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TECHNO-SERVICE-PROFIT CHAIN: THE IMPACTS OF IOT-ENABLED ALGORITHMIC CUSTOMER SERVICE SYSTEMS FROM AN INTERDISCIPLINARY PERSPECTIVE[1]

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The infusion of emerging technologies (e.g., IoT-enabled algorithmic customer service systems [IACSs]) often brings disruptive changes to customer service. In particular, the agentic nature of these technologies challenges prominent service theories. Among these challenges, recent scholarly calls have pushed for more research on the infusion of emerging technologies into the service-profit chain (SPC) framework, advocating for the importance of extended knowledge to develop a techno-infused version of the SPC. Thus, from an interdisciplinary perspective, we draw upon role theory and propose a technoservice-profit chain (TSPC). Specifically, we contextualize the SPC in the technoservice context with different approaches, including decomposing context-specific constructs and theorizing IACS implementation as a contextual factor that moderates TSPC relationships. Using a sequential mixed methods design combining quantitative and qualitative approaches, we tested our research model by conducting multiwave surveys and follow-up interviews in a large business-to-business service firm with data from employees, supervisors, and customers before and after IACS implementation. This interdisciplinary study contributes to the information systems, service marketing, and management literatures by enriching the compositions of core SPC constructs, theorizing interactions between human agents and technology agents, and scrutinizing the impacts of technology agents on the linkages between internal employee management and external customer service. Our results further reveal the emerging issues of competing bosses (i.e., supervisors and IACSs), competing employees (i.e., employees and IACSs), and the unintended dehumanization effects of IACSs on supervisors and employees.

Keywords: Technoservice-profit chain, artificial intelligence, algorithmic systems, internet of things, customer service, role theory, dehumanization, competing agents, the future of work, interdisciplinary approach

Introduction

The infusion of emerging digital technologies (hereafter referred to as technologies) often brings disruptive changes to customer service (Bock et al., 2020). For instance, firms are increasingly replacing employees with technologies in service tasks (McLeay et al., 2021). As a result, the term *technoservices* (Bryson et al., 2020; Harwood & Garry, 2017) is increasingly being used to portray the digital transformation of service work where humans and technologies interact

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synergistically (Haesevoets et al., 2021). Since effective service work demands knowledge and expertise across functional areas like information systems (IS), service marketing, and management, an interdisciplinary approach is crucial to theoretically understanding technology-infused service innovations (Chen et al., 2021, 2022; Hsieh et al., 2011, 2012, 2013).

As a practice of configuring technoservices, many firms are integrating algorithmic customer service systems with large-scale networks of heterogeneous devices, such as the internet of things (IoT) (Faraj et al., 2018; Monteiro & Parmiggiani, 2019), thereby creating IoT-enabled algorithmic customer service systems (IACSs) (pronounced "ices"). For instance, in the manufacturing sector, Diebold—a multinational financial and retail technology firm that controls 35% of the global automated teller machine (ATM) market (Wolde & Knolle, 2015)—uses an IACS to monitor the operation of its ATMs and interact with employees to provide maintenance services for bank clients (Porter & Heppelmann, 2014). Specifically, the IACS algorithmically evaluates any problematic situation and, if necessary, deploys a service technician with a detailed diagnosis of the problem, a recommended repair process, and the needed parts. The system also enables Diebold to provide technicians with advanced intelligence about problems and solutions, thus reducing service costs and improving first-time fix rates. Overall, the integration of the IoT and algorithms enables the powerful impacts of IACSs.

While IACSs have long been viewed as passive tools that can be used to improve operational efficiency (see a review in Appendix A, Table A1), recent discussions have advocated for viewing such systems as possessing agentic capabilities to initiate their own actions to engage humans and even to behave like bosses making decisions (Baird & Maruping, 2021; Berente et al., 2021; Möhlmann et al., 2021). In this vein, some scholars have discussed how to coordinate IACSs and humans to achieve effective outcomes when power becomes transferrable between these two forms of agents (Rai et al., 2019; Schuetz & Venkatesh, 2020; Sturm et al., 2021; Xu et al., 2020). One unsolved challenge is uncovering how IACSs affect human agent behaviors and reshape the relationships among different actors in service encounters (Bitner & Wang, 2014; Hogreve et al., 2022; Ostrom et al., 2015).

The above discussion urges a nuanced understanding of the interplay between humans and IACSs in service processes ranging from internal employee management to external customer service. To that end, the service-profit chain[2] (SPC) theoretically prescribes that effective internal management enhances employees' performance, thereby elevating customer satisfaction and loyalty (see a review in Appendix A, Table A2). The conventional SPC model thus stresses the boundary-spanning role of employees and articulates the chain effects of internal employee management on external customer service (Heskett et al., 1997; Hogreve et al., 2017, 2022).

However, the emerging infusion of IACSs into service encounters challenges the traditional SPC model in various ways. First, conventional SPC constructs fail to capture the nuances in core SPC constructs stemming from the infusion of emerging technology agents into service encounters. Second, the traditional SPC focuses on interactions among human agents (mostly employees and customers) and views technologies simply as tools (e.g., Hogreve et al., 2017). It does not fully capture how emerging technology agents, such as IACSs, may interact with human agents (i.e., supervisors, employees, and customers) and redefine and reshape their relationships in service encounters (e.g., Hogreve et al., 2022; Mick & Fournier, 1998). Third, the first customer touchpoints and interactions with supervisors are shifting from employees to technologies, challenging employees' boundary-spanning role in service encounters (Collier & Kimes, 2013). As the service interface is becoming more technology dominant than human driven, the roles of supervisors and employees could become dehumanized in the eyes of employees and customers.

The above challenges have led to recent calls for research on the infusion of emerging technologies within the SPC framework (Bock et al., 2020; Hogreve et al., 2022), advocating the need to extend knowledge from multiple disciplines to develop a techno-infused version of SPC. Such an expanded model can account for the impact of the digital transformation of services by IACS implementation on changing key stakeholders' roles, experiences, and expectations (Hollebeek et al., 2021). In response, we aim to revamp the traditional SPC by proposing a techno-service-profit chain (TSPC) that theoretically explores the changes IACSs bring to service processes and the impacts of IACSs on chain relationships.

[2] Heskett et al.'s (1994) paper, which proposes the SPC framework, was named "a perennial best-selling paper" at *Harvard Business Review* (see the editor's note in 2008, p. 118). The framework is now one of the most prominent concepts in service research (Hogreve et al., 2022) and has gained considerable scholarly attention over the last 25 years, reaching almost 7,000 citations (Google Scholar, October 31, 2022).

Following the framework developed by Hong et al. (2014), we employ a systematic contextualization approach to formulate the TSPC. First, we include techno-related constructs in the TSPC by decomposing (1) employees' job motivation into external motivation to comply with requirements from the IACS (EM-IACS) and external motivation to comply with one's supervisor (EM-S) and (2) employees' job performance into in-role performance (IPerf), which pertains to technical core tasks, and extra-role performance (EPerf), which relates to nontechnical core tasks. Second, we include IACS implementation as a key contextual contingency that moderates the relationships among the decomposed SPC constructs. Third, we assess the direct effect of the contextual factor (i.e., IACS implementation) within the TSPC in our post hoc analyses. Drawing on role theory, we elaborate how IACSs affect employees' service process scripts, script uncertainty, and interdependence and relational exchanges with other stakeholders (e.g., supervisors and customers) and then compare TSPC relationships before and after IACS implementation in a business-to-business (B2B) service setting.

Empirically, we conducted a sequential quantitative-qualitative mixed methods design to test the proposed TSPC model (see Figure 1) and hypotheses in a technical service setting (i.e., ATM maintenance services) wherein the distinction between IPerf and EPerf is salient, stable, and important for ensuring organizational effectiveness (Bateman & Organ, 1983; Van Dyne & LePine, 1998; MacKenzie et al., 1991).

This interdisciplinary study contributes to the IS, service marketing, and management literatures by revamping the SPC under the infusion of IACSs and proposing a new TSPC model. In particular, we contextualize the SPC in the techno-service context with different approaches, including decomposing context-specific constructs, theorizing IACS implementation as a contextual factor that moderates TSPC relationships, and examining the direct effects of IACS implementation on the TSPC constructs in post hoc analyses. Viewing IACSs as agentic IS artifacts instead of passive tools interacting with human agents in service encounters, we extend the conventional SPC model in several important ways. First, the TSPC, a renewed version of the SPC, enriches the compositions of core SPC constructs by reflecting the nuances in how employees are motivated and perform in service encounters. Second, the TSPC theorizes the interactions between human and technology agents to explain how IACSs can reshape relationships between internal employee and external customer management. Third, a techno-infused version of the SPC challenges employees' boundary-spanning role in service encounters and uncovers a new servicescape of dehumanized employees and supervisors in technology-dominant service interfaces. In a broader sense, our work contributes to the service ecosystem as a whole by illustrating how IACSs, as an emerging form of technology agent, change the interplay among service supervisors, employees, and customers, thereby exerting a ripple effect on employee services experienced by external customers. We also reveal a salient power shift from supervisors and employees to the system after IACS implementation, highlighting the emerging issues of competing bosses and competing employees and the unintended dehumanization of supervisors and employees in the eyes of employees and customers, respectively.

Theoretical Background

In this section, we discuss the theoretical background of the TSPC model and our approach to contextualization based on the framework suggested by Hong et al. (2014). Following a systematic process, we elaborate on the agentic nature of IACSs, which informs the decomposition of the core SPC constructs in our context. We then scrutinize the service processes from a role theory perspective, which leads us to incorporate IACS implementation as a contextual factor in the conventional SPC model, thereby formulating the TSPC.

Techno-Service-Profit Chain: Contextualization of the SPC

The conventional SPC is a theoretical framework that links various aspects of a company's customer service operations (Heskett et al., 1994; Hogreve et al., 2017). The SPC articulates that internal employees who are provided with and guided by supportive internal employee management practices, such as training and development, rewards and compensation, and appropriate job design, tend to engender personal obligation and gratitude toward their companies. In turn, these employees are more capable and highly motivated to provide superior performance (e.g., Kuvaas & Dysvik, 2009) and tend to serve customers well by achieving customer satisfaction and loyalty (e.g., Liao et al., 2009). Scholars have demonstrated the spillover effects of internal employees' performance on external customers' evaluations with different chain constructs (Hogreve et al., 2022; Homburg & Stock, 2004; Homburg et al., 2009). A few studies have further substantiated the framework with different extensions, such as temporal effects (Evanschitzky et al., 2012) and chain effects in B2B environments (Theoharakis et al., 2009) (see Appendix A, Table A2).

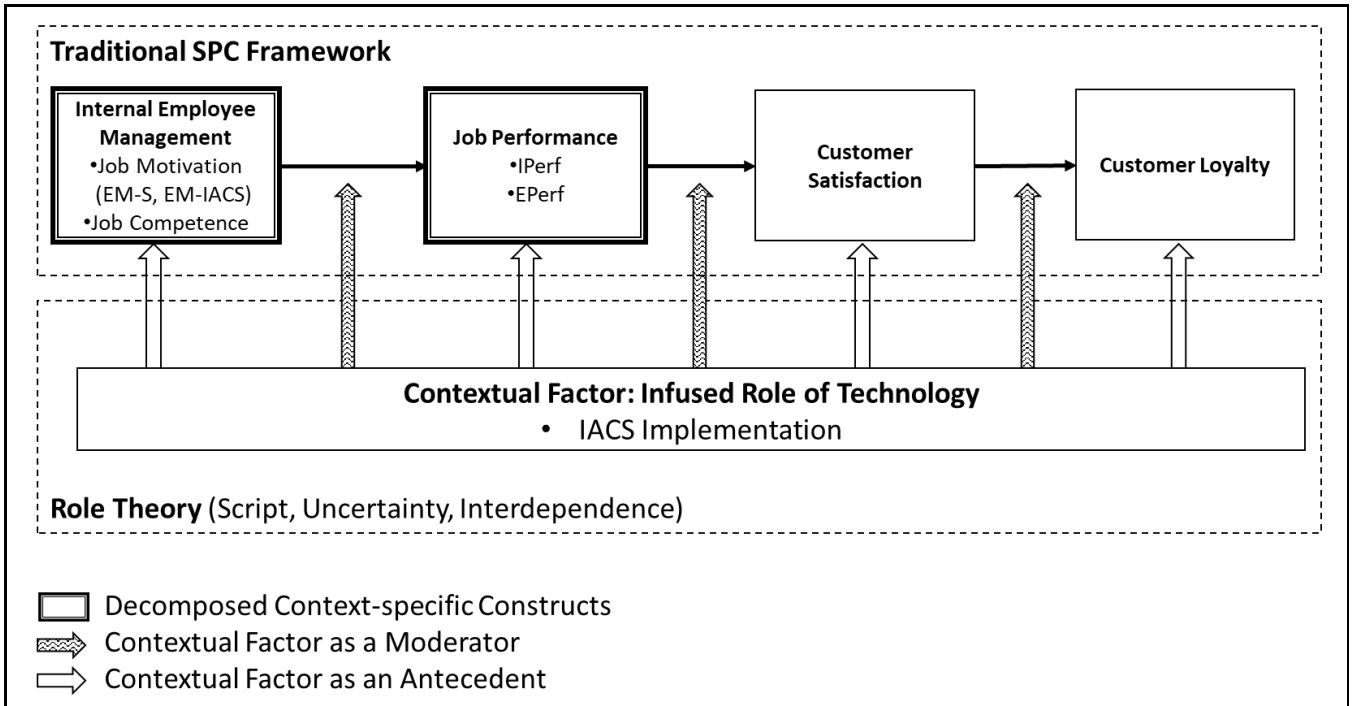

Figure 1. Conceptual Framework of the TSPC Based on Our Theoretical Background

While prior SPC research has examined technologies (Hogreve et al., 2017; Kamakura et al., 2002; Sergeant & Frenkel, 2000), these studies tend to view them merely as one of many organizational tools or investments (Heskett et al., 1994; Kamakura et al., 2002) without clearly conceptualizing the agentic capabilities of these technologies and how they can affect the SPC as a whole. Accordingly, scholars have recently called for research investigating the infusion of agentic technologies within the SPC framework (Hogreve et al., 2022).

To that end, the rapid development of IoT-enabled algorithmic systems like IACSs has facilitated algorithmic control around the direction, evaluation, and disciplining of employees, thus reshaping the control structures in service firms and complicating employees' compliance with human supervisors and algorithmic systems (Kellogg et al., 2020; Möhlmann et al., 2021). IACS implementation could further alter the scripts of all involved actors (i.e., supervisors, employees, and customers) and the way they interact with one another (Christ-Brendemühl & Schaarschmidt, 2019; Rafaeli et al., 2017).

As IACSs bring significant changes to the service processes, we introduce the TSPC to precisely capture the chain relationships that arise during the transformation caused by IACS implementation. The TSPC also allows us to revisit a traditional research topic with a more contextualized lens (Johns, 2017). Scholars have long advocated for treating context proactively in the theorizing process rather than viewing it simply as a background setting (e.g., Johns, 2006, 2017). In the IS area, the study of technologies, in particular, requires better contextualization (Orlikowski & Iacono, 2001), and this contextualization should center around the characteristics of the technologies (Hong et al., 2013).

Accordingly, we employ a contextualization approach in formulating the TSPC so as to revamp the conventional SPC in the context of IACS implementation. Specifically, to develop a richer understanding of the relationships in service encounters that arise during the digital transformation driven by IACSs, we drew inspiration from Hong et al. (2014). Namely, we followed their guidelines for single-context theory contextualization and delineated our systematic process in Table 1.

Our proposed TSPC focusing on the SPC model as the general theory helps understand the chain impact of internal employee management on external customer service. We next discuss the agentic nature of IACSs and how IACS implementation, as a contextual factor, enriches the compositions of and relationships among the SPC constructs.

Table 1. Conceptual Development of the TSPC as a Contextualized Theory (Adapted from Hong et al.'s [2014] Guidelines)

Step	Explanation	Our efforts toward developing the TSPC
Step 1: Identify the general theory	The general theory should be "applicable to the research domain of interest."	The SPC is identified as the general theory, which argues that employees' job competence and job motivation influence their job performance, thereby affecting customer satisfaction with the employee and ultimately customer loyalty (Techno-Service-Profit Chain: Contextualization of the SPC section).
Step 2: Contextualize and refine the general theory	The general theory should be contextualized to the specific context (selecting relevant variables).	The agentic nature of IACSs revamps the SPC, as it enriches the compositions of employees' job motivation and job performance and changes the relationships among SPC constructs (Agentic Nature of IACSs section).
Step 3: Identify context-specific factors	The context should be thoroughly evaluated to generate context-specific factors as decomposed core constructs, moderators, or antecedents.	We thoroughly evaluated the context to generate context-specific factors in three ways: (1) We decomposed the core SPC constructs in the IACS context. Specifically, we differentiated two constructs for employees' job motivation (i.e., EM-S, EM-IACS) and two constructs for employees' job performance (i.e., IPerf and EPerf), as applicable to the IACS implementation context (Construct Decomposition in the TSPC section). (2) We incorporated IACS implementation as a contextual factor that moderates the baseline relationships (Sections: Role Theory: Scripts, Script Uncertainty, and Interdependence and Incorporating IACS Implementation in the TSPC from a Role Theory Perspective). (3) We further assessed the direct effects of the contextual factor (i.e., IACS implementation) on decomposed SPC factors in our post hoc analyses (Latent Construct Mean Comparison section).
Step 4: Model context-specific variables	The context-specific factors should be incorporated into the general model as decomposed core constructs, moderators, or antecedents.	A context-specific model (i.e., the TSPC) is developed. This model conceptualizes the decomposed SPC constructs in the context of IACS implementation and hypothesizes how IACS implementation moderates the relationships among the context-specific SPC constructs (Hypothesis Development section). We also explore the direct effects of IACS implementation on the context-specific SPC constructs (Latent Construct Mean Comparison section).
Step 5: Examine the interplay between the IT artifact and the context-specific variables	The interactions between the specific technology and the context-specific factors should be examined.	A technology-specific factor (i.e., IACS implementation) is included as part of the research model. Furthermore, we strive to incorporate IACS features to theorize our hypotheses.

