stated that the negative relationship between FSEs' experiences of customer incivility and service performance/customer helping behavior was mediated by work engagement. The results of the mediation analyses showed that work engagement significantly mediated the negative relationship between FSEs' experiences of customer incivility and service performance ($b = -.023$, 95% CI $[-.074, -.001]$; Table 2), supporting H1. Furthermore, the negative indirect effect of FSEs' experiences of customer incivility on customer helping behavior via work engagement was statistically significant ($b = -.027$, 95% CI $[-.083, -.001]$; Table 2), supporting H2.

Hypothesis 3 posited that service robot support moderates the negative relationship between customer incivility and work engagement. Service robot support significantly mitigated the negative relationship between customer incivility and work engagement ($b = .20$, $p < .01$; Table 3), supporting Hypothesis 3. We plotted this relationship at high, mean, and low levels of (± 1 SD) the moderator (Aiken & West, 1991). As illustrated in Figures 1 and 2, the negative relationship between customer incivility and

work engagement was significant among FSEs who had a low level of service robot support ($b = -.32, p < .01$), whereas customer incivility was not related to work engagement among FSEs who reported a high level of service robot support ($b = -.03, p > .05$).

Hypothesis 4 proposed a three-way interaction among customer incivility, service robot support, and service robot knowledge on work engagement. As Table 3 shows, the three-way interaction was significant ($b = -.17, p < .01$). This three-way interaction is illustrated in Figure 3. The results indicated that customer incivility was negatively associated with work engagement only when both service robot support and service robot knowledge were low ($b = -.56, p < .01$). When either service robot support or service robot knowledge was low, the relationship between customer incivility and work engagement was not statistically significant. These findings suggest that service robot support and robot-related knowledge function as technological resources that buffer the detrimental effects of customer incivility on work engagement. Specifically, the negative relationship between customer incivility and work engagement emerged only when both service robot support and robot-related knowledge were low. In contrast, when either service robot support or robot-related knowledge was high, the negative relationship was no longer significant. These findings indicate that the availability of at least one technological resource may help employees better cope with stressful customer interactions and protect them from resource depletion. These findings support Hypothesis 4.

Post hoc analysis

Building on the primary results, we conducted a moderated mediation analysis using Models 7 and 11 of the PROCESS macro (Hayes, 2022). Specifically, we examined whether the mediating role of work engagement in the relationship between customer incivility and the two outcome variables (service performance and customer helping behavior) was contingent on the level of technological resources provided by service robots. Table 3 shows that the moderated mediating effects of service robot support were both significant (b Customer incivility $\times$ Service robot support $\rightarrow$ Work engagement $\rightarrow$ Service performance = .042, 95% CI [.008, .102]; b Customer incivility $\times$ Service robot support $\rightarrow$ Work engagement $\rightarrow$ Customer helping behavior = .049, 95% CI [.008, .126]; Table 3). This finding indicates that the positive effect of customer incivility on service performance and cus-

tomers helping behavior through performance pressure is less pronounced for employees reporting higher levels of service robot support than for those reporting lower levels of service robot support.

Furthermore, we explored whether the indirect effect of customer incivility on service performance and customer helping behavior through work engagement varies depending on the levels of service robot support and knowledge. We found that the three-way moderated mediation effects of customer incivility, service robot support, and service robot knowledge on service performance ($b = -.035$, 95% CI $[-.095, -.003]$) and customer helping behavior ($b = -.042$, 95% CI $[-.111, -.004]$) through work engagement were statistically significant (Table 3).

Discussion

Drawing on COR theory, this study demonstrates that customer incivility undermines FSEs' behavioral performance, primarily by depleting work engagement as a core psychological resource. Specifically, the findings show that work engagement mediates the negative effects of customer incivility on service performance (in-role behavior) and customer helping behavior (extra-role behavior). These results highlight that repeated low-intensity stressors, such as customer incivility, not only influence employees' affective states but also translate into observable declines in required task execution and discretionary customer-oriented behaviors through resource depletion.

Beyond establishing this mediating mechanism, this study identifies perceived service robot support as a critical technological buffer in service encounters. The results indicate that when employees perceive high levels of service robot support, the negative relationship between customer incivility and work engagement is significantly attenuated. In contrast, customer incivility is strongly associated with reduced engagement when perceived robot support is low. These findings position service robots as instrumental resources that help conserve employees' emotional and cognitive energy by reducing their direct exposure to taxing customer interactions, thereby sustaining engagement under adverse conditions.

Moreover, the buffering effect of service robot support is not unconditional. The three-way interaction results reveal that the protective role of robot support depends on employees' service robot knowledge. Customer

incivility exerts the strongest negative effect on work engagement when both perceived robot support and robot-related knowledge are low, thereby leading to poorer service performance and reduced customer helping behavior. Conversely, high robot support coupled with sufficient knowledge weakens this negative pathway. Collectively, these findings underscore that technology-based resources function most effectively as part of a broader resource caravan, operating as conditional buffers rather than as automatic safeguards against customer-induced resource losses.

Theoretical implications

First, this study advances customer incivility research by deepening the theoretical understanding of how low-intensity routine interpersonal stressors translate into distinct forms of behavioral performance through resource depletion mechanisms. Although prior studies have established that customer incivility undermines employee well-being and performance (Alola *et al.*, 2019; Hur *et al.*, 2016; Zhu *et al.*, 2019), they have often treated performance outcomes in an aggregated or undifferentiated manner. By simultaneously examining in-role service performance and extra-role customer helping behavior, this study demonstrates that customer incivility affects mandatory and discretionary service behaviors through the erosion of work engagement. This distinction is theoretically important because it reveals that resource loss not only reduces overall performance but also reshapes how employees prioritize effort allocation under resource constraints, which is consistent with COR theory's emphasis on defensive conservation strategies (Hobfoll, 2001).