Agentic Nature of IACSs

We conducted this study in the B2B context, wherein algorithms and IoT-enabled service innovations are becoming increasingly prevalent (e.g., Dimitrov, 2016; Faraj et al., 2018; Monteiro & Parmiggiani, 2019; Wortmann & Fluchter, 2015). The IoT refers to a collection of devices, such as radio tags, sensors, actuators, smartphones, and GPS receivers, that are connected to the internet (Andersson & Mattsson, 2015; Pavlou, 2018). These devices can sense, gather, and exchange data without human intervention and are capable of tracking, monitoring, and controlling products and services (Yu et al., 2015; Zhou, 2013).

The IoT can be integrated with algorithms, or computer-programmed procedures for transforming input data into a desired output (Gillespie, 2014), to manage employees and support their customer service activities (Pavlou, 2018). Various sectors, including the manufacturing (e.g., Diebold), airline (e.g., GE Aviation), logistics (e.g., UPS), beverage (e.g., Coca-Cola), and energy (e.g., ABB) sectors, have implemented IACSs to improve their customer service experience (see Table 2 for a summary and Appendix B for more details about Coca Cola and GE Aviation).

Table 2. Key Features of IACSs with Examples

Core IACS features	Examples		
	Diebold	**Coca-Cola**	**GE Aviation**
Cloud-enabled information hub	Centralizes information on ATM performance and condition in the cloud-based information hub.	Centralizes information on consumption patterns and product inventories from vending machines in the cloud-based information hub.	Centralizes information on aircraft usage, fuel consumption, and aircraft operations in the cloud-based information hub.
IoT-enabled 24/7 monitoring and tracking	Monitors and tracks the company's ATMs in terms of performance and signs of trouble 24/7.	Monitors and tracks consumption patterns and inventories of the company's vending machines 24/7.	Continuously monitors and tracks aircraft performance in the air and on the ground.
Algorithm-enabled real-time decision-making	Algorithmically evaluates the centralized information and, if necessary, deploys a technician with algorithmic intelligence about what is malfunctioning, what parts are needed, and how to address the issue to maximize first-time fix rates.	Analyzes the centralized information using algorithmic intelligence to optimize decisions about where and when to replenish specific products by the most appropriate replenishment truck/van.	Algorithmically analyzes the centralized information and gives operators, maintenance technicians, and logisticians actionable insights into aircraft performance by identifying problems before they happen and assisting in addressing difficult-to-diagnose issues.

IACSs integrate a variety of IoT devices to collectively automate and optimize customer service processes. A typical IACS differs from a traditional customer service system by introducing the following technological features: (1) a cloud-based information hub that centralizes the vast stream of data and disseminates this data to different parties involved in the SPC (Wortmann & Fluchter, 2015); (2) an IoT-enabled 24/7 monitoring and tracking feature that automatically detects and updates the status of customers' products (e.g., any malfunction), submits requests to send service employees to customer sites for maintenance, and keeps track of employee details (e.g., location, travel routes, and service outcomes) (Andersson & Mattsson, 2015); and (3) a real-time algorithmic decision-making feature that immediately optimizes employees' task assignments based on their prior performance record, schedules, availability, and physical proximity to customer sites and recommends appropriate solutions and tools to fulfill customer requests (Porter & Heppelmann, 2014).

The extant literature on algorithms at work mostly focuses on algorithmic systems as a means of achieving organizational and economic goals. Algorithmic systems have shown potential to optimize labor productivity (Möhlmann et al., 2021), enhance decision-making (Fügener et al., 2021), and facilitate organizational learning (Sturm et al., 2021). However, this line of discussion assumes that human agency has primacy in the human-algorithm relationship (Orlikowski & Iacono, 2001). Conventional IS theories view algorithmic systems as passive technological tools and maintain that human agents are responsible for applying these tools to a problem or process. However, some have recently urged scholars to revisit this assumption of human agency primacy for the generation of new IS artifacts, including artificial intelligence and the IoT (Baird & Maruping, 2021; Berente et al., 2021). These artifacts possess agentic capabilities relevant to task completion and goal attainment and can initiate their own actions to engage users. The agentic nature of these artifacts may fundamentally change the relationships in service encounters, as power may transfer between human and IS artifacts as a result of changes in employees' roles and scripts in terms of their interdependence and relational exchanges with supervisors and customers.

In our context, IACSs are no longer passive tools waiting to be used. With the three technological features described above, IACSs can initiate task-dispatching decisions; conduct performance evaluations; and coordinate with human supervisors to direct, evaluate, and control employees (Kellogg et al., 2020; Möhlmann et al., 2021). As a consequence, the agentic nature of IACSs may lead to the issue of dehumanization in service encounters. In general, dehumanization refers to objectifying essential human attributes and representing people as inanimate objects, such as robots and machines (Haslam, 2006). In service encounters, the information centralization, algorithmic task assignments, and objective performance evaluations enabled by IACSs have deprived supervisors of their agency and objectified social relationships between supervisors and employees. Similarly, IACSs routinize employees' responsibilities, reducing their interdependence and relational exchanges with customers and devaluing their experience and expertise. Hence, the roles of supervisors and employees become dehumanized in the eyes of employees and customers, respectively.

Construct Decomposition in the TSPC

The agentic capabilities of IACSs reshape relationships among key stakeholders in service processes. Thus, it is theoretically important to scrutinize the nuances of TSPC constructs in the context of IACSs.

To start, *internal employee management practices* are essentially aimed at developing a skilled and motivated workforce (Wright et al., 1997). Accordingly, Jiang et al. (2012) identified human capital and motivation as the two core mechanisms that channel the effects of internal employee management practices to employees' job performance. Following this line, our proposed TSPC includes both human capital and employees' motivation as the two key internal employee management mechanisms that initiate the chain effects in the TSPC. Specifically, we refer to human capital as employees' job competence (JobComp), defined as employees' knowledge, skills, and abilities in performing their job roles (Spreitzer, 1995).

Regarding employees' motivation, scholars have discussed the effects of internal motivation (IM) and external motivation (EM) on employees' job performance (Deci & Ryan, 2002; Sansone & Harackiewicz, 2000). While IM facilitates employees' job performance based on personal interest or the enjoyment inherent in an activity itself (Ryan & Deci, 2000), the effect of EM can be situationally determined. Referring to individuals acting with instrumental purpose, EM represents the desire to act based on a sense of pressure and obligation—namely, when individuals feel that their behaviors are externally regulated by outside forces, such as other people or rewards and punishments (Grant et al., 2011; Sansone & Harackiewicz, 2000). In this study, with our proposed TSPC, we include EM-S together with EM-IACS as the two key sources employees need to comply with. First, as employees often perform work-related behaviors to attain, satisfy, and comply with their supervisors' expectations, scholars often view supervisors as the primary source of employees' EM (Gagné & Deci, 2005; Salvaggio et al., 2007; Schneider et al., 2005). Kozlowski and Doherty (1989, p. 547) stated that "an individual's immediate supervisor is the most salient, tangible representative of management action, policies, and procedures." We thus define EM from supervisors (EM-S) as employees' motivation to complete their work to fulfill instructions from their immediate supervisors (Malhotra et al., 2008). Second, IACSs take over some supervisory functions, such as task assignments, information support, and performance monitoring and evaluations. Thus, employees are also externally motivated to comply with new requirements from IACSs (EM-IACS), which has recently been viewed as another type of boss other than human supervisors at work (Möhlmann et al., 2021).

The distinction between EM-S and EM-IACS corresponds to different forms of managerial controls that motivate employees' performance (Kellogg et al., 2020). In detail, rational control prompts employees' performance by appealing to their self-interest and increasing EM-S to comply with bureaucratic leadership in organizations (e.g., Barley & Kunda, 1992), whereas algorithmic control, a new form of managerial control, implies that IACSs are instruments that regulate employees' performance, provoking their EM-IACS to comply with algorithms (Kellogg et al., 2020). Our decomposition approach thus sheds light on changes in the strength of these competing bosses (supervisor versus IACS) in influencing employees' service process scripts and relationships with others, which then affect their job performance.

While services scholars have acknowledged the pivotal role of employees' performance in influencing customers' evaluations, they predominately treat employees' job performance as an overall evaluation without differentiating between IPerf and EPerf (Hong et al., 2013; Martinaityte et al., 2019; Netemeyer et al., 2010; Simons & Roberson, 2003). However, as with the infusion of technology in contemporary services, this differentiation of employees' job performance is crucial for capturing their distinct nuances in techno-services where human agents interact with technology agents. IPerf refers to predefined, regular activities based on formal job descriptions that affect the focal organization's *technical core* as employees either execute technical processes or maintain technical requirements (Borman & Motowidlo, 1993; Motowidlo & van Scotter, 1994). The absence of in-role behaviors leads to reprimands and negative financial consequences. On the contrary, EPerf refers to behaviors that are discretionary and go beyond formal job requirements, thus pertaining to the *nontechnical core* of the focal organization (e.g., proactively providing extra care to customers) (Hu et al., 2015; Netemeyer et al., 2005). Hence, IPerf links employees to their organization through a formal or economic exchange relationship, whereas EPerf links employees to the collective through an informal or social relationship outside formal control (Organ, 1990). Some have also described this conceptual distinction between in-role and extra-role duties as task versus non-task behaviors (Organ, 1997; Podsakoff et al., 2000). An investigation of the separate effects of IPerf and EPerf is applicable in our context, as there is a clear boundary between these two types of performance. Such differentiation between IPerf and EPerf is also imperative to understand changes in their interrelationships with employee management mechanisms and customers' evaluations of service due to IACS implementation. This combination further echoes Noble et al.'s (2022) and Mende and van Doorn's (2013) view that human-machine interactions need to involve both technical and relational aspects to attain successful working alliances, though the degree of their importance could vary situationally.

In short, our discussion decomposes the SPC in the IACS context. Below, we discuss role theory, the overarching lens informing the interplay between the SPC and IACSs in our TSPC framework.

Role Theory: Scripts, Script Uncertainty, and Interdependence

Role theory describes organizations as open systems consisting of the "patterned activities of a number of individuals" (Katz & Kahn, 1978, p. 17). These patterned activities, or roles, represent collections of actions that are expected to be or perceived as necessary by different stakeholders (Ilgen & Hollenbeck, 1991). Work roles encompass expectations pertaining to responsibilities or requirements associated with performing specific jobs (Dierdorff & Rubin, 2007). These role expectations are thus beliefs about what is required for successful role performance for all actors involved (Biddle, 1986). Each role is associated with a set of scripts, referring to "predetermined, stereotyped sequence[s] of actions that define a well-known situation" (Schank & Abelson, 1977, p. 41). Thus, roles and scripts are important as they can help people understand their own actions and other actors' behaviors (Miao et al., 2011) so that encounters among actors can proceed smoothly (Giebelhausen et al., 2014).

Moreover, role theory asserts that contextual factors shape and change individuals' scripts (Biddle, 1979) as a script "does not occur in isolation; it is itself shaped by additional or contextual factors" (Katz & Kahn, 1978, p. 19). Among these contextual factors, work context (e.g., IACSs in this study) is considered the "backdrop against which role enactment occurs" (Dierdorff & Morgeson, 2007, p. 129). In particular, script uncertainty and interdependence are two pervasive factors organizations must manage to achieve effective performance among employees (Dierdorff et al., 2012; Katz & Kahn, 1978). Script uncertainty and interdependence represent the informational and interpersonal elements, respectively, of social contingencies that affect how people construe and enact their work roles (Dierdorff et al., 2009, 2021; Johns, 2006; Morgeson & Humphrey, 2006). Script uncertainty occurs when the inputs, processes, and/or outputs of work systems are unpredictable (Wall et al., 2002). In our context, it refers to a lack of clarity in employees' service procedures for how, when, and where to perform tasks. Script uncertainty influences the extent to which work or tasks can be routinized and hence determines whether an individual works effectively by following predefined scripts. Prior research has widely shown that standardized work procedures can enhance employees' work effectiveness (Gilson et al., 2005; Münstermann et al., 2010). Thus, script uncertainty could breed ambiguous task procedures, making it difficult for employees to anticipate contingencies and perform tasks (Ilgen & Hollenbeck, 1991). Similarly, ambiguous service procedures without clear guidelines affect customers' expectations for employees' work (Czepiel et al., 1982; Gilson et al., 2005), so customers need to rely more on employees' extra-role or non-task-specific behaviors when evaluating their job performance (Dierdorff et al., 2012).

On top of script uncertainty, interdependence is another key factor pertaining to individuals' perceptions of their role responsibilities and their expectations for relational exchanges with others (Pearce & Gregersen, 1991). Interdependence refers to the extent to which work roles are embedded in a broader social system (Griffin et al., 2007). In an interdependent context, individuals are more likely to cooperate with others and be affected by others' performance. They also tend to be more attentive to others' voluntary and prosocial behaviors, which are seen as having greater utility when role interdependence is high (Nielsen et al., 2012; Organ et al., 2006).

Incorporating IACS Implementation in the TSPC from a Role Theory Perspective

While implementing an IACS is unlikely to change the more generic scripts of employees' IPerf and EPerf (Van Dyne & LePine, 1998; MacKenzie et al., 1991), it can nonetheless alter employees' service process scripts pertaining to the way service requests from customers are initiated, the way service tasks are assigned, the direction and speed of information flow, and the interdependence and relationships between the system and human agents (i.e., employees, supervisors, and customers) (Andersson & Mattsson, 2015; Porter & Heppelmann, 2014; Wortmann & Fluchter, 2015). Specifically, IACS implementation may change employees' service process scripts by reducing the uncertainty in their work procedures (e.g., how, when, and where to fix machines), weakening their interdependence and relationships with other stakeholders (i.e., supervisors and customers) while increasing their interdependence with the IACS. Below, we discuss the changes in employees' service process scripts and interdependence with others resulting from IACS implementation.

Prior to IACS implementation (Figure 2a), customers initiate service requests by contacting the service firm to describe a problem. Such requests are handled by a designated supervisor who has extensive field experience and knowledge to assess the situation. If the task requires an employee's physical presence at the customer site, the supervisor, who usually has a bird's-eye view of the historical service records of all the employees under supervision, will select an employee. That employee will then be given instructions and will visit the customer site to address the request. Employees can accept or reject the request based on their current availability. If the employee accepts the request, they will communicate with the customer to diagnose and solve the problem based on the request. After the visit, the employee reports to the supervisor about the work progress on-site and determines if additional resources (e.g., parts or tools) or visits are needed (Porter & Heppelmann, 2014). Further visits are generally required when the employee is not knowledgeable about the problem or request, reducing the first-time fix rate.

After the employee completes the task, the customer provides feedback on the employee's service to the supervisor, who then evaluates the employee's performance.

Throughout this process, employees' service process scripts cannot be predefined, as employees lack clarity about how to accomplish the needed tasks (e.g., fix a machine). Thus, before IACS implementation, this lack of predefined service process scripts gives supervisors more discretion to exercise their power in employees' performance appraisals and reward decisions. Employees' work is also highly interdependent on their supervisors and customers. Supervisors serve both as a bridge that ensures smooth and accurate information flow between customers and employees and as a knowledge source that assesses customer requests and provides instructions to help employees address problems. As such, employees may perceive closer relationships with and significant reliance on their supervisors to assign tasks, provide instructions, and evaluate job performance (Settoon et al., 1996). Meanwhile, employees also count on their interactions with customers to perform tasks. When working at a customer site, an employee often develops a close relationship with the customer, as the employee needs to closely coordinate their activities with the customer to further analyze the situation and, if necessary, adjust the service plan recommended by their supervisor to accommodate the customer's needs.

However, given the technological features described earlier, IACSs could extensively modify employees' service process scripts and allow for more objective evaluations of employees' performance (Figure 2b), as well as alter their relational exchanges with others. For example, an IACS can automatically detect the need for service at a customer site (e.g., machine malfunction) and submit a request instantly to the cloud-based information hub (Porter & Heppelmann, 2014). In response to the request, the IACS can immediately assign an employee to the customer site based on schedules, locations, and prior performance records and can generate clear service instructions to fulfill the service request. The IACS can further monitor service progress and track if the request has been fulfilled (i.e., effectiveness) in a timely manner (i.e., efficiency) (Andersson & Mattsson, 2015). Such clarified scripts and objective evaluation criteria for employees' work reduce supervisors' discretion and diminish employees' dependence on supervisors (Porter & Heppelmann, 2014). That is, the IACS takes over supervisors' duties and power, which consequently shifts employees' reliance on their supervisors to the system—functioning as a competing boss. In other words, the supervisor's role becomes dehumanized in the eyes of the employees due to their weakening agentic and relational exchanges with employees. Meanwhile, the IACS allows employees to resolve problems prior to customers' awareness and without necessarily communicating with customers. Hence, employees may experience reduced interdependence and relationships with their customers. Correspondingly, from the customer's perspective, their reliance shifts from employees to the system to achieve service outcomes, and they tend to view employees' task execution as more robotic and mechanic, which thus dehumanizes the role of employees.

Overall, the role theory perspective allows us to incorporate IACS implementation as a contextual factor that changes the service process scripts, role interdependence, and relationships among actors, which may alter the strength of TSPC relationships, as theorized below.

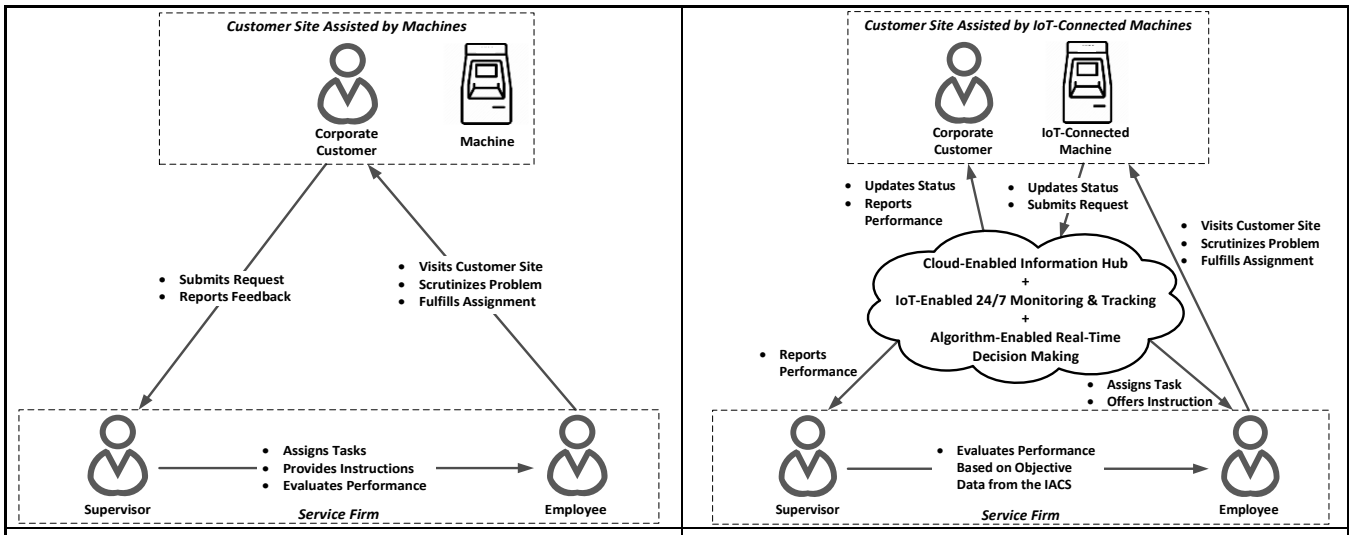

Figure 2a. Before IACS Implementation | **Figure 2a. After IACS Implementation**

Figure 2. Impact of IACS Implementation on Service Processes

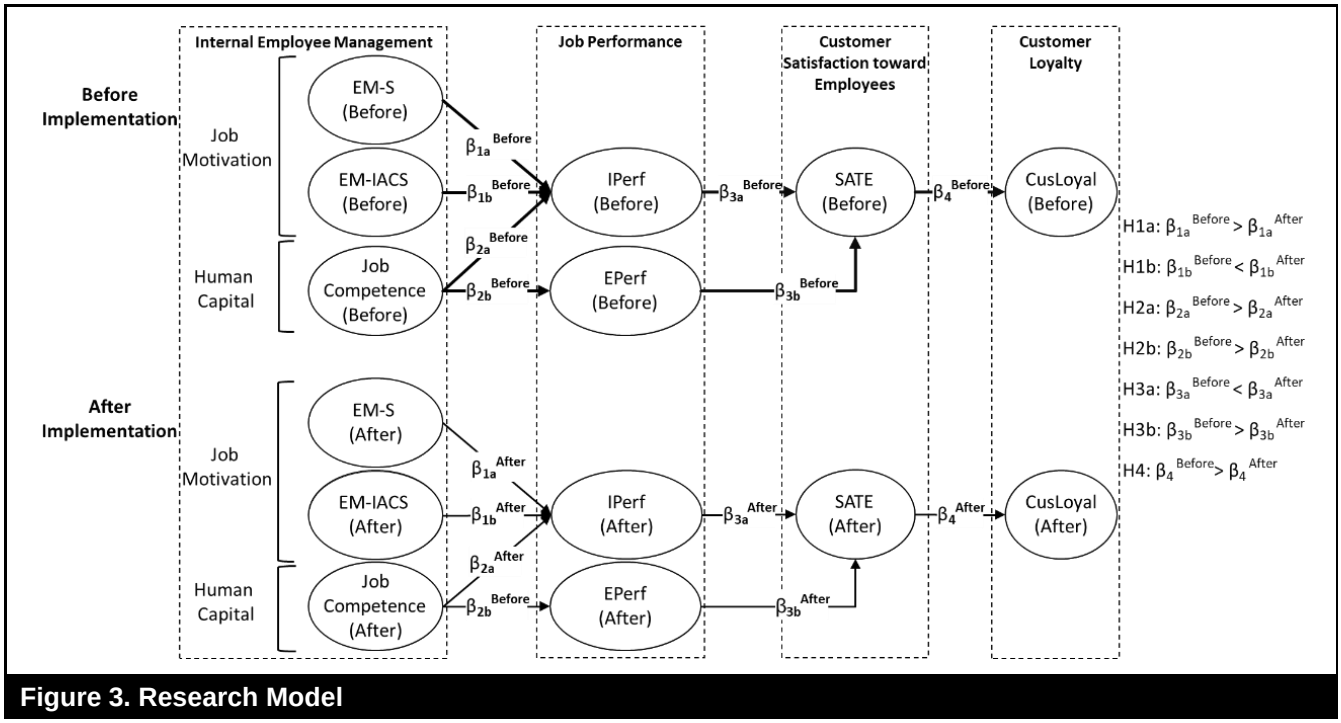

Figure 3. Research Model

Hypothesis Development

We propose a TSPC model by examining the spillover effects of two key internal employee management mechanisms (job motivation and human capital) on employees' IPerf and EPerf, which may then affect customer satisfaction toward employees (SATE) and, finally, customer loyalty (CusLoyal). Specifically, we used the key premises of scripts, script uncertainty, and interdependence from role theory to theorize the effects of an IACS in altering the strength of the constituent relationships underlying the TSPC. Figure 3 presents our research model.

Effects of Internal Employee Management on Job Performance

Effects of Employees' Motivation (EM-S and EM-IACS) on Performance (IPerf and EPerf)

Researchers generally support the contention that job motivation positively affects job performance. Some have further identified different types of job motivation and job performance and have distinguished different motivation-performance relationships (Iacobucci & Ostrom, 1996). While it is generally believed that IM positively affects employees' job performance (e.g., Chan & Lam, 2011; Luria et al., 2009), the effect of EM may vary. As Grant et al. (2011) found, IM motivates employees to engage in both IPerf and EPerf, whereas EM incentivizes employees to focus primarily on IPerf. To elaborate, employees are formally required to perform in-role activities closely associated with external rewards, promotions, and punishments (Gagné & Deci, 2005). Thus, employees' EM to comply with either their supervisors or an IACS is closely associated with IPerf (Janssen & Van Yperen, 2004; Raub & Robert, 2010).

In this study, we expect that the strength of these EM effects on employees' job performance may change differently with IACS implementation. Particularly, given that one's supervisor and the system represent employees' competing bosses, we propose that EM-S (EM-IACS) should be less (more) impactful in driving employees' job performance after system implementation due to a shift in employees' interdependence and reliance on their supervisors to that of the focal IACS. Before IACS implementation, employees' service process scripts relating to work procedures and task assignments are not predefined, and supervisors have more discretion in directing and appraising employees' performance. Employees thus exhibit a high level of interdependence and closer bonding with their supervisors to serve customers because supervisors have the dominant power in assigning jobs, recommending solutions, monitoring behaviors, and evaluating performance. Hence, without an IACS, employees' job performance heavily relies on compliance with their immediate supervisors, and thus their IPerf is driven more by EM-S.

However, with IACS implementation, employees' work procedures become largely predefined and have clear guidelines, as the IACS can automatically detect service requests, assign tasks to employees who are available and close to customer sites, provide service instructions, and objectively monitor employees' performance on a constant basis (Porter & Heppelmann, 2014). As a result, employees experience changes in their service process scripts because they receive task assignments and instructions directly from the IACS in a more timely, accurate, and regulated fashion, compared to before when they received these things from their immediate supervisors (McFarlan, 1984; Tarafdar et al., 2007; Weiss & Hughes, 2005). As the IACS objectifies service process scripts, supervisors are less able to exercise their discretion and are structurally dehumanized because employees' dependence on and relational exchanges with them diminish as many of their interactions become unnecessary. In this vein, employees' job performance relies less on their supervisors for job dispatch and service knowledge. By contrast, employees tend to perceive their job performance as depending more on receiving task assignments from the IACS and following the system-generated task instructions. The 24/7 tracking and monitoring feature also prompts employees to coordinate their activities with the job requirements predefined by the system, amplifying their interdependence on the IACS and enforcing the importance of complying with the IACS.

In brief, the IACS shifts employees' dependence on their supervisors to the system, and consequently, employees' IPerf (e.g., fixing a machine and getting the job done) is driven more by EM-IACS but less by EM-S after IACS implementation due to the reduced (increased) importance of supervisors' (the system's) role for employees' performance. Thus, we propose the following:

H1a: *The effect of EM-S on IPerf decreases after IACS implementation* ($\beta_{1a}^{Before} > \beta_{1a}^{After}$).

H1b: *The effect of EM-IACS on IPerf increases after IACS implementation* ($\beta_{1b}^{Before} < \beta_{1b}^{After}$).

Effects of Employees' Human Capital (JobComp) on Performance (IPerf and EPerf)

Besides job motivation, a skillful workforce is also essential for firm performance (Jiang et al., 2012). Prior research has shown that employees' JobComp influences their job performance, including IPerf and EPerf (Axtell et al., 2000; Parker et al., 2006). We argue that this performance impact from JobComp is likely reduced after IACS implementation due to employees' increased dependence on the IACS in their revised service process scripts. Specifically, prior to IACS implementation, real-time informational support is limited for employees' tasks. Employees may receive some guidance from supervisors when their supervisors assign tasks to them, but once employees start delivering services on-site, they need to make their own judgments and resolve problems based on their own professional expertise.

After IACS implementation, employees receive real-time instructions and detailed guidance from the IACS, which represents a major change in their service process scripts. Employees can follow the instructions to successfully resolve problems without understanding the underlying rationale. The predefined procedures and guidelines embedded in the IACS thus objectify employees' roles and routinize their responsibilities in the service processes. Employees may become more robotic and mechanic in executing the IACS guidance, and their personal judgments and professional expertise become less essential in shaping performance. As employees rely less on their own expertise and more on IACS-generated instructions to perform their jobs, the importance of JobComp for IPerf and EPerf decreases after IACS implementation. We thus propose the following:

H2a: *The effect of JobComp on IPerf decreases after IACS implementation* ($\beta_{2a}^{Before} > \beta_{2a}^{After}$).

H2b: *The effect of JobComp on EPerf decreases after IACS implementation* ($\beta_{2b}^{Before} > \beta_{2b}^{After}$).

Effects of IPerf and EPerf on SATE

Employees play a crucial role in delivering services to customers (Pfeffer, 1994). While extant research has found a positive effect of employees' performance on customer satisfaction (e.g., Hong et al., 2013; Martinaityte et al., 2019; Netemeyer et al., 2010; Simons & Roberson, 2003), the distinctive and relative effects of IPerf and EPerf have not been examined well, in general, or in relation to the infused role of technology, in particular. In this study, we argue that the effects of employees' IPerf (EPerf) on SATE increase (decrease) after IACS implementation for two main reasons.

First, script uncertainty decreases after the implementation of an IACS. Specifically, before system implementation, employees' service process scripts can emerge dynamically in response to changing conditions and demands. Thus, service outcomes may heavily depend on each employee's expertise and judgments about how to carry out tasks (Morris & Venkatesh, 2010), and customers may receive less standardized service from employees. As indicated by Dierdorff et al. (2010), the value of EPerf is likely to emerge under such uncertain working conditions. With less standardized service processes, customers may appreciate and

be more attentive to employees' EPerf. These behaviors are often more personal, social, and relationship oriented, demonstrated, for example, by showing special care like personal greetings and small tokens (Bitner et al., 1990; Lee et al., 2016). Hence, the less predefined service process before IACS implementation leads customers to rely more on employees' extra-role behaviors beyond their in-role behaviors for satisfaction evaluations.

After IACS implementation, however, service processes become well-scripted and routinized. Each employee follows predefined work procedures to perform their in-role duties, leading to more consistent service experienced by customers, echoing the findings of prior research that effective and standardized work procedures enhance customer satisfaction (e.g., Gilson et al., 2005). In such situations, work roles are expected to be performed within more predictable service environments with a high degree of task regularity (Pentland & Rueter, 1994). Accordingly, such routinized work environments are known to promote greater consensus regarding predefined tasks (Dierdorff & Morgeson, 2007) and allow less behavioral freedom for role enactment. Deviating from predictable patterns of role behaviors in routinized work environments is thus viewed as inappropriate (Dierdorff et al., 2021). From this perspective, the decreased service process uncertainty from IACS implementation, which represents a routinized service environment, may lead customers to expect conformity or regularity in employees' predefined service roles (i.e., IPerf). As such, customers may interpret employees' discretionary behaviors (i.e., EPerf) as somehow deviating from expected or prescribed behaviors, thus reducing their intended value. Hence, customers are more appreciative if employees can handle the technical core of the service well and become less attentive to employees' extra care (Dierdorff et al., 2021). In other words, customers perceive increased (decreased) value of employees' IPerf (EPerf) (Dierdorff et al., 2010) because employees' tasks are viewed as more robotic and mechanic after IACS implementation.

Second, the interdependence between customers and employees may decrease after IACS implementation. Prior to IACS implementation, a customer is more likely to interact with the same employee over time, as the respective supervisor is likely to prioritize assigning the same employee to a particular customer based on their prior interactions. Due to their repeated interactions and the discretion the employee has in performing the less predefined tasks, both parties have a closer relationship and greater interdependence with each other. The high interdependence characterizes employees' reciprocal interactions with customers to perform their roles (Morgeson & Humphrey, 2006). Under this condition, customers are likely to construe employees' prosocial behaviors as role relevant (Dierdorff et al., 2021) and will appreciate such behaviors due to the intensive social exchanges involved in role enactment (Humphrey et al., 2007; Stone & Gueutal, 1985). As Yi and Gong (2008) also note, a stronger relationship and interactions between a customer and a particular employee may increase their mutual understanding and bonding. Hence, customers' satisfaction might be heavily driven by employees' prosocial extra-role behaviors (i.e., EPerf) beyond their in-role problem-solving behaviors (i.e., IPerf).

However, after implementation, the IACS redefines workforce-allocation operations such that employees may not necessarily be assigned to the same customer for all situations as task assignments are now determined by the system. Thus, customers are more likely to interact with different employees for service tasks. With fewer chances to interact with particular employees to detect and diagnose problems as in the past, customers may objectify their relationships with employees, and their relational bonding may become weaker. As a result, customers may focus more on problem-solving outcomes and less on relationship-oriented care when formulating their satisfaction evaluations (e.g., Yi & Gong, 2008). Hence, employees' IPerf, which reflects the extent to which they can solve technical core problems effectively, becomes a more important consideration in enhancing SATE, thus strengthening the impact of IPerf on SATE.

In the meantime, due to their weakening interdependence and relational bonding with employees, customers' focus on and appreciation of employees' personal care and extra-role behaviors may be reduced (Yi & Gong, 2008). They might also attribute extra-mile efforts to purpose-driven motives, such as employees' intentions to impress their supervisors or obtain recognition or other rewards (e.g., Bendapudi et al., 1996; Chan et al., 2017). In that case, customers are less likely to make satisfaction evaluations based on EPerf, as they may perceive such behaviors to be unlikely to endure (Bendapudi et al., 1996). Hence, the impact of EPerf on SATE will likely be reduced. Taken together, we posit:

H3a: *The effect IPerf on SATE increases after IACS implementation* ($\beta_{3a}^{Before} < \beta_{3a}^{After}$).

H3b: *The effect of EPerf on SATE decreases after IACS implementation* ($\beta_{3b}^{Before} > \beta_{3b}^{After}$).

Effects of SATE on CusLoyal

Achieving CusLoyal is instrumental in enhancing and sustaining firms' profitability (e.g., Evanschitzky et al., 2012; Kumar & Shah, 2004; Reinartz & Kumar, 2002). While the drivers leading to CusLoyal are considerable, it is widely accepted that customer satisfaction is one of the key antecedents of CusLoyal (e.g., Hogreve et al., 2022; Yim et

al., 2008). Specifically, given the key boundary-spanning role of employees in the SPC, we focus on SATE and expect that the positive spillover effect of SATE on CusLoyal diminishes with IACS implementation for two reasons. First, IACSs routinize employees' service process scripts and weaken and dehumanize the role of employees in formulating CusLoyal. Before IACS implementation, service procedures are less clearly defined (Andersson & Mattsson, 2015), and customers' service experiences are more heterogeneous, as they depend more on employees' service behaviors in response to conditions and demands that emerge on-site (Morris & Venkatesh, 2010; Venkatesh et al., 2010). Scholars have further suggested that a selective halo effect exists such that customers tend to rely on easy-to-evaluate attributes to infer difficult-to-evaluate attributes (Dagger et al., 2013). Analogously, when customers are unclear about service procedures, they may rely more on easier-to-observe attributes (i.e., employees' service) to judge a firm's service capabilities (which are more behind the scenes) and formulate their loyalty evaluations. Thus, SATE based on employees' on-site services is likely pivotal in determining CusLoyal.

In contrast, after IACS implementation, employees are likely to be seen by customers more as agents who help execute instructions generated by the IACS rather than as autonomous individuals delivering service on their own initiative. That is, employees' service becomes less distinctive and more mechanical and robotic from the customer's viewpoint. While standardized working procedures might enhance customers' general satisfaction (e.g., Gilson et al., 2005), such satisfaction evaluations could be due to customers' attribution of employees' service and behaviors to firm management rather than to individual employees (Bitner et al., 1990; Yim et al., 2008). Also, as work procedures become more transparent and routinized after IACS implementation, customers can obtain more information to directly evaluate the firm's service performance, minimizing the selective halo effect from relying on employees' service to develop their loyalty evaluations (Dagger et al., 2013). Hence, CusLoyal is likely less dependent on employees' service after IACS implementation.

Second, the systematic task assignments performed by IACSs reduce the interdependence between customers and employees, as such automation renders these relationships more transactional and transient, reducing the importance of employees in fostering CusLoyal. Before IACS implementation, employees rely on their communication with customers when they work on-site to diagnose and resolve problems, strengthening their bonding with customers (e.g., Gremler & Gwinner, 2000). SATE is thus salient in affecting CusLoyal for future business. However, after IACS implementation, task assignments are carried out by the IACS, and employees accomplish work with real-time information supported by the IACS. IACSs also reduce customers' communication and interaction with particular employees and thus weaken customers' interdependence and bonding with employees, leading to more transactional relationships between these parties. Such transactional relationships not only lead to a more dehumanized role of employees in the eyes of customers but also decrease the value of employees' agency in building CusLoyal (e.g., Delcourt et al., 2013). Overall, the above reasoning collectively suggests that SATE becomes less crucial in the formation of customers' loyalty assessments after IACS implementation. We thus propose the following:

H4: *The effect of SATE on CusLoyal decreases after IACS implementation* ($\beta_4^{Before} > \beta_4^{After}$).