Second, this study contributes to COR theory by positioning work engagement as a core finite resource that functions as a key transmission mechanism between interpersonal stressors and behavioral outcomes. Although work engagement has frequently been examined as an outcome of customer mistreatment (Hwang *et al.*, 2022; Mostafa, 2022), this study conceptualizes it as a central psychological reservoir that enables sustained task execution and voluntary customer-oriented behavior. Accordingly, this study extends loss spiral logic by showing that engagement depletion precedes and explains declines in both in-role and extra-role performance, thereby moving beyond emotion-focused outcomes, such as exhaustion. This resource-based conceptualization offers a more behaviorally grounded account of how incivility-induced resource loss unfolds in service work.

Third, this study extends the COR literature by integrating service robots as technology-based instrumental resources within employees' resource caravans. Prior incivility research has predominantly focused on human-centered buffers, such as resilience, job crafting, supervisory support, and collective mindfulness (Al-Hawari *et al.*, 2020; Baker & Kim, 2020; Gaan & Shin, 2024; Zahoor & Siddiqi, 2023). In contrast, this study theorizes and empirically demonstrates that perceived service robot support operates as an encounter-level buffering mechanism that directly reduces employees' exposure to resource-draining customer interactions. This finding broadens COR theory by illustrating how technological artifacts, not only social or personal resources, can function as protective resources that conserve emotional and cognitive energy in high-contact service contexts.

Fourth, the findings extend the COR theory by elucidating the contingent mechanisms through which technological resources operate. Specifically, the results empirically demonstrate that it is not merely the possession of resources that determines their effectiveness but rather the extent to which individuals possess the knowledge and capabilities required to activate and utilize those resources. According to the COR theory, individuals are motivated to acquire, retain, and protect valuable resources, and the loss of such resources can trigger further resource depletion (Hobfoll, 2012). Extending this logic, the present study suggests that the effectiveness of resources is determined not simply by their presence but also by their availability for effective utilization.

More specifically, the findings showed that the negative relationship between customer incivility and work engagement emerged only when both service robot support and robot-related knowledge were low. In contrast, when either service robot support or robot-related knowledge was high, the negative relationship was no longer significant. These findings indicate that the availability of at least one technological resource may help employees better cope with stressful customer interactions and reduce vulnerability to resource depletion. Prior research has suggested that technological complexity and insufficient technological support can increase employees' cognitive strain and technostress (Tarafdar *et al.*, 2007). From the perspective of the transactional stress theory, when individuals appraise technological demands as exceeding their coping resources, a stress–resource imbalance arises, which in turn leads to anxiety and resource depletion (Lazarus & Folkman, 1984). Consistent with these perspectives, the present findings imply that employees may become more vulnerable to the detri-

mental effects of customer incivility when both organizational technological support and individual robot-related knowledge are lacking.

Taken together, these findings suggest that technological resources can buffer the detrimental effects of customer incivility even when only one form of resource is available. This finding extends COR theory by demonstrating that technological resources do not necessarily need to coexist simultaneously to exert protective effects; rather, the presence of either organizational technological support or individual robot-related knowledge may help employees cope with stressful customer interactions. Furthermore, the study supports prior research suggesting that the effectiveness of technological adoption depends on employees' ability to access and utilize available resources in workplace contexts (Balcerzak *et al.*, 2026). Overall, the findings advance the understanding of human–technology interaction by highlighting the buffering role of technological resources in protecting employees from resource depletion.

Finally, this study advances theories at the intersection of service robotics and employee psychology by shifting the focus from automation outcomes or efficiency gains to resource dynamics within frontline service work. Rather than treating robots as exogenous technological tools, this study conceptualizes them as embedded components of employees' psychological resource systems, the effectiveness of which depends on perceptions, competencies, and situational demands. By linking service robots to work engagement, behavioral performance, and COR-based buffering processes, this study provides a more integrative theoretical framework for understanding human–robot coexistence in service environments characterized by chronic interpersonal stressors, such as customer incivility.

Practical implications

This study has several important practical implications. First, the findings highlight the importance of managing customer incivility not only as a customer relations issue but also as a resource management challenge that directly affects employees' work engagement and service behaviors. Managers should move beyond reactive responses to severe customer misconduct and proactively address low-intensity incivility that occurs routinely at service touchpoints. Practical strategies include implementing clear service protocols that legitimize employees' right to disengage temporarily from hostile interactions, rotating frontline roles to prevent cumula-

tive resource depletion, and establishing structured recovery practices (e.g., micro-breaks following difficult customer encounters). By recognizing work engagement as a finite resource, organizations can design workflows that prevent chronic depletion and sustain in-role service quality and discretionary customer helping behaviors.

Second, this study suggests that service robots can be effective buffering tools when strategically integrated into service operations. Managers should deploy service robots in roles that directly reduce employees' exposure to emotionally taxing or repetitive interactions, such as handling routine inquiries, deliveries, queue management, and complaint triage. Notably, managers should frame robots not as performance monitors or replacements but as instrumental support resources that protect employees' psychological energy. Clearly communicating this supportive role can enhance employees' perceived robot support, which our findings demonstrate to be critical for mitigating the negative effects of customer incivility on work engagement. Organizations should also continuously assess which service encounters generate the greatest emotional strain and prioritize robotic assistance in these areas.

Third, the conditional nature of the buffering effect underscores the need to invest in service robot knowledge and competence development. Simply introducing robots is insufficient and may even backfire if employees lack the skills to use them effectively. Managers should implement targeted training programs that focus on hands-on interactions with service robots, troubleshooting common issues, and smoothly integrating robots into service routines. These programs should be tailored to employees' roles and technological proficiency levels, reinforcing confidence and reducing cognitive burden. By aligning technological support with employee capabilities, organizations can ensure that service robots function as part of a broader resource caravan that sustains work engagement, preserves service performance, and maintains employees' willingness to go beyond formal job requirements, even under conditions of customer incivility.