Research Methodology

Mixed Methods Research Design

For this study, we adopted a sequential quantitative-qualitative mixed methods design following Venkatesh et al. (2016). Given our research objectives, we first conducted a multiwave survey by gathering matched pair data from employees and customers of the investigative firm to test our hypotheses. As some of the survey results were inconsistent with our expectations, we followed prior studies (e.g., Koh et al., 2004) and subsequently conducted in-depth interviews with some employees and customers who joined the survey as well as their supervisors and the general manager of the focal firm. We administrated semi-structured interviews using protocols informed by prior literature (e.g., role theory) and our research model and included open-ended questions to allow for further insights from the interviewees. Importantly, all participants were assured confidentiality of their responses, which we directly collected without intervention from top management to minimize any information-disclosure concerns from the involved parties in the survey and interview studies.

The mixed methods design helped us achieve three objectives. First, this design enabled us to confirm our theoretical assumptions (e.g., in-role requirements did not vary before and after IACS implementation) and triangulate the results across the quantitative and qualitative components to ensure the credibility of the inferences derived from both methods. Second, the qualitative study allowed us to explain the unexpected findings from the survey and expand our understanding of the investigative phenomenon beyond the quantitative results. Third, with insights derived from both methods, we attained a more complete picture of the investigative phenomenon. Epistemologically speaking, we chose a single pragmatism paradigm that emphasized practical consequences (Biesta, 2010), allowed for using positivism in

both the quantitative and qualitative components (Venkatesh et al., 2016; Yin, 2016), and permitted both deductive and inductive logical reasoning (Tashakkori et al., 1998).

We also followed Venkatesh et al.'s (2016) work when formulating our design strategies. Specifically, we conducted a single-strand research study consisting of both quantitative and qualitative components. This study assumed the dominant-less dominant design such that the quantitative part played the dominant role. Regarding the design investigation strategy (Venkatesh et al., 2016), we chose primarily an explanatory research study, given our core objective to test hypotheses formulated a priori and to conduct follow-up qualitative interviews to further explain and expand our knowledge of the investigative phenomenon. Also, we opted for a partially mixed design as only part of this study used mixed methods (Venkatesh et al., 2016). We performed the quantitative part prior to the qualitative part, and the participants in the qualitative study were mostly survey respondents. Thus, this is a sequential quantitative-qualitative research study with sequential nested sampling. As such, we also adopted the sequential quantitative-qualitative analysis approach.

Moreover, our inference decisions considered both reasoning and inference quality. Regarding the type of reasoning, since both our quantitative and qualitative designs were primarily informed by extant literature, we relied on deduction as our primary reasoning approach. When analyzing the interview data, besides triangulating between the quantitative and qualitative components, we also inductively allowed for the emergence of unforeseen ideas (under the lens of role theory, the TSPC, and algorithmic management) in a positivist manner (Yin, 2003, 2016). We elaborate on inference quality when discussing the quantitative inferences, qualitative inferences, and meta-inferences of our mixed methods results in the ensuing subsections. Please refer to Appendix C for a brief summary of our decision choices for the mixed methods research design.

Research Site

Our investigative site is a leading ATM service provider in China. The firm specializes in maintaining ATMs used by major banks. This firm recently started implementing an IACS to innovate its B2B ATM service, providing a unique opportunity to examine changes in SPC relationships before and after IACS implementation. The way this firm leverages its IACS in its service process is similar to what Diebold does with its ATM service, as mentioned before. Appendix D provides a detailed description of the target firm's ATM service before and after IACS implementation.

Measures

All measures were adapted from prior literature with minor wording modifications to fit our study context. First, regarding employees' motivation, we captured the two key influencers for EM—namely, the immediate supervisor and the system. We measured EM-S using four items (Malhotra et al., 2008; Ryan & Connell, 1989) depicting employees' desire to work based on a sense of pressure and obligation from their supervisors (Cerasoli et al., 2014; Grant et al., 2011; Malhotra et al., 2008). Similarly, to measure EM-IACS, we adapted two items from Xue et al. (2011) to evaluate the extent to which employees were motivated to follow the instructions provided by the IACS to perform their work in line with the firm's expectations. Second, regarding human capital, we measured JobComp with three items from Spreitzer (1995) to capture employees' ability to perform well.

Third, reflecting the technical core of employees' performance, we measured IPerf by constructing a formative construct with one archival objective item and one perceptual item of equal weight, an approach commonly used in the marketing and management literatures (Allen & Meyer, 1990; Homburg et al., 1999; Jarvis et al., 2003; Moorman & Miner, 1998; Plouffe & Gregorie, 2011; Wieseke et al., 2009). The objective item recorded employees' average ATM repair time for the most recent month. A lower repair time indicates a higher level of IPerf in terms of work efficiency (Kankanhalli et al., 2011; Moorman & Miner, 1998). The perceptual item asked employees to rate the relative number of ATMs they have fixed compared to their peer colleagues.[3] Fixing more machines indicates a higher level of IPerf in terms of work effectiveness. Both items capture the technical core of the ATM maintenance services (Motowidlo & Van Scotter, 1994), thus collectively serving as appropriate indicators of IPerf. For the creation of a composite IPerf score in our SEM analysis, we undertook the following steps. First, to adjust for the scale difference[4] between the objective and perceptual items, we applied a logarithmic transformation to the objective item. We then performed a reflection, which entailed dividing this item by its maximum value, multiplying the

[3] The employees know their relative performance, as the firm provides monthly productivity reports and shares aggregated performance data (e.g., maximum, minimum, and average number of ATM machines fixed by employees). It also recognizes top performers in their internal regular meetings in accordance with those performance data. These practices are commonly seen in the sales and service sectors (van Vulpen 2023).

[4] Note that while the perceptual item was measured on a seven-point Likert scale ranging from 1 to 7, the objective item ranged from 0 to 30 minutes with a right-skewed distribution (skewness = 6.53).

result by 6, and adding 1. Second, a unit mean was calculated from the two adjusted items and employed as the composite score for the formative construct (Petter et al., 2007). This approach, using a linear composite based on unit means, was selected due to its simplicity and potential for replicability across studies (Hair et al., 2018). Likewise, Rozeboom (1979) also suggests that linear composites display high correlations when measurement items are internally consistent, as in our case.

To measure EPerf, we used four items adapted from Netemeyer et al. (2005) to assess employees' discretionary behaviors that go beyond their formal job requirements. Moreover, scholars have claimed that the distinction between IPerf and EPerf is more apparent for nonmanagerial jobs (Conway, 1996) and is stable if objective and quantitative measures for in-role behaviors are used (Bateman & Organ, 1983; Van Dyne et al., 1994, 1998; MacKenzie et al., 1991). As our study context involves ATM maintenance tasks, which are typical technical services for which quantitative productivity (e.g., repair time and number of machines fixed) represents the technical core, we believe the conceptual and operational distinction between IPerf and EPerf is clear throughout this study.

Fourth, we adapted three items for SATE from Chan et al. (2010), Bettencourt (1997), and Homburg et al. (2009). Finally, we adapted four items for CusLoyal from Yim et al. (2008) to capture the extent to which customers are willing to purchase services from the firm in the future. We also included questions capturing employees' IM (Gagne et al., 2010, 2015; Li et al., 2015), satisfaction toward the firm (SATF) (Chan et al., 2010; Homburg et al., 2009), and both customers' and employees' demographics.

We invited two senior scholars to first evaluate the adapted items. We then conducted a pilot test to further assess the instrument. We invited 30 employees and 18 corporate customers to assess the employee and customer versions of the survey, respectively. After minor modifications based on their feedback, we conducted the official data collection. Appendix E presents all items.

Data Collection

We conducted multiwave (T1, T2, T3, and T4), multisourced data collection in the ATM service firm, which provides technology services to corporate customers. Figure 4 illustrates our research design. With support from the firm's top management, we were allowed to contact employees and customers directly. Since "service employee" is the unit of analysis, we collected data on each employee's job motivation and JobComp. We also gathered objective data and employee self-evaluations to measure job performance. The participating customers provided assessments of SATE and CusLoyal. Overall, we collected data from matched pairs of employee-customer respondents. Given our focus on the moderation of IACS implementation on the spillover effect of employees' job performance on customers' service evaluations, using a dyadic data structure is appropriate for this study.

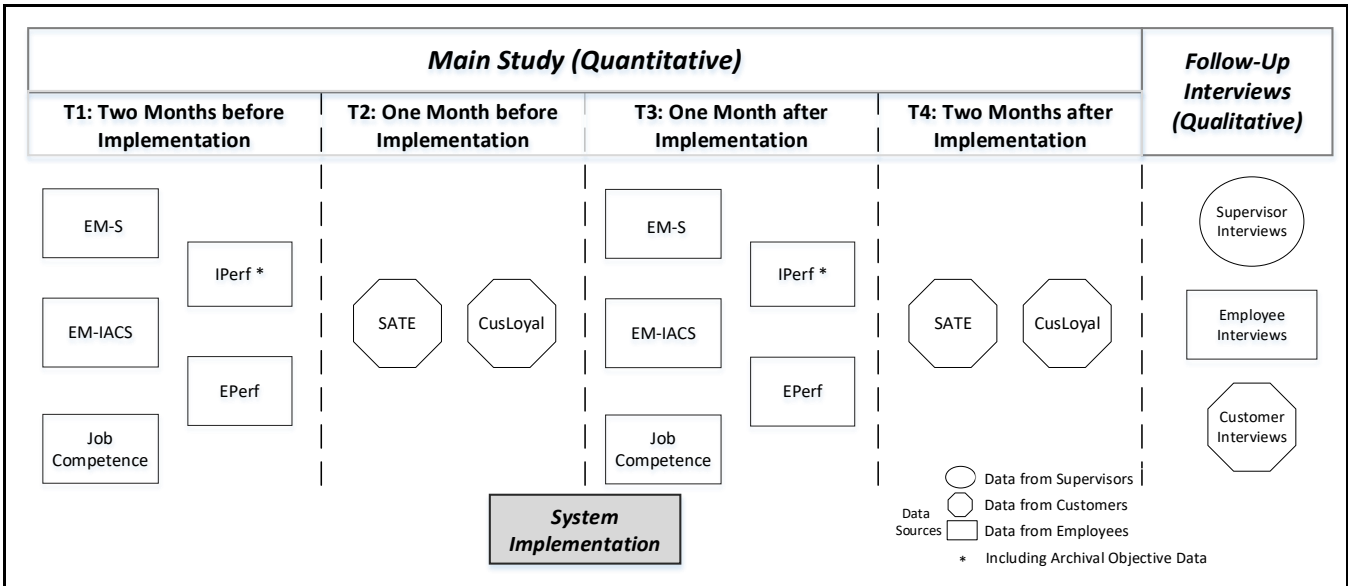

Figure 4. Data-Collection Timeline and Data Structure

Table 3. Sample Demographics

	Category	Employees		Customers	
Gender	Female	1.5%		49.0%	
	Male	98.5%		51.0%	
Education	Secondary/high school	8.3%		4.5%	
	Post-secondary	87.5%		48.0%	
	University or higher	4.2%		47.5%	
		Mean	***SD***	**Mean**	***SD***
Age (years)		26.1	3.3	31.9	87.2
Tenure (months)		29.3	21.4	49.5	39.2

Two months before IACS implementation (T1), the firm announced to its employees and customers that it would be implementing a new service system to standardize and streamline its ATM service process. After the announcement, we sent our survey to 251 randomly sampled employees to measure their EM-S, EM-IACS, JobComp, IPerf, and EPerf. One month later (T2), we randomly selected a customer each employee had recently served and sent the survey to the person responsible for the ATM at the customer site. After our data collection at T2, the firm officially introduced the system and provided a one-week training, during which employees started interacting with the new system. One month after implementation (T3), at which point the system had been running as part of daily operations, we sent a follow-up survey to the same group of employees with the same questions. Two months after implementation (T4), we sent the same survey to the same group of customers to track their evaluations.

To stimulate responses, we entered employee respondents into a lottery to win an iPad via a lucky draw. We offered each customer respondent a 200 RMB coupon to use on a major website. As our unit of analysis was the individual employee, a data point was effective only when the employee and the matched customer both provided their evaluations of the focal employee. We received 229 and 202 effective data points before and after implementation, respectively, rendering an effective sample size of 202. Table 3 shows the sample demographics.

Results

Measurement Model

We conducted confirmation factor analysis (CFA) with AMOS 25 to evaluate the measurement models before and after IACS implementation. After dropping one item for EPerf and one item for CusLoyal due to low item loadings, the resulting CFA shows reasonable model fit for both stages (before implementation: $X^2/df = 1.744$, CFI = 0.948, SRMR = 0.047, RMSEA = 0.061; after implementation: $X^2/df = 1.949$, CFI = 0.931, SRMR = 0.059, RMSEA = 0.072). We further assessed internal consistency and convergent validity by examining item loadings (see Appendix E).

As shown in Table 4 (Panels A and B), the Cronbach's alphas and composite reliabilities are all higher than the recommended 0.707, and the average variance extracted (AVE) values are all above 0.50, supporting construct reliability (Hair et al., 2018). For each pair of constructs, the absolute value of their correlation is less than the square root of each construct's AVE (Hair et al., 2018). We further examined discriminant validity by testing whether the correlations between pairs of constructs are significantly different from unity (Gefen et al., 2003). The chi-square of the unconstrained CFA is lower than any possible union of any two constructs (i.e., by constraining the correlation between each pair of constructs to unity). These results jointly support the discriminant validity of our constructs.

Structural Model Specification and Hypothesis Testing Results

After assessing the measurement model, we constructed a cross-lagged structural equation model (Bollen & Curran, 2006; Selig & Little, 2012) and used AMOS 25 to test the hypotheses.[5] Parameters were estimated using maximum likelihood estimation. The cross-lagged structural equation modeling approach enabled a detailed evaluation of causality and allowed us to go beyond the short-term fluctuations of the investigated constructs to study how they relate to one another over time (Bollen & Curran, 2006; Selig & Little, 2012).

[5] Configural and metric invariance are preconditions for estimations in cross-lagged models (Lang et al., 2011; Little et al., 2007; Zablah et al., 2016). Our measurement invariance analyses (Cheung & Rensvold, 2002; Steenkamp & Baumgartner, 1998; Hsieh et al., 2011; Chen et al., 2021) support configural and metric invariance, allowing for the inclusion of constructs across implementation stages.

Table 4. Descriptive Statistics and Psychometric Properties

Panel A. Before implementation

Construct	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. EM-S	5.66	1.38	0.85															
2. EM-IACS	5.77	0.83	-0.04	0.91														
3. JobComp	6.01	0.66	0.16**	0.22***	0.86													
4. IPerf	5.59	0.66	0.30***	0.04	0.31***	N/A												
5. EPerf	5.71	0.88	0.13*	0.12*	0.58***	0.35***	0.79											
6. SATE	6.27	0.57	0.06	0.21***	0.45***	0.14**	0.37***	0.85										
7. CusLoyal	5.47	0.92	0.11	0.13*	0.23***	0.02	0.20***	0.42**	0.86									
8. CV: IM	5.75	0.83	0.19**	0.19**	0.59**	0.49**	0.47**	0.37**	0.25**	0.86								
9. CV: SATF	5.82	0.76	-0.08	0.17**	0.23**	0.11	0.19**	0.45**	0.35**	0.22**	0.88							
10. CV: EmpAge	26.1	3.30	-0.06	0.00	0.10	-0.00	0.09	0.08	0.01	0.14**	0.02	-						
11. CV: EmpGen	0.99	0.38	-0.03	0.14**	0.06	-0.01	0.10	0.09	-0.05	0.10	-0.08	0.04	-					
12. CV: EmpEdu	3.97	0.38	-0.07	0.09	0.04	-0.06	-0.02	-0.02	-0.04	0.02	-0.04	0.02	-0.11*	-				
13. CV: EmpTenure	29.3	21.4	-0.03	0.14**	0.10	-0.05	-0.04	0.10	-0.05	0.05	-0.01	0.47***	0.11*	0.15**	-			
14. CV: CusAge	31.9	87.2	-0.06	-0.11	0.09	-0.01	0.21***	0.13	0.17**	0.16**	0.13**	0.16**	-	-0.00	0.11	-		
15. CV: CusGen	0.51	0.47	0.08	0.01	-0.01	-0.14**	-0.08	-0.04	-0.08	-0.07	-0.09	0.17**	0.04	0.08	0.16	-0.05	-	
16. CV: CusEdu	4.43	0.57	0.09	0.03	0.08	0.13**	0.03	0.11	0.14**	0.00	0.07	-0.01	-0.12*	0.09	0.08	0.16**	0.01	-
17. CV: CusTenure	49.5	39.2	0.02	-0.09	-0.02	-0.03	0.03	0.05	0.17***	0.04	0.12*	0.18***	-0.03	-	0.07	0.54**	-	-0.01
Cronbach' s Alpha			0.88	0.84	0.85	N/A	0.83	0.85	0.89	0.88	0.91	-	-	-	-	-	-	-
Composite Reliability			0.91	0.90	0.90	N/A	0.84	0.89	0.90	0.78	0.81	-	-	-	-	-	-	-

Panel B. After implementation

Construct	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. EM-S	5.24	1.06	0.80															
2. EM-IACS	6.07	0.61	0.01	0.89														
3. JobComp	5.99	0.8	0.25***	0.18**	0.87													
4. IPerf	5.6	0.87	0.12	0.18***	0.30***	N/A												
5. EPerf	5.81	0.88	0.26***	0.27***	0.52***	0.47***	0.87											
6. SATE	6.21	0.71	0.08	0.03	0.25***	0.25***	0.28***	0.85										
7. CusLoyal	5.61	0.87	0.09	-0.01	0.06	0.16**	0.17**	0.16**	0.85									
8. CV: IM	5.73	0.8	0.39**	0.17**	0.61**	0.42**	0.66**	0.33**	0.21**	0.86								
9. CV: SATF	5.84	0.71	0.08	0.05	0.19**	0.10	0.20**	0.27**	0.50**	0.22**	0.86							
10. CV: EmpAge	26.1	3.30	0.08	0.01	0.18***	0.02	0.13**	0.04	0.12*	0.06	0.11	-						
11. CV: EmpGen	0.99	0.38	-0.05	0.06	-0.08	0.04	-0.09	-0.11*	-0.08	-0.01	-0.1	0.04	-					
12. CV: EmpEdu	3.97	0.38	-0.08	-0.05	-0.03	-0.05	-0.01	0.07	-0.01	0.04	-0.05	0.02	-0.11*	-				
13. CV: EmpTenure	29.3	21.4	-0.02	-0.01	0.06	-0.03	0.09	-0.01	0.03	0.07	-0.05	0.47***	0.11*	0.15**	-			
14. CV: CusAge	31.9	87.2	0.07	0.06	0.11*	0.09	0.14**	0.02	0.01	0.14**	0.05	0.16**	-	-0.00	0.11	-		
15. CV: CusGen	0.51	0.47	0.03	0.01	-0.02	-0.08	0.02	-0.11	0.05	-0.10	0.03	0.17**	0.04	0.08	0.16	-0.05	-	
16. CV: CusEdu	4.43	0.57	0.07	-0.06	-0.01	0.04	0.00	0.08	0.11*	0.09	0.08	-0.01	-0.12*	0.09	0.08	0.16**	0.01	-
17. CV: CusTenure	49.5	39.2	0.11	0.07	0.16**	0.04	0.09	0.05	0.03	0.12*	0.07	0.18***	-0.03	-	0.07	0.54**	-	-0.01
Cronbach' s Alpha			0.86	0.91	0.90	N/A	0.90	0.91	0.85	0.89	0.89	-	-	-	-	-	-	-
Composite Reliability			0.88	0.88	0.90	N/A	0.90	0.89	0.89	0.79	0.79	-	-	-	-	-	-	-

Note: Square root AVE is shown on the main diagonal. CV: Control Variable

In particular, we specified (1) the SPC relationships for the pre-implementation and post-implementation stages, respectively (e.g., $EM\_S_{before} \rightarrow IPerf_{before}$ and $EM\_S_{after} \rightarrow IPerf_{after}$); (2) the autoregressive effects for each construct (e.g., $EM\_S_{before} \rightarrow EM\_S_{after}$); and (3) the cross-lagged effects for the chain relationships (e.g., $EM\_S_{before} \rightarrow IPerf_{after}$). Error variances of corresponding indicators measured across time (e.g., EM_S_{before} and EM_S_{after}) were allowed to covary as these constructs were composed of the same items. In addition, we controlled for both customers' and employees' age, gender, education level, and tenure at their institutions, as well as employees' IM and customer satisfaction toward the firm (SATF), to rule out alternative explanations.