Limitations and future research opportunities

Despite its contributions, this study has some limitations that suggest avenues for future research. First, although a two-wave time-lagged design was employed to mitigate common method bias and strengthen causal inference, data were collected through self-report measures from a single

cultural context (South Korea). Cultural norms regarding customer–employee interactions, power distance, and technology acceptance may influence the prevalence of customer incivility and employees’ responses to service robots. Future research should replicate and extend the model across diverse cultural and institutional contexts to examine the generalizability of the findings. Furthermore, while this study focused on work engagement as a core mediating resource, other psychological mechanisms, such as moral disengagement, surface versus deep acting, and momentary affective fluctuations, may operate in parallel and warrant further investigation.

Second, this study examined perceived service robot support and knowledge at an aggregated level, without distinguishing between different types of robots or forms of support. Future research could differentiate between functional and social robots, as well as instrumental and emotional forms of robotic support, to clarify how specific technological attributes shape resource conservation processes. Moreover, longitudinal or experience-sampling designs could capture dynamic resource fluctuations and recovery cycles following episodes of customer incivility in real time. Such approaches would allow scholars to explore how engagement depletion and replenishment unfold across service encounters and shifts, offering deeper insight into loss spirals, recovery trajectories, and the evolving role of human–robot collaboration in frontline service work.

Conclusions

This study demonstrates that the effectiveness of service robots in safeguarding employee well-being and performance depends not merely on technological deployment, but on how such technological resources are organizationally supported and intellectually leveraged by employees. Specifically, customer incivility depletes frontline service employees’ psychological resources—namely, work engagement—which subsequently impairs both in-role performance and customer-helping behavior. However, this resource depletion process is significantly mitigated when organizational service robot support and employee service robot knowledge are jointly high.

Integrating a three-way interaction within a conservation of resources (COR) perspective, the findings illuminate how service robots function as

context-dependent technological resources; only when combined with systemic support and domain-specific knowledge is their stress-buffering capacity realized. Overall, this study extends theoretical insights into technology-enabled service work, while simultaneously underscoring the importance of cultivating both robust organizational support and employee robot-related competencies in order to successfully enhance employee resilience and harness the transformative promise of robotic innovation in service environments.

Although this study was conducted in the context of South Korea, its findings offer important implications for developed economies in Europe and Japan, which are simultaneously experiencing rapid population decline and accelerating service automation. Beyond the deployment of technological infrastructure, the effective management of employees' knowledge and competencies required to leverage such technologies will become an increasingly critical challenge for future service management.

References

- Agarwal, P., Kaur, P., & Budhwar, P. (2025). Silencing quiet quitting: Crafting a symphony of high-performance work systems and psychological conditions. *Human Resource Management*, 64(3), 621–635. <https://doi.org/10.1002/hrm.22275>.
- Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.
- Al-Hawari, M. A., Bani-Melhem, S., & Quratulain, S. (2020). Do frontline employees cope effectively with abusive supervision and customer incivility? Testing the effect of employee resilience. *Journal of Business and Psychology*, 35(2), 223–240. <https://doi.org/10.1007/s10869-019-09621-2>.
- Alola, U. V., Olugbade, O. A., Avci, T., & Öztüren, A. (2019). Customer incivility and employees' outcomes in the hotel: Testing the mediating role of emotional exhaustion. *Tourism Management Perspectives*, 29, 9–17. <https://doi.org/10.1016/j.tmp.2018.10.004>.
- Baker, M. A., & Kim, K. (2020). Dealing with customer incivility: The effects of managerial support on employee psychological well-being and quality of life. *International Journal of Hospitality Management*, 87, 102503. <https://doi.org/10.1016/j.ijhm.2020.102503>.
- Balcerzak, A. P., Škapa, S., & Zinecker, M. (2026). AI proliferation and productivity growth: Do we face a new wave of Solow's paradox? *Equilibrium: Quarterly Journal of Economics and Economic Policy*, 21(1), 13–21. <https://doi.org/10.24136/eq.4250>.

- Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, 16(1), 78–117. <https://doi.org/10.1177/0049124187016001004>.
- Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185–216. <https://doi.org/10.1177/135910457000100301>.
- Chiu, Y. T., Zhu, Y. Q., & Corbett, J. (2021). In the hearts and minds of employees: A model of pre-adoptive appraisal toward artificial intelligence in organizations. *International Journal of Information Management*, 60, 102379. <https://doi.org/10.1016/j.ijinfomgt.2021.102379>.
- Christ-Brendemühl, S., & Schaarschmidt, M. (2020). The impact of service employees' technostress on customer satisfaction and delight: A dyadic analysis. *Journal of Business Research*, 117, 378–388. <https://doi.org/10.1016/j.jbusres.2020.06.021>.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.
- Cramarencu, R. E., Burcă-Voicu, M. I., & Dabija, D. C. (2023). The impact of artificial intelligence (AI) on employees' skills and well-being in global labor markets: A systematic review. *Oeconomia Copernicana*, 14(3), 731–767. <https://doi.org/10.24136/oc.2023.022>.
- El-Sherbeeney, A. M., Alsetoohy, O., Sheikhelsouk, S., Liu, S., & Abou Kamar, M. (2024). Enhancing hotel employees' well-being and safe behaviors: The influences of physical workload, mental workload, and psychological resilience. *Oeconomia Copernicana*, 15(2), 765–807. <https://doi.org/10.24136/oc.3018>.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.1177/002224378101800104>.
- Gaan, N., & Shin, Y. (2024). The buffering role of collective mindfulness in customer incivility and service sabotage: A multilevel study of Indian banks. *International Journal of Bank Marketing*, 42(3), 596–619. <https://doi.org/10.1108/IJBM-07-2023-0371>.
- Gong, T. (2025). Unveiling the nexus: Service robot support and proactive customer service performance in hospitality industry. *International Journal of Hospitality Management*, 129, 104202. <https://doi.org/10.1016/j.ijhm.2025.104202>.
- Grandey, A. A., Dickter, D. N., & Sin, H. P. (2004). The customer is not always right: Customer aggression and emotion regulation of service employees. *Journal of Organizational Behavior*, 25(3), 397–418. <https://doi.org/10.1002/job.252>.
- Halbesleben, J. R., Neveu, J. P., Paustian-Underdahl, S. C., & Westman, M. (2014). Getting to the “COR” understanding the role of resources in conservation of resources theory. *Journal of Management*, 40(5), 1334–1364. <https://doi.org/10.1177/0149206314527130>.

- Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd ed.). Guilford Press.
- Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, 44(3), 513–524. <https://doi.org/10.1037/0003-066X.44.3.513>.
- Hobfoll, S. E. (2001). The influence of culture, community, and the nested-self in the stress process: Advancing conservation of resources theory. *Applied Psychology*, 50(3), 337–421. <https://doi.org/10.1111/1464-0597.00062>.
- Hobfoll, S. E. (2012). Conservation of resources and disaster in cultural context: The caravans and passageways for resources. *Psychiatry: Interpersonal & Biological Processes*, 75(3), 227–232. <https://doi.org/10.1521/psyc.2012.75.3.227>.
- Hobfoll, S. E., Halbesleben, J., Neveu, J. P., & Westman, M. (2018). Conservation of resources in the organizational context: The reality of resources and their consequences. *Annual Review of Organizational Psychology and Organizational Behavior*, 5, 103–128. <https://doi.org/10.1146/annurev-orgpsych-032117-104640>.
- Hur, W. M., & Shin, Y. (2024). Service employees' STARA awareness and proactive service performance. *Journal of Services Marketing*, 38(4), 426–442. <https://doi.org/10.1108/JSM-03-2023-0115>.
- Hur, W. M., Moon, T., & Jun, J. K. (2016). The effect of workplace incivility on service employee creativity: The mediating role of emotional exhaustion and intrinsic motivation. *Journal of Services Marketing*, 30(3), 302–315. <https://doi.org/10.1108/JSM-10-2014-0342>.
- Hur, W. M., Park, H., & Chung, J. H. (2024). Unlocking emotional labor: How organizational control systems shape frontline service employees' emotional labor. *Journal of Service Theory and Practice*, 34(6), 915–940. <https://doi.org/10.1108/JSTP-12-2023-0322>.
- Hur, W. M., Shin, G., & Shin, Y. (2026). When and how generative AI support promotes job crafting: Mediation of GenAI self-efficacy and moderation of GenAI usage. *Oeconomia Copernicana*, 17(1), 141–179. <https://doi.org/10.24136/oc.4159>.
- Hur, W. M., Shin, Y., & Shin, G. (2022a). Linking motivation, emotional labor, and service performance from a self-determination perspective. *Journal of Service Research*, 25(2), 227–241. <https://doi.org/10.1177/1094670520975204>.
- Hur, W. M., Shin, Y., & Shin, G. (2022b). Daily relationships between customer incivility, organizational control, self-efficacy, and service performance. *Journal of Retailing and Consumer Services*, 69, 103092. <https://doi.org/10.1016/j.jretconser.2022.103092>.
- Hwang, H., Hur, W. M., Shin, Y., & Kim, Y. (2022). Customer incivility and employee outcomes in the new service marketplace. *Journal of Services Marketing*, 36(4), 612–625. <https://doi.org/10.1108/JSM-04-2021-0117>.
- Hwang, H., Hur, W. M., Shin, Y., & Paik, M. S. (2025). Work-from-home satisfaction and task crafting in South Korea: The roles of resilience and job tenure. *Asia Pacific Business Review*, 31(1), 157–179. <https://doi.org/10.1080/13602381.2024.2363933>.

- Im, A. Y., Cho, S., & Kim, D. Y. (2024). The cost of rude customers: Customer incivility and employee performance. *Current Issues in Tourism*, 27(13), 2031–2047. <https://doi.org/10.1080/13683500.2023.2294482>.
- Islam, M. S., Amin, M., Feranita, F., & Karatepe, O. M. (2023). High-involvement work practices, work engagement and their effects on bank employees' turnover intentions: The moderating role of functional competence. *International Journal of Bank Marketing*, 41(6), 1360–1388. <https://doi.org/10.1108/IJBM-04-2022-0157>.
- Jang, J., Jo, W., & Kim, J. S. (2020). Can employee workplace mindfulness counteract the indirect effects of customer incivility on proactive service performance through work engagement? A moderated mediation model. *Journal of Hospitality Marketing & Management*, 29(7), 812–829. <https://doi.org/10.1080/19368623.2020.1725954>.
- Jin, D., Yao, X., Liu, B., Wang, S., & Wen, Z. (2025). Perceived service climate and in-role and extra-role service performance: A moderated mediation model of work engagement and perceived overqualification. *Current Psychology*, 44(3), 1874–1895. <https://doi.org/10.1007/s12144-024-07237-1>.
- Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4), 692–724. <https://doi.org/10.5465/256287>.
- Kang, D. Y., Hur, W. M., & Shin, Y. (2023). Smart technology and service employees' job crafting: Relationship between STARA awareness, performance pressure, receiving and giving help, and job crafting. *Journal of Retailing and Consumer Services*, 73, 103282. <https://doi.org/10.1016/j.jretconser.2023.103282>.
- Khanam, A., & Tarab, S. (2025). Customer incivility and frontline employee job performance: A moderated mediation analysis of PsyCap and emotional exhaustion. *Journal of Hospitality and Tourism Insights*, 8(2), 513–531. <https://doi.org/10.1108/JHTI-08-2023-0569>.
- Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.
- Kong, X., Yuan, W., & Ma, C. (2026). Service robots, artificial intelligence awareness, self-efficacy and work engagement. *Management Decision*, 64(5), 1960–1977. <https://doi.org/10.1108/MD-05-2024-1058>.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing Company.
- Le, K. B. Q., & Cayrat, C. (2025). Howdy, Robo-Partner: Exploring artificial companionship and its stress-alleviating potential for service employees. *Journal of Service Management*, 36(4), 631–658. <https://doi.org/10.1108/JOSM-09-2023-0408>.
- Lee, S. H., Hur, W. M., & Shin, Y. (2023). Struggling to stay engaged during adversity: A daily investigation of frontline service employees' job insecurity and the moderating role of ethical leader behavior. *Journal of Business Ethics*, 184(1), 281–295. <https://doi.org/10.1007/s10551-022-05140-y>.

- Liao, H., & Chuang, A. (2004). A multilevel investigation of factors influencing employee service performance and customer outcomes. *Academy of Management Journal*, 47(1), 41–58. <https://doi.org/10.5465/20159559>.
- Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, 9(2), 151–173. https://doi.org/10.1207/S15328007SEM0902_1.
- Liu, Q., & Kamioka, T. (2025). The effects of employees' digital growth mindset and supervisors' coaching behaviour on digital self-efficacy. *Technology in Society*, 81, 102875. <https://doi.org/10.1016/j.techsoc.2025.102875>.
- Ma, J., Ollier-Malaterre, A., & Lu, C. Q. (2021). The impact of techno-stressors on work–life balance: The moderation of job self-efficacy and the mediation of emotional exhaustion. *Computers in Human Behavior*, 122, 106811. <https://doi.org/10.1016/j.chb.2021.106811>.
- Mostafa, A. M. S. (2022). Customer incivility, work engagement and service-oriented citizenship behaviours: Does servant leadership make a difference? *Human Performance*, 35(1), 31–47. <https://doi.org/10.1080/08959285.2021.1998061>.
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.
- Nguyen-Viet, B., & Nguyen, P. M. (2026). Customer incivility in hospitality and banking industry: The roles of green orientation and religious beliefs. *International Journal of Productivity and Performance Management*, 75(4), 1302–1320. <https://doi.org/10.1108/IJPPM-07-2025-0667>.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill.
- Osmanovic, S., Pajic, S., Petrovic, I. B., & Portoghese, I. (2024). Workaholism, work engagement, and burnout among academics in Montenegro: A psychometric network approach. *Work*, 78(4), 1081–1092. <https://doi.org/10.3233/WOR-230347>.
- Paluch, S., Tuzovic, S., Holz, H. F., Kies, A., & Jörling, M. (2022). “My colleague is a robot”: Exploring frontline employees' willingness to work with collaborative service robots. *Journal of Service Management*, 33(2), 363–388. <https://doi.org/10.1108/JOSM-11-2020-0406>.
- Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, 63(1), 539–569. <https://doi.org/10.1146/annurev-psych-120710-100452>.
- Saiyed, S., Nimo J. R., A., Kumar, V., & Hasan, M. (2026). AI-enabled and gamified green HRM practices: Impacts on employee environmental engagement. *Oeconomia Copernicana*, 17(1), 181–224. <https://doi.org/10.24136/oc.3979>.
- Schaufeli, W., Shimazu, A., Hakanen, J., Salanova, M., & De Witte, H. (2017). An ultra-short measure for work engagement: The UWES-3 validation across five countries. *European Journal of Psychological Assessment*, 35(4), 577–591. <https://doi.org/10.1027/1015-5759/a000430>.

- Settoon, R. P., & Mossholder, K. W. (2002). Relationship quality and relationship context as antecedents of person- and task-focused interpersonal citizenship behavior. *Journal of Applied Psychology, 87*(2), 255–267. <https://doi.org/10.1037/0021-9010.87.2.255>.
- Sharif, M. N., Zhang, L., Asif, M., Alshdaifat, S. M., & Hanaysha, J. R. (2025). Artificial intelligence and employee outcomes: Investigating the role of job insecurity and technostress in the hospitality industry. *Acta Psychologica, 253*, 104733. <https://doi.org/10.1016/j.actpsy.2025.104733>.
- Shin, G., Hur, W. M., & Shin, Y. (2024). Does person-job fit buffer employees from rumination about customer incivility? *Current Psychology, 43*(8), 7411–7423. <https://doi.org/10.1007/s12144-023-04930-5>.
- Shin, H., Ryu, J., & Jo, Y. (2025). Navigating artificial intelligence adoption in hospitality and tourism: Managerial insights, workforce transformation, and a future research agenda. *International Journal of Hospitality Management, 128*, 104187. <https://doi.org/10.1016/j.ijhm.2025.104187>.
- Sommovigo, V., Filosa, L., Hobfoll, S., Tavolucci, S., Rosa, V., & Alessandri, G. (2025). What does customer incivility tell me about my worth? A diary study on the short-term effects of customer incivility on self-esteem and job satisfaction. *Work & Stress, 39*(3), 223–249. <https://doi.org/10.1080/02678373.2024.2364609>.
- Sommovigo, V., Setti, I., & Argentero, P. (2019). The role of service providers' resilience in buffering the negative impact of customer incivility on service recovery performance. *Sustainability, 11*(1), 285. <https://doi.org/10.3390/su11010285>.
- Stride, C. B., Gardner, S., Catley, N., & Thomas, F. (2015). *Mplus code for the mediation, moderation, and moderated mediation models templates from Andrew Hayes' PROCESS analysis examples*. <http://www.offbeat.group.shef.ac.uk/FIO/mplusmedmod.htm> (21.12.2025).
- Tam, D. U. (2025). The effects of experienced customer incivility on employees' job performance: The mediating role of ego depletion and moderating role of mindfulness. *International Journal of Quality and Service Sciences, 17*(3), 337–354. <https://doi.org/10.1108/IJQSS-01-2025-0012>.
- Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., & Ragu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. *Journal of Management Information Systems, 24*(1), 301–328. <https://doi.org/10.2753/MIS0742-1222240109>.
- Tews, M. J., Michel, J. W., & Ellingson, J. E. (2013). The impact of coworker support on employee turnover in the hospitality industry. *Group & Organization Management, 38*(5), 630–653. <https://doi.org/10.1177/1059601113503039>.
- Trougakos, J. P., Beal, D. J., Cheng, B. H., Hideg, I., & Zweig, D. (2015). Too drained to help: A resource depletion perspective on daily interpersonal citizenship behaviors. *Journal of Applied Psychology, 100*(1), 227–236. <https://doi.org/10.1037/a0038082>.

- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070. <https://doi.org/10.1037/0022-3514.54.6.1063>.
- Williams, L. J., Cote, J. A., & Buckley, M. R. (1989). Lack of method variance in self-reported affect and perceptions at work: Reality or artifact? *Journal of Applied Psychology*, 74(3), 462–468. <https://doi.org/10.1037/0021-9010.74.3.462>.
- Wilson, N. L., & Holmvall, C. M. (2013). The development and validation of the Incivility from Customers Scale. *Journal of Occupational Health Psychology*, 18(3), 310–326. <https://doi.org/10.1037/a0032753>.
- Wirtz, J., Patterson, P. G., Kunz, W. H., Gruber, T., Lu, V. N., Paluch, S., & Martins, A. (2018). Brave new world: Service robots in the frontline. *Journal of Service Management*, 29(5), 907–931. <https://doi.org/10.1108/JOSM-04-2018-0119>.
- Xie, F., Zhang, X., Ye, J., Zhou, L., Zhang, W., & Tian, F. (2023). Understanding the role of customer incivility and supervisor monitoring in the relationship between customer orientation and frontline employees' emotional exhaustion. *Journal of Service Theory and Practice*, 33(6), 796–819. <https://doi.org/10.1108/JSTP-12-2022-0273>.
- Yang, X., & Wu, W. (2026). The double-edged sword effect of human-robot collaboration on hospitality employees' service innovation behavior. *Journal of Hospitality Marketing & Management*, 35(4), 494–517. <https://doi.org/10.1080/19368623.2026.2614411>.
- Yu, Y., Zhang, X., & Jiao, X. (2026). Employees' perceived service robot support: Construct conceptualisation and scale development. *International Journal of Contemporary Hospitality Management*, 38(2), 771–790. <https://doi.org/10.1108/IJCHM-06-2025-0839>.
- Yue, Y., Wang, K. L., & Groth, M. (2017). Feeling bad and doing good: The effect of customer mistreatment on service employee's daily display of helping behaviors. *Personnel Psychology*, 70(4), 769–808. <https://doi.org/10.1111/peps.12208>.
- Zahoor, A., & Siddiqi, M. A. (2023). Customer incivility and service recovery performance: Job crafting as a buffer. *Vision*, 27(2), 178–188. <https://doi.org/10.1177/0972262921991963>.
- Zhang, S., Guo, P., Yuan, Y., & Ji, Y. (2025). Anxiety or engaged? Research on the impact of technostress on employees' innovative behavior in the era of artificial intelligence. *Acta Psychologica*, 259, 105442. <https://doi.org/10.1016/j.actpsy.2025.105442>.
- Zhu, H., Lyu, Y., & Ye, Y. (2021). The impact of customer incivility on employees' family undermining: A conservation of resources perspective. *Asia Pacific Journal of Management*, 38(3), 1061–1083. <https://doi.org/10.1007/s10490-019-09688-8>.
- Zhu, J. N., Lam, L. W., & Lai, J. Y. (2019). Returning good for evil: A study of customer incivility and extra-role customer service. *International Journal of Hospitality Management*, 81, 65–72. <https://doi.org/10.1016/j.ijhm.2019.03.004>.

AI declaration statement

The authors declare that they got acquired, accept and apply General Artificial Intelligence Policy of the publisher.

The authors declare that they have not used AI tools for research process.

Compliance with ethical standards

This article does not contain any studies with human participants or animals performed by the authors. Extracting and inspecting publicly accessible files (scholarly sources) as evidence, before the research began no institutional ethics approval was required.

Data availability statement

All data generated or analyzed are included in the published article. The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation. The raw anonymized data can be provided by emailing the primary author.

Author contributions

All listed authors have made an equal, direct and intellectual contribution to the work, and approved it for publication. The authors take full responsibility for the accuracy and the integrity of the source analysis.

Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Annex

Table 1. Means, standard deviations, and correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Industry dummy1	–													
2. Industry dummy2	-.24 ^a	–												
3. Industry dummy3	-.11	-.27 ^{ab}	–											
4. Gender	-.04	-.14	.07	–										
5. Age	-.05	.03	-.02	.18 ^a	–									
6. Job tenure	.06	-.13	.05	.08	.32 ^{ab}	–								
7. Positive affectivity	-.11	-.01	-.02	.20 ^{ab}	.00	.07	–							
8. Negative affectivity	.07	-.08	-.07	-.06	-.06	.00	-.13	–						
9. Customer incivility	-.01	.06	-.10	-.03	-.16 ^a	-.15 ^a	-.03	.37 ^{ab}	–					
10. Service robot support	-.03	.00	-.10	-.08	-.03	-.03	.28 ^{ab}	.04	.16 ^a	–				
11. Service robot knowledge	-.03	.02	-.06	-.02	.00	.08	.44 ^{ab}	.09	.30 ^{ab}	.42 ^{ab}	–			
12. Work engagement	-.20 ^{ab}	.06	.02	.02	.04	.16 ^a	.67 ^{ab}	-.16 ^a	-.15 ^a	.29 ^{ab}	.39 ^{ab}	–		
13. Service performance	-.02	-.03	.19 ^{ab}	-.01	.03	.10	.31 ^{ab}	-.06	-.22 ^{ab}	.17 ^a	.11	.38 ^{ab}	–	
14. Customer helping behavior	-.14 ^a	.08	-.05	-.02	-.05	.02	.36 ^{ab}	-.07	.04	.27 ^{ab}	.34 ^{ab}	.40 ^{ab}	.43 ^{ab}	–
Mean	.09	.37	.12	.52	.35.24	4.59	2.98	2.98	2.84	3.26	3.11	3.28	3.77	3.42
SD	.29	.48	.32	.50	7.62	3.78	.92	.89	.80	.71	.76	.84	.65	.70
Median	.00	.00	.00	1.00	34.00	3.42	3.00	3.00	2.90	3.33	3.10	3.33	3.75	3.33
Mode	.00	.00	.00	1.00	30.00	1.17	3.00	3.33	3.00	3.50	3.00	3.00	3.50	3.33
Min	.00	.00	.00	.00	20.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max	1.00	1.00	1.00	1.00	54.00	21.83	5.00	5.00	4.80	4.83	4.80	5.00	5.00	5.00