The results reveal satisfactory model fit ($X^2/df = 1.652$, CFI = 0.900, SRMR = 0.073, RMSEA = 0.054). The model (Figure 5) explains 45.4% (37.9%), 31.7% (36.7%), 28.9% (35.3%), and 33.2% (51.6%) of variance in IPerf, EPerf, SATE, and CusLoyal before (after) implementation, respectively.

To test our hypotheses, we assessed the equivalence of the path coefficients between the pre- and post-implementation stages. Specifically, we constrained each pair of path coefficients between the same constructs, one at a time, to be equal across the implementation stages. We then performed a chi-square difference test to compare the constrained and nonconstrained models. A significant chi-square change between the two models indicates that the corresponding path coefficient varied significantly across implementation stages (Bollen, 1989; Cohen et al., 2003). As elaborated below, we found six relationships in the research model showing salient changes after implementation.

We first found that the impact of EM-S on IPerf was significant prior to ($\beta_{1a}^{Before} = 0.12$, $p < 0.01$) and after IACS implementation ($\beta_{1a}^{After} = -0.20$, $p < 0.01$). Comparing the constrained model specifying that the path coefficients should be equal across the implementation stages with the unconstrained model, we found a significant change in chi-square between the two models, thus supporting H1a ($\Delta \chi^2_{1a}$ (1) = 19.6, $p < 0.01$). Surprisingly, the impact of EM-S on IPerf turned from positive to negative after system implementation. We later offer a more detailed explanation about this intriguing finding based on our follow-up interviews with the supervisors and employees (see Follow-Up Interviews with Supervisors, Employees, and Customers section). Next, while EM-IACS had no effect on IPerf before system implementation, this effect became significant ($\beta_{1b}^{After} = 1.01$, $p < 0.01$) after implementation. The results of the chi-square difference test further show significantly different path coefficients across the implementation stages ($\Delta \chi^2_{1b}$ (1) = 3.6, $p < 0.1$), thus supporting H1b.

Regarding the impact of human capital, the results suggest that JobComp significantly affected both IPerf ($\beta_{2a}^{Before} = 0.80$, $p < 0.01$) and EPerf ($\beta_{2b}^{Before} = 1.09$, $p < 0.01$) before and after IACS implementation ($\beta_{2a}^{After} = 0.39$, $p < 0.01$; $\beta_{2b}^{After} = 0.51$, $p < 0.01$). The significant change in coefficients ($\Delta \chi^2_{2a}$ (1) = 10.4, $p < 0.01$; $\Delta \chi^2_{2b}$ (1) = 17.1, $p < 0.01$) for both paths support H2a and H2b.

Regarding the links between employees' job performance and SATE, our results show that the impact of IPerf on SATE became stronger after system implementation. In particular, IPerf had no significant influence on SATE before IACS implementation; however, its effect became significant and positive after implementation ($\beta_{3a}^{After} = 0.12$, $p < 0.1$). The path coefficients across the implementation stages are significantly different ($\Delta \chi^2_{3a}$ (1) = 3.4, $p < 0.1$), thus supporting H3a.

Furthermore, we found that EPerf had a significant positive impact on SATE ($\beta_{3b}^{Before} = 0.47$, $p < 0.01$) before IACS implementation; nevertheless, EPerf had a weakened positive impact on SATE ($\beta_{3b}^{After} = 0.17$, $p < 0.05$) after system implementation. The results of the chi-square difference test reveal that β_{3b}^{Before} and β_{3b}^{After} are significantly different ($\Delta \chi^2_{3b}$ (1) = 6.3, $p < 0.01$). H3b is thus supported.

For CusLoyal, in line with our expectations, the effect of SATE on CusLoyal decreased, and the change in the path coefficient was statistically significant after implementation ($\beta_4^{Before} = 0.32$, $p < 0.01$; $\beta_4^{After} = 0.13$, $p < 0.1$; $\Delta \chi^2_4$ (1) = 3.9, $p < 0.05$). Hence, H4 is supported.

In terms of the control variables, we found customer age, employee gender, and employee tenure were significantly associated with EPerf before the system implementation. In addition, SATF was positively associated with CusLoyal both before and after the system implementation.

Post Hoc Statistical Analyses

Further Comparison of Path Coefficients

We conducted the following analyses for more insights. First, using Cohen et al.'s (2003) formula to compare if two path coefficients concerning the same dependent variable are statistically different, we assessed the relative importance of EM-S and EM-IACS in terms of their impacts on IPerf. The results suggest that prior to system implementation, relative to EM-IACS (β_{1b}^{Before} = n.s.), EM-S ($\beta_{1a}^{Before} = 0.12$, $p < 0.01$) had a significantly stronger effect ($p < 0.05$) on IPerf. In contrast, after system implementation, relative to EM-IACS ($\beta_{1b}^{After} = 1.01$, $p < 0.01$), EM-S ($\beta_{1a}^{After} = -0.20$, $p < 0.01$) had a weaker and negative effect ($p < 0.05$) on IPerf.

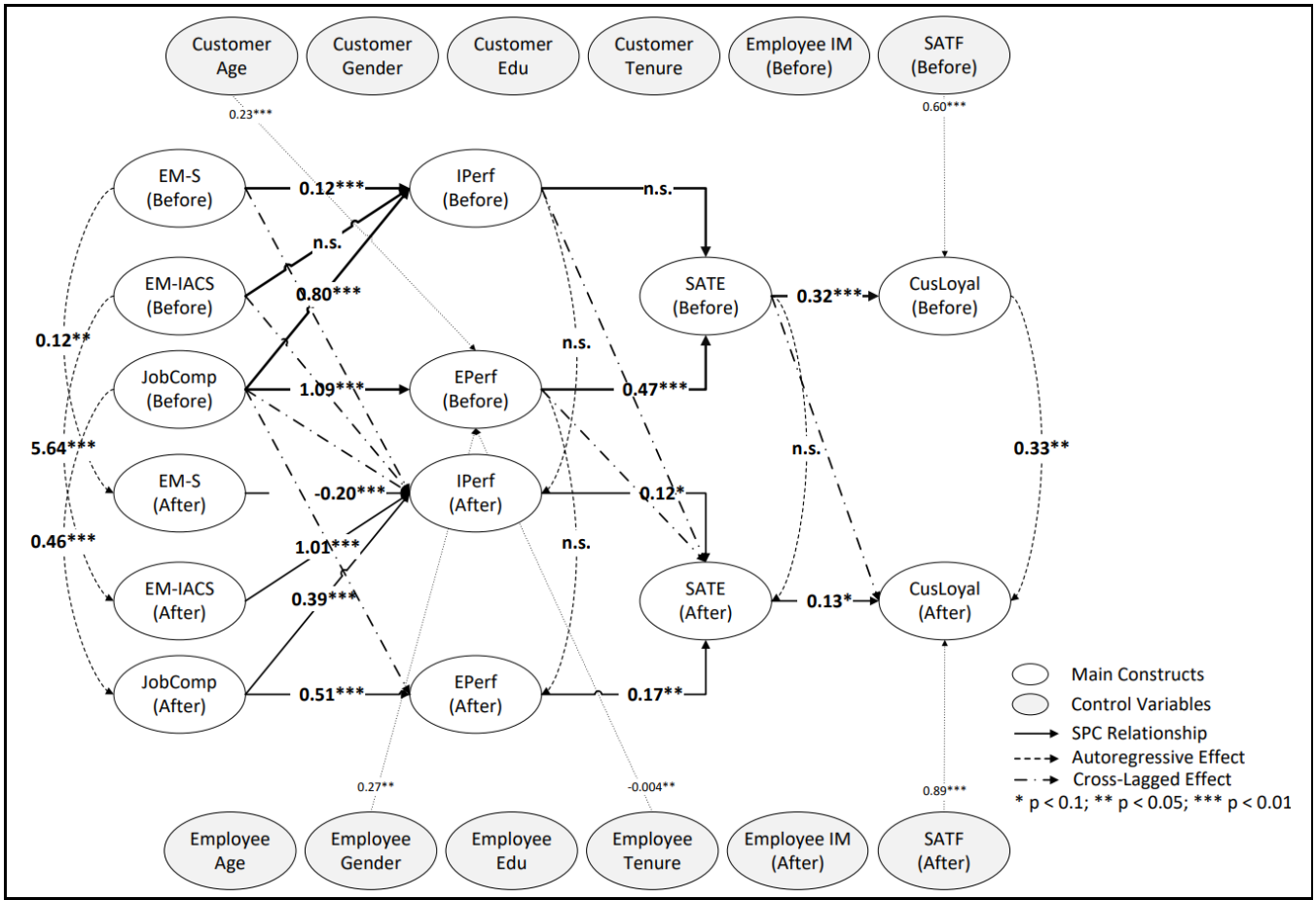

Figure 5. Results of the Cross-Lagged Structural Equation Model

We also assessed the relative importance of EPerf and IPerf in determining SATE. The results suggest that before IACS implementation, IPerf (β_{3a}^{Before} = n.s.), relative to EPerf (β_{3b}^{Before}= 0.47, $p < 0.01$), had a significantly weaker effect ($p < 0.05$) on SATE. Nevertheless, after system implementation, the dominant role of EPerf in influencing SATE diminished ($\beta_{3b}^{After} = 0.17, p < 0.05$), whereas the importance of IPerf rose (β_{3a}^{After} = 0.12, $p < 0.05$). These results of our post hoc analyses, together with results for H3a and H3b, provide compelling evidence supporting one of our core arguments—namely, the role of IPerf becomes more crucial moving from the pre- to the post-implementation stage.

Latent Construct Mean Comparison

According to Hong et al. (2014), contextual factors may moderate relationships between constructs and exhibit main effects on constructs. Thus, we also evaluated whether IACS implementation significantly changed the mean values of the focal constructs. We conducted paired *t*-tests to compare the means of the latent constructs[6] and observed significant mean changes for three constructs: EM-S, EM-IACS, and CusLoyal. Specifically, employees experienced a significant decrease and increase in EM-S and EM-IACS, respectively, after system implementation. These results serve as additional evidence illustrating the shift in employees' motivation from following instructions from their supervisors to following instructions from the IACS.

Moreover, IACS implementation significantly enhanced CusLoyal and customers' willingness to continue business with the service firm amid intensive competition in the market. This result is interesting, especially considering the decreased effect of SATE on CusLoyal after system implementation. The enhanced CusLoyal, while not solely derived from SATE, may stem from other factors not captured

[6] Alternatively, we followed Alessandri et al.'s (2017) approach and used latent growth models to test the mean changes for the constructs. The results for the significance of the constructs' mean changes are consistent with those from the paired *t*-tests. We thank the associate editor's suggestion of this alternative approach to demonstrate the robustness of our results.

in our model. We offer a plausible explanation for this finding based on our follow-up interviews with the customers in the ensuing section.

Follow-Up Interviews with Supervisors, Employees, and Customers

We conducted follow-up interviews to confirm our theoretical assumptions (e.g., employees' in-role requirements remain unchanged after IACS implementation), expand our understanding of the roles of supervisors and customers and their interdependence with employees, and offer a more complete picture of the investigative phenomenon. We conducted interviews with 10 employees and six customers who participated in the survey, as well as three supervisors and the general manager. We developed a semi-structured protocol for each group of interviewees. These semi-structured protocols (Appendix F) guided the interviews via a preliminary structure with room for further expansion. With the support of the firm, we had repeated and direct access to these informants to clarify and confirm our understanding.

Our analysis of the interview data was also primarily informed by our theoretical lens (i.e., role theory) and conceptual frameworks (i.e., Figures 1 and 3). We also expanded our focus from employees to include supervisors and customers. Hence, our data analysis and coding scheme were mostly coupled with role theory elements like service process script, script uncertainty, and interdependence. Two scholars on our team first coded the interview data. The third scholar compared the coding results from the first two scholars to determine agreement and discrepancies; discrepancies were discussed among the three researchers until resolution was attained (Miles et al., 2014). The coding process followed an iterative procedure that involved identifying the representative concepts, examining empirical evidence to support the concepts, consolidating similar concepts to create more refined ideas, and collecting more data until reaching theoretical saturation. Data analysis was based on the three types of coding suggested by Corbin and Strauss (1990): open coding, axial coding, and selective coding.[7] This process was facilitated by the NVivo software, which is designed to support qualitative analysis. We first identified 19 concepts during open coding. During axial coding, we consolidated conceptually similar concepts. Finally, during selective coding, we sought to integrate the identified concepts and formulate a storyline that offered a coherent and insightful account in line with our survey results (Kvansy & Keil, 2005; Venkatesh et al., 2016). Further rounds of data collection and coding were performed until theoretical saturation was achieved. To enhance transparency (Sarker et al., 2013), sample concepts and supporting quotes are shown in Appendix G.

Venkatesh et al. (2016) emphasize the importance of making credible (reliable) inferences in mixed methods research. In qualitative research, credible inferences "capture the meaning of the phenomenon under consideration for study participants" (Teddlie & Tashakkori, 2009, p. 295) to establish the correspondence between how respondents actually feel and how researchers portray the phenomenon (Mertens, 2005). To that end, we shared the results with the interviewees, including employees, customers, supervisors, and the general manager, for their feedback. This step was also carried out iteratively until we achieved consensus and the results stabilized (Miles et al., 2014).

Following the above procedures, we found that interviewees expressed a clear understanding of employees' in-role and extra-role behaviors and acknowledged their distinctiveness and stability both before and after system implementation. They consistently believed that fixing machines and getting tasks done timely encompassed employees' required jobs, whereas nontechnical tasks, such as providing extra care (e.g., personal greetings or small tokens), were not officially required or expected. As one employee stated, "My job specification is very clearly stated. That is, to fix the machines and get the job done. This requirement remains the same after IACS implementation." A customer also noted, "The employees' job is basically to fix the machines. Though they sometimes provide me some festive gifts, these are only their personal gestures rather than their formal tasks." This evidence collectively confirms our assumption that the distinction between IPerf and EPerf is meaningful, with clear boundaries and relative stability over time. This evidence also confirms a shift in attention from human agents to the technology after implementation. Next, we discuss the resulting concepts pertaining to the roles of supervisors, employees, and customers.

Role of Supervisors

The results of our qualitative analysis suggest that although the IACS was primarily designed to standardize and streamline employees' service tasks for customers, the system has had many collateral impacts on supervisors' work focus and their role in the TSPC. Based on our analysis, three concepts characterizing these impacts emerged: the need for supervisors, supervisors' sense of power loss, and their changed work focus.

[7] Myers (2009) indicates that some scholars use this coding approach (i.e., open, axial, and selective coding) as a way of coding qualitative data, while others use it as a method for theory generation. We acknowledge such a distinction and, in this research, use this coding approach for data analysis, not for theory generation.

Do we still need supervisors? In the first few months after deploying the IACS, employees sometimes experienced conflicting instructions from their supervisors and the IACS, which provides a plausible explanation for why EM-S negatively impacts IPerf after system implementation. In addition, from the perspective of employees, compared to their own increased work intensity, supervisors seemed to have less work to do after IACS implementation. Thus, there could be role incongruence between employees' expectations of supervisors' roles and their perceptions of supervisors' tasks after system implementation. Some employees cast doubt on the value of their supervisors. For example, during one interview, an employee asked, "Do we really need these supervisors anymore? After the IACS, our work has become more challenging, but they [the supervisors] have fewer things to do and yet still enjoy the same level of salary and benefits!" Such role incongruence might engender psychological discomfort (Solomon et al., 1985) in employees and result in a negative relationship between EM-S and IPerf.

A sense of power loss: Supervisors generally experienced a sense of power loss after system implementation. Prior to the IACS, supervisors dominated the evaluation process regarding employees' rewards and punishments. With the IACS, although supervisors still have a say in employees' appraisals, they must perform such evaluations based on data collected from the system. Relative to supervisors' traditional subjective approach, this objective, evidence-based approach has led supervisors to make more rigid reward and punishment decisions with less flexibility to factor in employees' personal situations. Losing authority over task assignments and technical guidance also reduced supervisors' personal interactions with employees and trivialized their roles. Hence, when discussing encountering unscripted situations that demand supervisors' intervention, one supervisor lamented, "All the task assignments are now being handled by the IACS. Why bother me when running into issues?"