Table 1. Continued

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Skewness		2.89	.57	2.43	-.06	.43	1.76	-.12	-.01	-.12	-.24	-.22	-.23	-.09
Kurtosis		6.40	-1.70	3.95	-2.02	-.48	3.55	-.41	-.51	-.43	.09	-.02	-.09	-.54
α		-	-	-	-	-	-	.86	.81	.94	.86	.87	.82	.80
CR	-	-	-	-	-	-	-	.87	.81	.94	.88	.87	.82	.81
AVE	-	-	-	-	-	-	.68	.60	.60	.85	.71	.57	.60	.51

Note: N = 200. SD = standard deviation. α = Cronbach's alpha. CR = composite reliability. AVE = average variance extracted.

Gender: 0 = female; 1 = male. * $p < .05$, " $p < .01$. Industry dummy 1 = banking and financing; dummy 2 = food & beverage; dummy 3 = hospitality & tourism; the base category is the retail sector.

Table 2. Indirect effect of customer incivility on service performance and customer helping behavior through work engagement

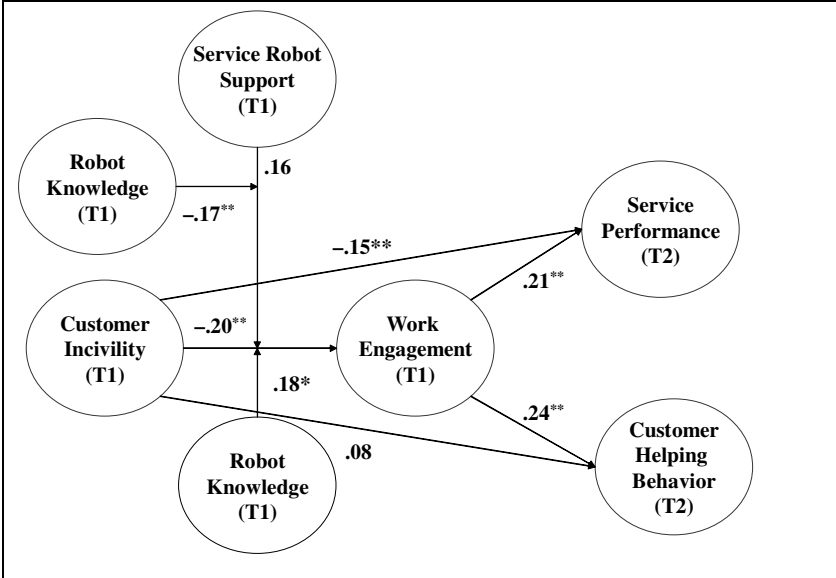
	Path	Effect(b)	95%CI _{low}	95%CI _{high}
Total effect				
	Customer Incivility → Service Performance	-.172	-.296	-.050
Direct effect				
	Customer Incivility → Service Performance	-.149	-.276	-.026
Indirect effect				
	Customer Incivility → Work Engagement → Service Performance	-.023	-.074	-.001
Total effect				
	Customer Incivility → Customer Helping Behavior	.048	-.089	.178
Direct effect				
	Customer Incivility → Customer Helping Behavior	.075	-.057	.194
Indirect effect				
	Customer Incivility → Work Engagement → Customer Helping Behavior	-.027	-.083	-.001

Table 3. Moderating effects of service robot support and service robot knowledge

Variables	Work engagement <i>b</i> (SE)	Work engagement <i>b</i> (SE)	Service performance <i>b</i> (SE)	Customer helping behavior <i>B</i> (SE)
Intercept	3.36(.08)**	3.35(.08)**	3.06(.25)**	2.67(.27)**
Industry dummy 1	-.34(.15)*	-.37(.14)*	.16(.15)	-.16(.17)
Industry dummy 2	.07(.09)	.05(.09)	.04(.09)	.04(.10)
Industry dummy 3	.08(.13)	.02(.13)	.39(.14)**	-.09(.15)
Gender	-.19(.09)*	-.19(.08)*	-.08(.09)	-.07(.10)
Age	.00(.01)	.00(.01)	.00(.01)	-.01(.01)
Job tenure	.03(.01)*	.02(.01)	.00(.01)	.00(.01)
Positive affectivity	.54(.05)**	.49(.05)**	.11(.06)	.12(.07)
Negative affectivity	-.04(.05)	-.04(.05)	.05(.05)	-.03(.06)
Customer incivility	-.18(.06)**	-.20(.06)**	-.15(.06)**	.08(.06)
Service robot support	.21(.06)**	.17(.07)*		
Service robot knowledge		.21(.07)**		
Customer incivility X Service robot support	.20(.07)**	.16(.08)		
Customer incivility X Service robot knowledge		.18(.07)*		
Service robot support X Service robot knowledge		-.02(.07)		
Customer incivility X Service robot support X Service robot knowledge		-.17(.06)**		
Work engagement			.21(.07)**	.24(.08)**
<i>R</i> ²	54.4%	58.5%	21.9%	19.7%
Moderated and three-way moderated mediation index				
Customer incivility X Service robot support → Work engagement → Service performance: <i>b</i> = .042, 95% CI [.008, .102]				
Customer incivility X Service robot support → Work engagement → Customer helping behavior: <i>b</i> = .049, 95% CI [.008, .126]				
Customer incivility X Service robot support X Service robot knowledge → Work engagement → Service performance: <i>b</i> = -.035, 95% CI [-.095, -.003]				
Customer incivility X Service robot support X Service robot knowledge → Work engagement → Customer helping behavior: <i>b</i> = -.042, 95% CI [-.111, -.004]				

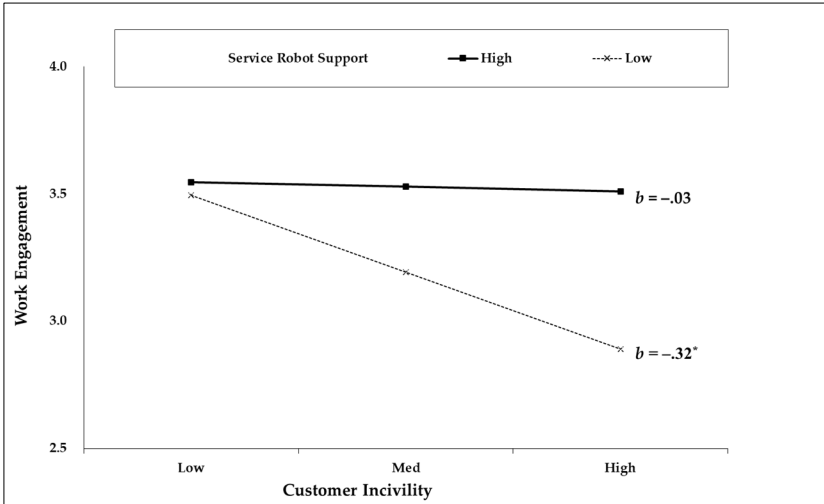
Note: N= 200; *b* = unstandardized coefficients. SE = standardized error. CI = confidence interval. **p* < .05, ***p* < .01. Industry dummy 1 = banking and financing; dummy 2 = food & beverage; dummy 3 = hospitality & tourism; the base category is the retail sector.

Figure 1. Summary of the proposed three-way moderated mediation model



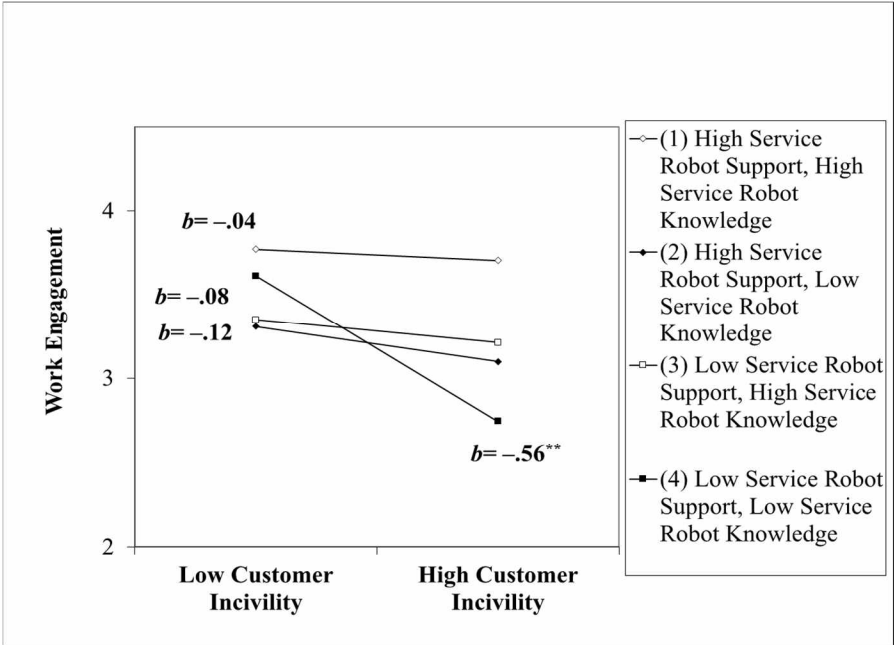
Note: $*p < .05$, $**p < .01$. Control variables = gender, age, job tenure, positive and negative affect, and industry dummies T1 = Time 1, T2 = Time 2.

Figure 2. Moderating effect of service robot support on the negative relationship between customer incivility and work engagement



Note: $*p < .05$, $**p < .01$

Figure 3. Three-way moderating effect of customer incivility, service robot support, service robot support on work engagement



Appendix

Measurement items

Construct	Measurement items
Customer incivility	<i>How often have customers (within the past one month)</i> ...continued to complain despite your efforts to assist them? ...made gestures (e.g., eye-rolling, sighing) to express their impatience? ...grumbled to you about slow service during busy times? ...made negative remarks to you about your organization? ...blamed you for a problem that you did not cause? ...addressed you in an inappropriate manner (e.g., "Hey you")? ...failed to acknowledge your efforts when you have gone out of your way to help them? ...grumbled to you that there were too few employees working? ...complained to you about the value of goods and services? ... made inappropriate gestures to get your attention (e.g., snapping fingers)?
Service robot support	My service robots assist me with heavy workloads. My service robots go out of their way to help me with work-related problems. My service robots help me out when things get demanding. My service robots help me when I'm running behind my work. My service robots help me with difficult assignments, even when I do not directly request My service robots show me where things are that I need to do my job.
Service robot knowledge	I know a lot about my service robots. I do not feel very knowledgeable about my service robots ®. Among my circle of friends, I'm one of the "experts" on my service robots. Compared to most other people, I know less about my service robots ®. When it comes to my service robots, I really don't know a lot ®.
Work engagement	At my work, I feel bursting with energy. I am enthusiastic about my job. I am immersed in my work.
Service performance	I am friendly and helpful to customers. I am approaching customers quickly. I am asking good questions and listening to find out what a customer wants. I am able to help customers when needed.
Customer helping behavior	I voluntarily assist customers even if it means going beyond my job requirements. I go out of my way to make a customer satisfied. I go above and beyond the call of duty when serving customers.
Positive affectivity	Inspired Active Interested
Negative affectivity	Upset Nervous Afraid

Note: All items were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with the exception of customer incivility, which was measured from 1 (never) to 5 (very often). Reversed coded = ®.