Still relevant but with a different work focus: After system implementation, supervisors' attention shifted from task assignments and technical guidance to (1) back-end logistics for supplies, (2) human resource (HR) management like sick leave and vacation applications, and (3) emerging scenarios that have not been scripted in the IACS. For the latter, the general manager explained the following:

> *The IACS cannot foresee all possible scenarios that our foot soldiers [service employees] encounter on the frontlines. For instance, when an employee travels through some areas with weak or no GPS signal, the system receives inaccurate or no information and thus generates inappropriate task assignments for other employees. In this case, the supervisors need to intervene to make alternative arrangements to overwrite the algorithm-generated instructions.*

Role of Employees

Our qualitative analysis revealed two overarching concepts characterizing the changes in employees' service procedures, relationships with supervisors, and the essence of their role related to the IACS-generated intelligence and nostalgia for the past.

Nothing but a vehicle for digitized intelligence: After IACS implementation, employees only need to follow IACS-generated intelligence to accomplish their assignments. This approach, in essence, greatly reduces the room for human agency and implicitly robotizes the role of service employees. This roboticization is perhaps best characterized by the following comment from the general manager of the investigative firm: "Simply put, service employees now act like a vehicle that carries the digitized instructions and standardized knowledge to fix problems in the physical world."

Nostalgia (about interdependence with human supervisors prior to IACS implementation): Ironically, while some employees challenged the value of supervisors after IACS implementation, others revealed that they miss the "good old days" when human supervisors rather than the IACS were in charge of task assignments. For these employees, supervisors are human beings with room for adjustment if an assignment is not reasonable from the employee's viewpoint. Serving as a buffer between customers' demands and employees' task operations, supervisors could factor in employees' personal situations when allocating tasks. Working with supervisors also gave employees a stronger feeling of human warmth that accommodated their personal needs. Such human warmth, unfortunately, was lost after the IACS was implemented. Finally, after revolutionizing the task-assignment process, which used to be coordinated by supervisors, the IACS can now assign tasks to any employee anywhere and anytime. Employees now have to stay alert and stand by with limited room for adjustment and accommodation for their personal situations.

Role of Customers

Two concepts from our analysis suggest that customers, relative to supervisors and employees, are perhaps the group that feels the most positive about the IACS initiative due to fewer interactions with service employees and game-changing service.

Happy with fewer interactions with service employees: For customers, it is evident that they rely more on the IACS for ATM maintenance. During the post-implementation stage, ensuring that ATMs operate smoothly (i.e.,

employees' IPerf) is far more important than seeing employees in person or even receiving their personal touch (i.e., employees' EPerf). Moreover, customers may view the IACS as a "competing employee" in service encounters. As customers are increasingly shifting their interdependence on employees to the IACS following system implementation, their satisfaction evaluations are derived not only from employees' performance but also, and more importantly, from the IACS's performance. When talking about the IACS and service employees, one customer shared the following:

> *This site used to be served by [Employee XYZ]. He and I had a close bond, and I appreciated his personal care about me. But things changed after having the IACS such that the service procedure has become more efficient, standardized, and easier to follow. While I do not see [XYZ] as often as before, I feel relaxed that I can be more hands off now and just leave the ATM things to the IACS.*

This finding also provides a plausible explanation for why CusLoyal increases while the impact of SATE on CusLoyal decreases after IACS implementation. In particular, the increased CusLoyal may stem from customer satisfaction toward the IACS. Implicitly viewing the IACS as a "competing employee," customers gradually shift their interdependence with employees (prior to IACS) to the IACS after its implementation. Thus, it is likely that the importance of employees in achieving desirable customer service outcomes might be supplemented by the IACS.

The game changer: Implementing the IACS enabled a common understanding of ATM maintenance scripts and standards among the firm, employees, and customers. This greatly reduced the unnecessary confusion customers used to experience with the firm and its employees. The IACS initiative ultimately made the firm stand out from its competition, as one customer explained: "The IACS differentiated this service provider from its competitors by saving us time, money, and troubles. I am happy with what happened after its implementation and have urged my boss to continue our business with this firm."

The general manager offered a similar observation from the provider's viewpoint. He indicated that besides benefiting customers, the IACS also saves a great deal of money and resources and increases operational efficiency for the firm. He further observed an overall decrease in customer complaints and an increase in CusLoyal across all of the firm's corporate clients: "At first, the IACS was only designed to facilitate employees' task assignments and standardize and streamline the service process. To our surprise, it has become a game changer for our business."

Discussion

Meta-Inferences

Developing credible meta-inferences in mixed methods research requires solid quantitative and qualitative inferences (Venkatesh et al., 2016). By following the conventional standards to safeguard the design and analysis of both the quantitative and qualitative components, we established reliable quantitative and qualitative inferences, allowing us to synthesize the quantitative and qualitative results to formulate theoretically cohesive meta-inferences. Below, we integrate the quantitative and qualitative results in Table 5 to organize our discussion of meta-inferences in this section and the implications for theory and practice.

First, to attain our research objectives, we conducted the (dominant) quantitative study by developing a nuanced model (i.e., the TSPC) that delineates the interplay between human and technology agents after the infusion of IACSs into service encounters. Next, we carried out the qualitative study to confirm our implicit assumptions and explain surprising results from the quantitative study and to expand our knowledge of supervisors and customers and their interdependence with employees. The results collectively support our proposed TSPC such that the traditional SPC framework can be meaningfully contextualized to the IACS setting by decomposing the SPC constructs, factoring in technology-related aspects (e.g., EM-IACS), and then elaborating the chain relationships. Together, our quantitative and qualitative results further reveal significant changes in (1) TSPC relationships; (2) the mean values of EM-S, EM-IACS, and CusLoyal; (3) supervisors' work focus; (4) the relationships and interdependence among supervisors, employees, and customers; and (5) their perceptions about one another. The findings derived from our mixed methods design are both convergent (both methods lead to similar results) and complementary (the quantitative and qualitative results relate to different aspects of the investigative phenomenon but complement each other); hence, their integration renders a more complete picture of the investigative phenomenon (Kelle & Erzberger, 2003; Venkatesh et al., 2016).

We also discovered additional issues by integrating the quantitative and qualitative results: competing agents and dehumanization. While we incorporated the possibility of competing bosses in our hypothesis formulation, this issue was empirically more salient than we expected, causing tensions between supervisors and employees and eventually compromising their performance. Moreover, our qualitative results reveal an interesting insight that an IACS may function as a competing employee in the eyes of customers. Specifically, customers' increasing interdependence with the IACS may explain the decreased impact of SATE on CusLoyal observed in the quantitative analysis.

Table 5. Summary of Integrative Results and Key Findings

Research objectives and contextualization approaches	Key findings		Contributions
Research objective: Revamp the SPC by proposing the new TSPC in the techno-service context	• Identify decomposed SPC constructs in the technology-infused service context. • Reveal the moderating effects of IACS implementation, as a contextual factor, on TSPC relationships. • Uncover the direct effects of IACS implementation on the TSPC constructs in post hoc analyses.		• Among the first studies to take an interdisciplinary approach to examine the infusion of technology agents in service encounters by revamping the conventional SPC model (Heskett et al., 1994) in the techno-infused service context.[a,b,c] • Incorporate the agentic nature (Baird & Maruping, 2021; Berente et al., 2021) of IACSs to elaborate the essence of technology in the TSPC.[a,b] • View IACSs as technology agents and theorize how IACS implementation redefines and alters the strength of chain relationships (Heskett et al., 1994; Hogreve et al., 2017).[a,b] • Uncover the dual roles of IACSs as competing bosses and competing employees from the eyes of employees and customers, respectively (Porter & Heppelmann, 2014; Vorobeva et al., 2022).[a,b,c] • Discover how and why IACSs dehumanize supervisors and employees (Garry & Harwood, 2019; Grewal et al., 2020; Haslam, 2006).[a,b,c]
Contextualization Approach 1: Decompose the constituent constructs in the TSPC	• Unveil how job motivation (EM-S, EM-IACS) and JobComp affect two types of job performance (IPerf and EPerf), which then affect SATE and eventually shape CusLoyal.		• Provide a more holistic and nuanced understanding of how firms can utilize IACSs to innovate internal employee management and external customer service (Bliese et al., 2017).[a,b]
Contextualization Approaches 2 & 3: Identify the role of IACSs in affecting the chain relationships and constructs in the TSPC	• Discover how IACSs moderate the relationships in the proposed TSPC model. • Explore the direct effects of IACS implementation on the TSPC constructs.		• Illustrate how algorithmic systems, together with human supervision, change the interplay between service employees and customers, exerting a rippling effect on the employee services experienced by external customers (Bala & Venkatesh, 2013, 2016; Kellogg et al., 2020; Morris & Venkatesh, 2010).[a,b] • Demonstrate the contingency role of an IACS that alters the scripts of different stakeholders (Monteiro & Parmiggiani, 2019).[a,c] • Incorporate the "algorithm-as-script" view (Martin, 2019) to explore the impacts of algorithms in human-algorithm symbiosis.[a,b] • Reveal that it is the integration of the IoT and other technologies (e.g., algorithms) (Porter & Heppelmann, 2014) that makes the powerful impacts observed in this study possible.[a]
H1: Employees' job motivation → Employees' job performance	***Quantitative results*** $\beta_{\text{EM-S} \rightarrow \text{IPerf}}^{\text{Before}} > \beta_{\text{EM-S} \rightarrow \text{IPerf}}^{\text{After}}$ (H1a: √) $\beta_{\text{EM-IACS} \rightarrow \text{IPerf}}^{\text{Before}} < \beta_{\text{EM-IACS} \rightarrow \text{IPerf}}^{\text{After}}$ (H1b: √)	• IACSs change the impact of employees' EM to comply with supervisors from reinforcing (i.e., positively affecting) to compromising (i.e., negatively affecting) employees' IPerf (H1a).	• Identify the importance of considering the complexity of competing bosses (i.e., human supervisors versus IACSs) (Kellogg et al., 2020) when algorithms assume more control in organizations that relentlessly pursue digitization.[c]

	Post hoc (relative importance) $\beta_{EM\text{-}S \rightarrow IPerf}^{Before} > \beta_{EM\text{-}IACS \rightarrow IPerf}^{Before}$ $\beta_{EM\text{-}S \rightarrow IPerf}^{After} < \beta_{EM\text{-}IACS \rightarrow IPerf}^{After}$ ***Post hoc (mean comparison)*** $Mean_{EM\text{-}S}^{Before} > Mean_{EM\text{-}S}^{After}$ $Mean_{EM\text{-}IACS}^{Before} < Mean_{EM\text{-}IACS}^{After}$ ***Qualitative results*** • Do employees still need supervisors? • Supervisors—a sense of power loss • Supervisors—relevant but different focus	• IACS implementation strengthens the power of employees' EM to comply with IACSs in influencing their IPerf (H1b). • Uncover a shift in the relative importance of EM-S *versus* EM-IACS in affecting IPerf: - EM-S, relative to EM-IACS, has a stronger effect on IPerf before IACS implementation; - EM-IACS, relative to EM-S, has a stronger effect on IPerf after IACS implementation. • Identify changes in the mean values of focal constructs due to IACS implementation: - The mean value of EM-S decreases after IACS implementation; - The mean value of EM-IACS increases after IACS implementation.	• Discover that IACSs take over responsibilities from supervisors, weaken social relationships between supervisors and employees, reduce employee dependency on supervisors, shift the power from supervisors to the algorithm, and deprive supervisors' discretion in making flexible decisions to accommodate employees' personal needs, hence dehumanizing supervisors (Haslam, 2006).[a,b,c]
H2: Employees' Job Competence → Employees' Job Performance	***Quantitative results*** $B_{JobComp \rightarrow IPerf}^{Before} > \beta_{EM \rightarrow IPerf}^{After}$ (H2a: √) $\beta_{JobComp \rightarrow EPerf}^{Before} > \beta_{EM \rightarrow EPerf}^{After}$ (H2b: √) ***Qualitative results*** Employees—the vehicle for digitized intelligence in the physical world	• IACS implementation weakens the effect of JobComp on IPerf (H2a). • IACS implementation weakens the effect of JobComp on EPerf (H2b).	• Discover that IACSs routinize employees' responsibilities, standardize their behaviors, decrease the uncertainty in their tasks, devalue their personal competence, and reduce their interdependence with supervisors and customers, causing employees to be seen merely as physical carriers of digitized intelligence and thus greatly dehumanizing employees (Garry & Harwood, 2019; Grewal et al., 2020).[a,b,c]
H3: Employees' Job Performance → Customer Satisfaction toward Employees	***Quantitative results*** $\beta_{IPerf \rightarrow SATE}^{Before} < \beta_{IPerf \rightarrow SATE}^{After}$ (H3a: √) $\beta_{EPerf \rightarrow SATE}^{Before} > \beta_{EPerf \rightarrow SATE}^{After}$ (H3b: √) ***Post Hoc Results (Relative Importance)*** $\beta_{IPerf \rightarrow SATE}^{Before} < \beta_{EPerf \rightarrow SATE}^{Before}$ $\beta_{IPerf \rightarrow SATE}^{After} \approx \beta_{EPerf \rightarrow SATE}^{After}$ ***Qualitative Results*** Customers—comfortable with fewer direct interactions with the employees	• IACS implementation enhances the effect of employees' IPerf on SATE (H3a). • IACS implementation weakens the effect of employees' EPerf on SATE (H3b). • Discover the change in the relative importance of IPerf versus EPerf in driving SATE: - EPerf, relative to IPerf, has a stronger impact on SATE before IACS implementation; - IPerf and EPerf have comparable effects on SATE after IACS implementation. • Customers are satisfied as long as employees keep their ATMs operating smoothly (i.e., IPerf); customers are less concerned about interactions with and the personal touches of employees (i.e., EPerf) after IACS implementation.	• Identify the diminishing value of EPerf (Hu et al., 2015; Kageyama & Barreda, 2018) in digital economies wherein technologies are the backbone.[c]
H4: Customer Satisfaction toward Employees → Customer Loyalty	***Quantitative results*** $\beta_{SATE \rightarrow CusLoyal}^{Before} > \beta_{SATE \rightarrow CusLoyal}^{After}$ (H4: √) ***Post hoc (mean comparison)*** $Mean_{CusLoyalty}^{Before} < Mean_{CusLoyalty}^{After}$ ***Qualitative results*** IACS—the game changer	• SATE plays a less critical role in driving CusLoyal after IACS implementation. • The mean value of CusLoyal increases after IACS implementation. • IACSs may serve as a potential driver of CusLoyal beyond employees.	• Discover customers' perceptions of competing employees (i.e., human employees versus IACSs) in deriving satisfaction evaluations, which may influence their loyalty decisions (Vorobeva et al., 2022).[a,b] • Reveal that although initially designed to facilitate task assignments and standardize the service processes (Gilson et al., 2005; Münstermann et al., 2010), the studied IACS has become a game changer in the ATM service sector, resulting in a significant reduction in complaints and an increase in loyalty among all corporate customers.[a,b]

Note: [a] contribution for IS research, [b] contribution for service marketing research, [c] contribution for management research

In addition, we theorized the dehumanization of supervisors and employees after IACS implementation. On the one hand, by taking over the task-assignment function, the IACS in our study removed the sense of human warmth that supervisors used to offer employees by accommodating their personal needs. Similarly, while prior to IACS implementation, employees' performance was evaluated based on supervisors' subjective judgments, their performance is now primarily evaluated based on objective data from the IACS. Employees may thus feel surrounded by things rather than people and unable to communicate and justify their actions. Ironically, while the IACS increased CusLoyal and became a game changer, some employees miss the time when human beings were the boss. This nostalgic sentiment also reveals that employees have experienced emotional and social disconnection with their supervisors as a result of being dehumanized. On the other hand, following IACS implementation, employees are objectified and evaluated mechanically. The IACS routinizes their responsibilities and reduces their interdependence with customers, thereby dehumanizing their role in the eyes of customers. We verified these arguments with quantitative and qualitative evidence.[8]

Contributions and Implications for Research

An Interdisciplinary Contextualization Approach to Revamp Dominant Frameworks

By leveraging the interdisciplinary approach and synthesizing the literatures from IS, service marketing, and management, we discovered valuable insights and contributions that cannot be achieved via the traditional single-domain approach. In particular, we proposed the TSPC, which integrates knowledge from multiple disciplines and develops an integrative understanding of the digital transformation of service encounters under the infusion of emerging technologies. The proposed TSPC captures the agentic nature of emerging technologies and theorizes the interplay between human agents (e.g., supervisors, employees, and customers) and technology agents (e.g., IACSs).

To elaborate, our work revamps the traditional SPC in the following ways. First, we decompose the context-generic SPC constructs to capture their various manifestations and portray the detailed relationships among these decomposed constructs in the IACS context. These decomposed constructs provide an insightful understanding of how firms can utilize IACSs to innovate their employee management and customer service. Second, the agentic nature of IACSs enriches the core concepts in the SPC. The TSPC uncovers the nuances in employees' job motivation and performance behaviors when they need to coordinate with and follow the instructions of IACSs to complete service tasks. Third, viewing IACSs as technology agents, our TSPC theorizes how IACS implementation redefines and alters the strength of chain relationships. Fourth, we uncover how and why IACSs influence the interdependence among human agents and, at the same time, dehumanize supervisors and employees in the context of the TSPC. We are thus one of the first studies to theoretically and empirically examine how IACS implementation moderates the chain relationships among employees' JobComp, motivation, performance, and customers' SATE and CusLoyal, answering the recent calls for research studying the infusion of emerging technologies in service encounters (Hogreve et al., 2022). Our contextualized study pioneers in articulating the unique characteristics of emerging technology agents and explicating a techno-version of the SPC from an interdisciplinary view. Given the prevalence of digital technologies across all business functions like marketing, management, finance, and operations, we encourage scholars of different disciplines to incorporate our interdisciplinary contextualization approach to examine how digital technologies impact the dominant theoretical frameworks in their domains.

Algorithm at Work and Algorithm as Scripts

For the IS domain, the findings of this study contribute to our theoretical understanding of several important topics. To begin with, our results advance our knowledge regarding the impacts of algorithms on internal employee management and external customer service, in turn providing several directions for future research. For instance, the rising popularity of algorithmic technologies in organizations prompts questions about the impacts of implementing such technologies (Faraj et al., 2018). Thus far, research on algorithms at work has primarily focused on the economic and operational values algorithms provide to organizations and has emphasized the algorithmic benefits of improving coordination, decision-making, and organizational learning (Appendix A, Table A1). While emerging research has acknowledged the agentic capabilities of algorithms in initiating their own actions to

[8] While we were able to integrate the quantitative and qualitative results effectively (i.e., integrative efficacy) to develop a cohesive understanding of the investigative phenomenon, Venkatesh et al. (2016) suggest additional assessment via Onwuegbuzie and Johnson's (2006) legitimation criteria. To that end, our meta-inferences meet (1) inside-outside legitimation because we iteratively asked various stakeholders to comment on our results at different stages; (2) weakness minimization legitimation, as we leveraged the strength of one method (e.g., qualitative method) to compensate for the weakness of the other method (e.g., quantitative method); (3) multiple validities legitimation because we applied relevant strategies to address the legitimation of the quantitative, qualitative, and mixed methods aspects of this research; and (4) political legitimation, as we were able to develop meta-inferences based on the quantitative and qualitative inferences that support most of our hypotheses, which collectively address our research objective.

engage humans (Baird & Maruping, 2021; Berente et al., 2021) and sought ways to ensure effective coordination between algorithms and humans at work (e.g., the use of human-algorithm hybrid practices, van den Broek et al., 2021; human-algorithm augmentation, Teodorescu et al., 2021), what is missing is an understanding of algorithmic technologies' potential to reconfigure the roles and relationships among key stakeholders within and across organizational boundaries (Kellogg et al., 2020).

To that end, prior research has mostly examined employees' role stress, role overload, and role clarity in the workplace but paid less attention to how algorithmic technologies could potentially alter the associated scripts and hence the relationship interdependence of all involved actors. In this vein, our findings in the IACS context reveal how algorithm-generated scripts can alter the uncertainty in employees' tasks and their interdependence with customers, supervisors, and systems. Our insights pertaining to this *algorithm-as-script* view warrant further research on the roles and impacts of algorithms in various domains, including human-algorithm symbiosis, algorithms at work, and human-centered automation.

Dehumanization Effects of IACSs

Our study also reveals the *dehumanization* effects engendered by IACSs. In the psychology literature, people are dehumanized when they are divested of the agentic and communal aspects of humanness, known as mechanistic dehumanization. Mechanistic dehumanization involves objectifying essential human attributes, representing a view of others as object- or automation-like (Haslam, 2006). Montague and Matson (1983) explain that the "pathology of mechanization" involves the robotic pursuit of efficiency and regularity as well as automation-like rigidity and conformity. Such technological dehumanization leads to concerns of reduced social relatedness and increased standardization (e.g., Beckers & Schmidt, 2001).

While psychologists have acknowledged the notion of dehumanization, this concept has rarely been explored in the business literature. A rising discussion has mentioned the *dehumanization of employees* in the workplace. For example, employees are being socially excluded and abused by their supervisors and peers treating them as objects (Baldissarri et al., 2014; Caesens et al., 2017; Taskin et al., 2019). Yet such discussions are more confined within workplace and not well explored in the service context that goes beyond organizational boundaries. Only a few studies have mentioned customers' perceived dehumanization of frontline employees when their capabilities are augmented with virtual reality and wearable devices (Castelo et al., 2019; Garry & Harwood, 2019; Grewal et al., 2020). We thus push this emerging discussion on the dehumanization of employees forward by providing theoretical arguments and empirical evidence on service encounters involving the interplay among supervisors, employees, and customers as a result of the IACS implementation and on the spillover effect from internal marketing to external marketing and, ultimately, to service outcomes.

Importantly, although recent studies have touched upon the dehumanization of employees, this study, to the best of our knowledge, is among the first that looks into the *dehumanization of supervisors*, thereby providing a more comprehensive and nuanced understanding of the phenomenon of dehumanization induced by algorithmic control in the service context. As such, we call for research on possible ways to minimize the dehumanization effects for supervisors and employees when the majority of their conventional responsibilities are robotized or even replaced by an IACS. Our discovery of IACSs' dehumanization effects thus highlights a critical emerging direction: given the rise of groundbreaking technologies, such as artificial intelligence, IoT, and blockchain, we need more scholarly attention on the undesirable effects that come along with implementing and integrating these technologies.

IACSs as Competing Bosses and Competing Employees

IS scholars have conceptually compared the *rational control* vs. *algorithmic control* that motivates employees and boosts their performance (Barley & Kunda, 1992; Möhlmann et al., 2021). We advance this line of research by simultaneously capturing the impacts of two key types of control from different sources (i.e., EM-S and EM-IACS). Our findings reveal a salient power shift from supervisors to IACSs after their implementation and the emerging issue of *competing bosses* (i.e., supervisors and IACSs) when algorithms assume more control in organizations that relentlessly pursue digitization.

Specifically, the unexpected negative impact of EM-S on IPerf after IACS implementation is intriguing. While counterintuitive in light of existing research showing that EM promotes IPerf, we discovered the dysfunctional effect of EM-S as an unintended consequence of IACSs. Employees' motivation to comply with their supervisors (EM-S) is in line with the workflow before IACS implementation; however, with an IACS taking over task-assignment authority from supervisors, our interview results suggest that the value of EM-S in directing IPerf becomes incongruent with the revised workflow. Although we are uncertain if this result is generalizable to other settings, we acknowledge the complexity associated with the issue of competing bosses and thus call for more research on this emerging phenomenon.

We further discovered that an IACS may serve as a *competing employee* in the eyes of customers. Recent research has recognized the perceived threat for employees from having agentic technologies as their peers, especially when their tasks involve thinking skills (Vorobeva et al., 2022). Our findings enrich this emerging discussion by taking the customer's perspective and shed light on how customers' perceptions of IACSs as competing employees shape customers' interdependence with employees in deriving loyalty decisions.

Interestingly, the presence of IACSs as competing employees may also shape employees' voluntary behaviors at work. Prior studies on EPerf have viewed EPerf as discretional extra-mile behaviors with positive connotations (e.g., Hu et al., 2015). Counter to this conventional wisdom, our work suggests that the facilitating effect of EPerf in driving SATE diminishes when an IACS is used to robotize the service processes wherein IPerf is viewed as more important. We thus call for more research on the value of EPerf in digital economies where technologies are the backbone.

IS Implementation with Internet-of-Things

While many acknowledge the potential of the IoT (Andersson & Mattsson, 2015; Porter & Heppelmann, 2014), little effort has been dedicated to theoretically examining the effects of the IoT, except the interpretative work by Monteiro and Parmiggiani (2019). Against this backdrop, this study contributes to the IoT literature by conducting a theoretically grounded study examining the downstream impacts of an IoT-enabled algorithmic system. Although algorithms allow for real-time analytic decision-making, the IoT affords organizations to significantly scale up their operation, thus permitting large-scale monitoring, tracking, control, and data exchange (Yu et al., 2015; Zhou, 2013). As emphasized, it is the integration of the IoT and algorithms that make the powerful impacts observed in this study possible. We therefore urge future research to include complementary technologies that work with the IoT to develop a more holistic picture of the impacts and value of the IoT.

Methodologically, IS implementation studies have typically compared pre- and post-implementation models of stakeholders within organizational boundaries (e.g., Bala & Venkatesh, 2013, 2016; Morris & Venkatesh, 2010). Our study pushes forward the development of this stream by examining the relationships among stakeholders both within (e.g., supervisors and employees) and across (e.g., employees and customers) organizational boundaries and, more importantly, by exploring how the implementation of an IACS changes these relationships. In a broader sense, our work illustrates how an IACS, as a technology agent, changes the interplay among service supervisors, employees, and customers, thereby exerting a ripple effect on the employee services experienced by external customers. Hence, we strongly recommend that future research leverage a longitudinal design incorporating the distinct perspectives of different stakeholders to obtain insights that would be unattainable otherwise.

Implications for Practice

This study also bears valuable implications for practice. First, many practitioners rely on the SPC to guide their business operations and management. Our proposed TSPC provides insights into the infusing effect of technology on various service stakeholders, which practitioners may want to be mindful of when implementing IACSs. Our results suggest that service firm executives should develop a holistic and integrative view to weigh the costs and benefits associated with service innovations facilitated by IACSs. For example, as employees can accomplish their work by mechanically following algorithmic instructions without knowing the underlying logic, the value of employees' competence diminishes after IACS implementation. The reduced influence of SATE on CusLoyal and our qualitative results also suggest that service firms may leverage IACSs to standardize service procedures and minimize variation in service due to employees' individual competence. Meanwhile, after an IACS is implemented, customers may view employees as replaceable and may hence appreciate employees' contributions and extra-role behaviors less when making loyalty decisions. In this vein, service firms can rely more on novice employees who incur fewer HR costs rather than highly experienced employees. These findings collectively suggest that service firms can actually enhance service efficiency and CusLoyal while attaining lower HR costs if they train their employees to follow IACS-generated instructions. These findings are consistent with prior evidence regarding the positive impact of IT-enabled standardization (e.g., Gilson et al., 2005; Münstermann et al., 2010).

Moreover, traditional wisdom about services suggests that customers often prefer human touch (high touch) over technology (high tech). Nevertheless, our findings reveal that this wisdom needs to be revised in light of the recent breakthroughs in digital technologies like IACSs. In particular, our findings reveal that although such technology-driven services imply reduced human touch, enhanced efficiency might not necessarily lead to poor customer satisfaction as long as the focal system provides clear and routinized services, because getting the job done is what matters most to corporate customers. As such, service firm executives may want to reconsider the nature of their services and be aware of the trade-off between offering services with high touch and offering services with high tech.

In addition, service managers should focus on different aspects of employees' performance to enhance customer satisfaction when an IACS is implemented. As shown in this research, prior to IACS implementation, employees' EPerf plays a significant role in shaping SATE. After implementing an IACS, however, service procedures become more transparent to customers. Customers know what to expect, have indicative clues to assess how well employees have fulfilled their required duties, and thus find it easier to develop satisfaction appraisals and rely less on employees' extra-role behaviors. Thus, managers should pay particular attention to employees' IPerf since its importance in influencing customer satisfaction increases after IACS implementation. Traditionally, it is harder for managers to motivate employees to engage in EPerf compared to IPerf. Interestingly, our results imply that after implementing an IACS, managers could shift more attention and resources to ensuring employees' completion of their assigned tasks (i.e., IPerf) as customers' reliance on IPerf (EPerf) in forming their satisfaction evaluations toward employees increases (decreases). Similarly, employees can devote more attention to completing their required tasks and put less effort into taking care of customers in the social context as customers' appreciation of EPerf reduces after IACS implementation.

Moreover, our discovery of the dehumanization effects of IACSs on supervisors and employees highlights the need for executives to be cautious about the potential threats accompanying IACS implementation. Firms need to be aware that introducing an IACS could be seen as introducing a competing boss and a competing employee in service encounters. Our findings reveal that after IACS implementation, the importance of supervisors in the eyes of employees is challenged, as many of the supervisors' tasks are completed by IACSs. In response to such changes, executives should strategically consider how to reposition or upgrade supervisors so they can generate new value for the TSPC when their original duties are largely automated by IACSs. Likewise, with IACSs, employees' jobs also become more standardized and roboticized, and customers tend to treat employees more like objects or machines that execute IACSs' instructions rather than humans who initiate their own behaviors. Thus, employees' value is not derived from their engagement with customers but from how well they are able to execute IACS-generated solutions. These results signal that while employees have long been considered service firms' most important assets, the role of employees in the eyes of customers is shrinking with the emergence of competing employees in the form of IACSs.

Limitations and Future Research

Our research has several limitations that warrant future research. First, despite the multisource, multiwave research design, this study was carried out at a single service firm undergoing large-scale IACS implementation. Further research is needed to examine our model in other industries to enhance the generalizability of our findings. Moreover, while the distinction between IPerf and EPerf is meaningful and has a clear boundary in our technical service context (i.e., ATM maintenance services), we acknowledge the potential overlap of these two types of behaviors for other services, such as credence or hospitality services. It would be meaningful to examine how IACS implementation changes the boundary of IPerf and EPerf in other service contexts. It would also be valuable to investigate and compare the role of IACSs in the context of transactional and relational services. Scholars could extend this research by relaxing our boundary condition and expanding the discussion to better understand the role of IACSs in innovating different types of customer service.

Second, although self-assessments of job competence and EPerf are common in prior literature (Netemeyer et al., 2005; Spreitzer, 1995) and are considered appropriate, as employees have the firsthand experience and the most direct information to evaluate themselves in the investigative context, we acknowledge the limitation of self-rated measures, we recommend that future research consider alternative methods to minimize the threat to internal validity and the threat of social desirability. We also acknowledge that our IPerf measure is specific to our investigative context, so future research should explore the comprehensive measurement of IPerf in other contexts.

Third, we qualitatively observed an interesting phenomenon of an IACS serving as a competing employee in the eyes of customers, which may affect customer satisfaction evaluations and loyalty. As we did not quantitatively test the associated effects, this is a promising direction for future research using different methods to investigate the dual role of IACSs as competing bosses and competing employees in the eyes of employees and customers, respectively. We thus suggest more research examining these effects via alternative approaches and perspectives.

Fourth, although we attributed the observed changes in the TSPC to IACS implementation, there is room to further investigate how specific features of IACSs affect the TSPC. Specifying the functional features of IACSs and examining how the various aspects of IACSs impact constituent TSPC relationships is important to further extend the model presented in this study.

Fifth, our TSPC does not capture the complete chain relationships with all key constructs. As managing the multiwave, multisource data collection in the field constrained us from using a lengthy questionnaire, which may have decreased corporate clients' willingness to participate, it was difficult to fully cover all chain constructs. While it is common

to examine partial chain relationships in the prior SPC literature (Homburg et al., 2009; Hong et al., 2013; also see a review by Hogreve et al., 2022), future research could expand the TSPC and adopt alternative research designs to study the impact of emerging technologies on complete chain relationships.

Finally, while our study focused on IACS implementation as a crucial contextual factor in altering TSPC relationships, future research should explore other contextual factors, such as personal and environmental factors (e.g., task complexity, environmental uncertainty, market competitiveness), to attain a more complete picture of stakeholders' responses to the infusion of algorithmic technologies.

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Appendix A

Literature Review Tables

Table A1. Research on Algorithmic Systems for Service Management

Author(s)	Method	System	User	Context	Macroperspectives		Microperspectives		
					Impact on society/ market	*Impact on organizations*	*Impact on employees*	*Impact on employees' relationships with internal stakeholders*	*Impact on employees' relationships with external stakeholders*
Our study	Multiwave multisource survey and multisource interviews	IoT and algorithms	Employees	Maintenance services			Dehumanized service roles	Motivation to comply with human versus algorithmic bosses	Relationships between employees' job performance and both customer satisfaction and loyalty
Macroperspective									
Athey & Scott (2002)	Economic model	Medical algorithms	911 centers	Emergency services	----	Service productivity (timeliness)	----	----	----
Noone & Coulter (2012)	Case study	Production planning algorithms	Employees	Quick-service restaurants	----	Service performance	----	----	----
Orlikowski & Scott (2014)	Interviews and archival data	Algorithmic evaluation	Hotels	Hospitality	----	Reconfiguration of valuation practices	----	----	----
Newell & Marabelli (2015)	Conceptual	Algorithmic decision-making	Organizations	General organizations	Negative social consequences (discrimination)	Organizational strategies	----	----	----
Marinova et al. (2017)	Conceptual	Algorithmic learning	Frontline employees	Services	----	Efficiency and effectiveness of services	----	----	----
Frey & Osborne (2017)	Economic model	Machine-learning algorithms	Employees	General organizations	Occupational computerization	----	----	----	----
Brayne (2017)	Observations and interviews	Algorithmic policing	Police	Criminal justice services	Social inequality	Transformation of surveillance practices	----	----	----
Faraj et al. (2018)	Conceptual	Learning algorithm	Knowledge workers	General organizations	Occupational boundaries; technology morality	Organizational expertise, control, and coordination	----	----	----
Huang & Rust (2018)	Conceptual	Artificial intelligence	Employees	Services	Job replacement	----	----	----	----
Liu et al. (2018)	Economic model	Algorithmic management	Drivers	Ridesharing services	Market transparency and moral hazards	----	----	----	----
Lindebaum et al. (2020)	Conceptual	Algorithmic decision-making	Organizations	General organizations	----	Formal rationality of organizational decision-making	----	----	----
Microperspective									
Pachidi et al. (2014)	Ethnographic observations, interviews, and archival data	Algorithmic recommendations	Employees	Sales services	----	----	----	Symbolic conformity and symbolic advocacy	----
Lee et al. (2015)	Qualitative study	Algorithmic management system	Drivers	Ridesharing services	----	----	----	Drivers' responses to algorithmic managerial decisions	----
Shestakofsky (2017)	Longitudinal observations	Algorithmic automation	Developers	Software engineering	----	----	----	Human-algorithm complementarity	----
Curchod et al. (2020)	Interviews	Algorithmic evaluations	Online sellers	E-commerce	----	----	----	Power asymmetry between sellers and platform owners	Power asymmetry between sellers and customers
Kellogg et al. (2020)	Conceptual	Algorithmic systems	Employees	General organizations	----	----	----	Managerial control and algorithmic control	----

Table A2. Research on the Service-Profit Chain

Author(s)	Method (context)	Chain relationship examined	Mechanisms channeling effects of internal employee management practices		Role of technology	Moderators/ contextual factors	Decomposed	
			Human capital	Job motivatio			Motiva -tion	Job perform.
Our Study	Empirical (ATM)	Internal management quality (human capital and job motivation) → Employees' job performance (in-role and extra-role) → Customer satisfaction → Customer loyalty	✓	✓	✓ (IACS)	✓	✓	✓
Heskett et al. (1994)	Conceptual	Internal service quality (workplace and job design, employee selection and development, rewards and recognition, tools) → Employee satisfaction → Employee retention and productivity→ External service value → Customer satisfaction → Customer loyalty → Revenue growth and profitability	†	×	† (Tools)	×	×	×
Loveman (1998)	Empirical (retail banking)	Internal service quality (training, reward, management, supervisor, technical support, etc.) → Employee satisfaction → Employee loyalty → External service value → Customer satisfaction → Customer loyalty and firm profitability	†	×	† (Technical and other related support)	×	×	×
Sergeant & Frenkel (2000)	Empirical (call centers)	Various organizational support (supervisor support, team support, technology effectiveness, etc.) → Job satisfaction→ Organizational commitment → Employees' capacity to satisfy customers	†	†	✓ (Technology effectiveness)	×	×	×
Kamakura et al. (2002)	Empirical (national banking in Brazil)	Operational inputs (personnel and equipment) → Attribute performance perception (customers' perceived performance of personnel and equipment) → Customers' overall evaluation→ Customer retention → Firm profits	×	×	✓ (Equipment inputs)	×	×	×
Liao et al. (2009)	Empirical (national bank)	Management high-performance work systems + employee high-performance work systems (training, job design, appraisal, employee security, etc.) → Employee human capital + Employee motivation→ Employee service performance → Customer satisfaction toward the branch	✓	✓ (Internal motivation)	×	×	×	×
Maxham et al. (2008)	Empirical (retail chain store)	Employees' organizational justice (distributive, procedural, and interactional justice) + organizational identification + employee personality → Employee performance (in-role and extra-role) → Customer evaluations (customer satisfaction) → Store performance (sales growth)	×	×	×	Employees' conscientious-ness	×	✓
Theoharakis et al. (2009)	Empirical (B2B firms)	Management support capabilities (effective human resource management, operations management expertise, and strong financial management) → Employee satisfaction and loyalty→ Employees' relational capability → Employee service PERFORMANCE → Customer performance → Financial performance	✓	†	×	×	×	×
Chuang & Liao (2010)	Empirical (multiple services)	High-performance work systems (staffing, training, appraisals, rewards, etc.) → Organizational climate (concern for customers and concern for employees) → Service performance/ helping behavior → Market performance	†	†	×	×	×	✓
Evanschitzky et al. (2012)	Empirical (retail chain)	Operational investments (personnel costs and operational costs) → Employee satisfaction → Customer satisfaction → Operating profits	×	†	×	×	×	×
Hsieh et al. (2012)	Empirical (telecom service)	Use of customer relationship management systems → Employees' user satisfaction→ Employees' service quality → Customer satisfaction	×	×	✓ (Mandatory CRM)	Employees' embodied service knowledge	×	×
Hong et al. (2013)	Empirical	HR practices (general and service-oriented HR practices) and leadership → Service climate → Employee outcomes (job satisfaction, service performance) → Customer outcomes (satisfaction and loyalty) → Financial performance	×	†	×	Service types, level of study, methodological measures	×	×
Hogreve et al. (2017)	Empirical	Internal service quality (support services and policies) → Employee satisfaction →Employee retention and productivity → External service quality → Customer satisfaction → Customer loyalty → Revenue growth and profitability	†	†	† (Tools)	Service types, industry characteristics	×	×

Note: ✓ = Empirically examined; × = Neither conceptually nor empirically examined; † = Only implicitly mentioned in conceptual arguments

Appendix B

Coca-Cola and GE Aviation

Coca-Cola—a leading soft drink provider—has integrated IoT with its fleet of cold drink equipment (e.g. fountains, coolers, vending machines) in convenience stores and other retail outlets (i.e. their corporate customers' retail channels). These IoT-enabled machines monitor and track consumption patterns and product inventories on a 24/7 basis and then centralize this information in the system's cloud-based hub (Moye, 2018). The real-time algorithmic decision-making function then analyzes the centralized information to optimize decisions about where and when to replenish specific products and assigns available service trucks/vans to do so in a timely manner (Moye, 2018). These IoT functions also continuously monitor the performance and condition of the company's equipment. If a machine fails to operate, the system will dispatch a technician with intelligence about what is malfunctioning, what parts are needed, and how to address the issue to maximize the chance of fixing the problem instantly.

As another example, GE Aviation—a world-class aircraft engine supplier—integrated IoT with its aircraft-monitoring system to continuously acquire aircraft performance data to help identify problems before they occur and to assist in troubleshooting issues that are difficult to diagnose. The IoT-enabled system centralizes information on aircraft usage, fuel consumption, and aircraft operations in the cloud-based information hub. By monitoring and analyzing aircraft performance in the air and on the ground 24/7, the system can identify problems before they happen and assist operators, maintenance technicians, and logisticians in troubleshooting difficult-to-diagnose issues.

Appendix C

Table C1. Summary of Decision Choices of the Mixed Methods Research Design

Steps	Property	Design decisions & rationales
Step 1: Determine the appropriateness of mixed methods research	Research objects	• Rhetorical style: *research objectives* • Research objectives are *predetermined*
	Purpose of mixed method Research	• Confirm assumptions in the quantitative study with qualitative results • Explain unexpected quantitative results with qualitative insights • Expand our understanding of the investigative phenomenon with both quantitative and qualitative components • Triangulate the results across the quantitative and qualitative components to ensure inference credibility • Complete a holistic picture with both quantitative and qualitative insights
	Epistemological perspective	• Single paradigm stance
	Paradigmatic assumption	• We chose the pragmatism paradigm that emphasizes practical consequences (Biesta, 2010), allows for using positivism in both quantitative and qualitative components (Venkatesh et al., 2016; Yin, 2016), and permits both deductive and inductive logical reasoning (Tashakkori & Teddlie, 1998)
Step 2: Develop strategies for mixed methods research design	Design investigation strategy	• Primarily an explanatory research given our core objective to test hypotheses formulated a priori, with the follow-up qualitative interviews that serve to further explain, as well as expand our knowledge of, the investigative phenomenon
	Strands of research	• Single-strand research with both quantitative and qualitative components
	Mixing strategy	• Partially mixed design as only part of this study uses mixed methods
	Time orientation	• Sequential quantitative-qualitative research
	Priority of methodology approach	• Dominant-less dominant design: the quantitative (qualitative) component plays the dominant (less dominant) role
Step 3: Develop strategies for collecting and analyzing mixed methods data	Sampling design strategy	• Sequential nested sampling
	Data collection strategy	• Quantitative data collected via a multiwave, multisourced survey and archival data • Qualitative data gathered through semi-structured interviews with employees, supervisors, customers, and the general manager of the investigative firm
	Data analysis strategy	• Sequential quantitative-qualitative data analysis
Step 4: Draw meta-inferences from mixed methods results	Types of reasoning	• As both the quantitative and qualitative designs were primarily informed by the extant literature, we relied on deduction as our primary reasoning approach • When analyzing the interview data, besides triangulating between the quantitative and qualitative components, we also allowed for the emergence of unforeseen ideas (under the lens of role theory, SPC, and algorithmic management) inductively in a positivist manner (Yin, 2003, 2016)
Step 5: Assess the quality of meta-inferences	Inference quality	• We used conventional quantitative and qualitative standards to ensure inference quality • The findings of our mixed methods design are convergent and complementary, rendering *a* holistic picture of the investigative phenomenon • The reliable quantitative and qualitative inferences, together, allow us to formulate theoretically cohesive meta-inferences • Inside-outside legitimation; weakness minimization legitimation; multiple validities legitimation; political legitimation
Step 6: Discuss potential threats and remedies	Inference quality	• Applied multiwaved and multisourced data to minimize common method/source biases • Used qualitative data to verify the assumptions in the quantitative part • Used the strength of one method to compensate the weakness of the other method • Asked various stakeholder to comment on the results at different stages to minimize the potential biases from a singular viewpoint

Appendix D

Research Site Elaboration

When a particular ATM fails to function normally, a specific person at the focal branch of the bank (who is responsible for ATM operations) will call the service firm and report the issue with the machine. Such requests are typically received and handled by the supervisor who oversees the service operations of the particular region. Upon receiving the request, the supervisor will quickly assess the situation and assign an employee based on various factors such as the geographic location of the ATM to be maintained, employees' availability, and employees' historical service records. The employee will then visit the site, develop a more in-depth understanding of the issue, and fix the problem. If the employee believes that addressing the issue requires additional equipment that they did not bring with them, the employee will have to fetch the right tools at the service firm's regional office and then revisit the customer site. Upon finishing the task, the employee will update the customer and their immediate supervisor about the ATM's status.

After IACS implementation, the IoT-enabled device within the ATM records and traces the ATM's functioning on a 24/7 basis. Whenever a problem occurs, the device can intelligently diagnose and classify the problem and then send a request for service directly to the information hub. The hub then informs the corporate client and the regional supervisor. Next, based on the working schedules, current location, and capacity of all the employees working in the same regional office, the intelligent decision-making feature of the IACS optimizes resource allocation based on employees' location, schedules, and prior service records. When informing the employee through their mobile device, the system also specifies the problem, detailed recommendations for how to solve the problem, and the tools the employee needs to bring in advance. Thus, an employee with little experience with the ATM and little familiarity with the branch can be equipped with the knowledge and tools needed to perform the task without much difficulty. As part of the IACS, employees carry mobile devices while working, which allows the system to trace and monitor their location and the time needed to travel to the customer site on a real-time basis to ensure employees are not deviating from the routes they have been assigned. Upon task completion, the ATM automatically updates its status on the information hub, the employee can close the case via their mobile device, and the customer is informed that the problem has been addressed and can later digitally evaluate the employee's performance. One key difference pre- and post-implementation is that before system implementation, employees had to rely on their supervisors' assessments and instructions to serve customers and had to interact with the contact person at each branch in person during their visits; after IACS implementation, however, employees might not necessarily rely on their supervisors nor meet contact people to deliver services as they might just visit the focal site and fix the machine based on the diagnosis and instructions generated by the IACS.

Appendix E

Table E1. Measurement Items and Factor Loadings

Constructs	Measures			Sources
	Statements	Loadings before IACS	Loadings after IACS	
Data from employees				
External motivation from supervisor (EM-S)	I try to perform my job well . . .			Malhotra et al. (2008); Ryan & Connell (1989)
	EM-S1: because it is required by my supervisor.	0.85	0.76	
	EM-S2: because my supervisor expects me to do it.	0.79	0.67	
	EM-S3: because I'll get in trouble if I do not perform it well.	0.87	0.84	
	EM-S4: so that my supervisor does not reprimand me.	0.88	0.91	
External motivation from IACS (EM-IACS)	To perform my job well…			Liang et al. (2013); Xue et al. (2011)
	EM-IACS1: I (would be)* am motivated to comply with the instructions from the IACS.	0.98	0.95	
	EM-IACS2: I (would be)* am motivated to follow the directions and requirements specified by the IACS.	0.83	0.82	
Job competence (JobComp)	JobComp1: I am confident about my ability to do my job.	0.77	0.74	Spreitzer (1995)
	JobComp2: I am self-assured about my capabilities to perform my work activities.	0.90	0.91	
	JobComp3: I have mastered the skills necessary for my job.	0.91	0.94	
Extra-role performance (EPerf)	EPerf1: How often do you go above and beyond the "call of duty" when serving customers?	0.79	0.86	Netemeyer et al. (2005)
	EPerf2: How often do you willingly go out of your way to make a customer satisfied?	0.81	0.89	
	EPerf3: How often do you help customers with problems beyond what was expected or required?	0.78	0.85	
In-role performance (IPerf)	IPerf1: Compared with other employees, I fix more ATM machines.	---	---	Allen & Meyer (1990); Wieseke et al. (2009)
	IPerf2: Employees' average ATM repair time for the most recent month [archival objective measure]	---	---	Lee & Lim (2011); Moorman & Miner (1998)
Internal motivation (IM)	Why do you do this job?			Gagne et al. (2010, 2015); Li et al. (2015)
	For the pleasure I feel while learning new things in my job.	0.89	0.83	
	Because I feel a lot of personal satisfaction while mastering certain difficult job skills.	0.77	0.86	
	Because I feel pleasant in my job.	0.92	0.90	
Data from customers				
Customer satisfaction toward employees (SATE)	SATE1: All in all, I am very satisfied with this employee.	0.85	0.86	Chan et al. (2010); Homburg et al. (2009); Bettencourt (1997)
	SATE2: The service provided by this employee meets my expectations of ideal service in this field.	0.87	0.83	
	SATE3: Overall, I am satisfied with the service provided by this employee.	0.84	0.86	
Customer satisfaction toward the firm (SATF)	SATF1: All in all I am very satisfied with this company.	0.87	0.87	Chan et al. (2010); Homburg et al.(2009)
	SATF2: The services provided by this company meet my expectations of ideal services in this field.	0.85	0.86	
	SATF3: Overall, I am satisfied with the services provided by this company.	0.92	0.84	
Customer loyalty (CusLoyal)	CusLoyal1: I consider this company my first choice for ATM maintenance service.	0.90	0.88	Chaudhuri & Holbrook (2001); Yim et al. (2008)
	CusLoyal2: This company is the ATM service provider that I prefer over others.	0.92	0.94	
	CusLoyal3: I would continue using this company's ATM service even if it increases its prices.	0.76	0.72	

Note: The items of EPerf used seven-point scales (1 = *Never* and 7 = *Always*). All items, except EPerf, used seven-point scales (1 = *Strongly disagree* and 7 = *Strongly agree*). * for the pre-implementation version—we followed the approach taken by prior studies (e.g. Ajzen & Fishbein, 1980; Hsieh et al., 2011; Karahanna et al., 1999) using two versions of (similar) wording in the survey before and after implementing an IS.

Appendix F

Table F1. Sample Interview Protocol

Interviewees	Sample interview questions
Employees	• From your viewpoint, what is in-role performance? What is extra-role performance? Do the meanings of in-role and extra-role performance change before and after IACS implementation? • How do you come up with the solutions before and after IACS implementation? • How does IACS implementation affect your work? What are the changes in your job after system implementation? • What are the changes in your supervisors' jobs after IACS implementation? • Do you perceive any inconsistent instructions from the supervisors and IACS? If so, could you elaborate? • Do you experience any changes in interacting with your supervisor before vs. after IACS? If so, could you elaborate? • Do you experience any changes in interacting with the customers before vs. after IACS? If so, could you elaborate?
Supervisors	• From your viewpoint, what is employees' in-role and extra-role performance? Do the meanings of in-role and extra-role performance change before and after IACS implementation? • What are the changes in your relationship and interaction with your employees after IACS implementation? • What are the changes in employees' job activities after IACS implementation? If so, could you elaborate? • What are the changes in your job activities before and after the system implementation? If so, could you elaborate? • How do you feel about your role before and after IACS implementation?
Customers	• From your viewpoint, what is employees' in-role and extra-role performance? Do the meanings of in-role and extra-role performance change before and after IACS implementation? • How do you interact with the employees before and after IACS implementation? • How does IACS implementation affect the service you experience? • Do you observe any changes in the employees' service activities before versus after IACS implementation? • How important are service employees' in-role performance and extra-role performance for you and your firm's operation before versus after the IACS system?
The general manager	• From your viewpoint, what is employees' in-role and extra-role performance? Do the meanings of in-role and extra-role performance change before and after IACS implementation? • What were the original motivations to implement IACS at first? • What are the differences in employees' job activities before versus after IACS implementation? • What are the differences in supervisors' job activities before versus after IACS implementation? • How do the customers feel about the IACS initiative? What are their feedbacks? • How does IACS affect the standing of your firm in this sector?

Appendix G

Table G1. Concepts and Sample Quotations from the Interviews

Role: Supervisors	***Supporting codes & data source***
Do we still need supervisors?	• *Do we really need these supervisors anymore? After the IACS, our work becomes more challenging, but they [the supervisors] have fewer things to do and yet still enjoy the same level of salary and benefits!* [quote from an employee] • *I am a bit confused. Who should we listen to right now, IACS or supervisors? If we should follow the order by IACS, why do we keep those supervisors?* [quote from an employee]
A sense of power loss	• *All the task assignments are now being handled by IACS. Why bother me when running into issues?* [quote from a supervisor] • *I was sort of the king in charge of everything about the employees and their tasks. IACS seems to take everything, including their respect, away from me.* [quote from a supervisor]
Still relevant but with a different work focus	• *The IACS cannot foresee all possible scenarios that our foot soldiers [service employees] encounter on the frontlines. For instance, when an employee travels through some areas with weak or no GPS signal, the system receives inaccurate or no information and thus generates inappropriate task assignments for other employees. In this case, the supervisors need to intervene to make alternative arrangements to overwrite the algorithm-generated instructions.* [quote from the general manager] • *Although I am not responsible for employees' task assignment anymore, I am still handling their [sick and vacation] leave applications. I also coordinate more with our vendors to make sure they provide parts and components to our warehouse in a timely and accurate manner.* [quote from a supervisor]
Role: Employees	***Supporting codes & data source***
Nothing but a vehicle for digitized intelligence	• *Honestly speaking, how I feel and what I think do not really matter. Just follow the order by IACS and fix the machines with the instruction from IACS, that's it!* [quote from an employee] • *Simply put, service employees now act like the vehicle that carries the digitized instructions and standardized knowledge to fix the problem in the physical world.* [quote from the general manager]
Nostalgia (about the interactions with *human* supervisors prior to IACS implementation)	• *Because IACS can now assign tasks to us anywhere anytime, we have to stay alert and standby all time. I can easily feel stressed out after having the implementation of IACS.* [quote from an employee] • *I miss the good old days working with the human boss. My supervisor understood that we, as human beings, all have our ups and downs. When assigning tasks, he could put that into consideration and give me some leeway if I had some personal or family issues.* [quote from an employee]
Role: Customers	***Supporting codes & data source***
Happy with fewer interactions with employees	• *After IACS, as long as the service employees do what they are paid for—keep the machines up and running [i.e. IPerf]—I don't really care if I see or talk to the employees in person. While I appreciated their personal greetings and small tokens [i.e. EPerf] before the IACS, it is much better now that I can spend less time handling these ATM chores.* [quote from a customer] • *This site used to be served by employee XYZ. He and I had a close bond and I appreciated his personal care about me. But things changed after having IACS such that the service procedure has become more efficient, standardized, and easier to follow. While I do not see [XYZ] often as before, I feel relaxed that I can be more hands off now and just leave the ATM things to the IACS.* [quote from a customer]
The game changer	• *IACS differentiated this service provider from its competitors by saving us time, money, and troubles. I am happy with what happened after its implementation and have urged my boss to continue our business with this firm.* [quote from a customer] • *At first, the IACS was only designed to facilitate employees' task assignments and standardize and streamline the service process. To our surprise, it has become a game changer of our business.* [quote from the general manager]