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RESEARCH ARTICLE

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Managing Change with the Support of Smart Technology: A Field Investigation of Ride-Hailing Services

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Abstract

With the support of smart technology, IT-enabled services have become "smart" and have progressively disrupted existing markets. Ride-hailing services (RHSs) are widely regarded as representative of these IT-enabled services. However, few studies on IT-enabled services investigate how the technological attributes of smart technology influence service performance in a continuously changing environment. We developed our research model according to Wixom and Todd's model, the literature on change management, and the literature on information system postadoption behavior. We conducted a large-scale field study by surveying 380 drivers from major metropolises in mainland China and a post hoc qualitative interpretation to validate our model. We found that smart technological attributes of RHS systems (i.e., monitoring, control, advisory support, and responsive support) positively influence functionality and content quality, which in turn influence service quality. In addition, service quality positively influences drivers' postadoption attitudes and behaviors, including openness to RHS change, job satisfaction, and continuous usage intentions. Our findings provide important theoretical and practical implications.

Keywords: Smart Services, Ride-Hailing Services, Smart Technology, Postadoption Behaviors, Openness to RHS Change, Mixed Data and Method

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1 Introduction

IT artifacts have become "smart" and have substantially disrupted existing markets. Smart technology is defined as technology capable of (1) monitoring environments by collecting data through its technology sensors, and (2) analyzing the collected data to provide informational support (Foroudi et al., 2018; Zoughbi & Al-Nasrawi, 2015). Given such characteristics, smart technology increasingly disrupts many business and service sectors. An example of such a technology disruption is ride-hailing services (RHSs). A recent report from Forbes indicates that RHSs accounted for 70.5% of the ground transportation market for business travelers in the first quarter of 2018 but only 8% in the first quarter of 2014 (Goldstein, 2018). The exponential growth experienced by RHS systems (e.g., Uber, Lyft, or Didi) has been attributed to smart technology or algorithmic management in some studies (e.g., Schildt 2017). Smart technology provides technological support for drivers completing ride tasks.

Although smart technology has helped RHS systems emerge, prior studies on RHSs have explored the role of smart technology with respect to either (1) a multisided platform strategy combined with a dynamic pricing strategy or (2) algorithm-based internal governance (Van Alstyne, Parker, & Choudary, 2016; Hagiu & Wright, 2015; Lee et al., 2015). Little is known about how smart technology has been instrumental in coping with the evolution of RHSs. Since its inception as an emerging service, RHSs have experienced their fair share of evolving controversies, including protests from taxi drivers and their labor unions, complaints of gender and racial discrimination, and accusations of sexual assault or passenger abuse (Dickinson, 2018; Kazmin, 2014). These conflicts have led policy makers to increase the stringency of regulations regarding RHSs. In response to these regulations, RHS firms have updated their RHS systems to ensure their survival and growth. Such exchange between policy makers and RHS firms has caused considerable turbulence and changes for drivers, which may reduce their willingness to continue offering service to passengers. If such a reduction occurs, then RHS businesses will be significantly challenged because of their multisided platform strategy; in short, fewer drivers means fewer passengers. Thus, evaluating how smart technology can help RHS firms adapt to evolving regulatory changes is an intriguing and novel research question.

To describe the role of smart technology in the evolution of RHSs, we delve into the literature on IT-enabled services, change management, and information systems (IS) postadoption behavior to develop our research model. The literature on IT-enabled services has delineated and examined how IT attributes exert significant impacts on IT-enabled service quality, i.e., quality of IT interactions (Tan, Benbasat, & Cenfetelli, 2013; Xu Benbasat, & Cenfetelli, 2013). The literature on change management has found that openness to change serves as a significant intermediate factor that bridges antecedents (e.g., personality attributes or contextual factors) and individual postadoption behaviors during changes. Based on the aforementioned literature, we propose that the attributes of smart technology, as primary IT-related antecedents, influence the perceived service quality of an RHS system. In turn, we show that service quality helps RHS drivers adapt to a series of evolving changes, thereby increasing their continuous usage intentions and driver retention. We further identify four attributes of smart technology (i.e., monitoring, control, advisory support, and responsive support) in our research context. According to the literature on IT-enabled services (Tan, Benbasat, & Cenfetelli, 2013), the attributes of smart technology can be categorized into two object-based beliefs: functional advancement and informational advancement. The former manifests a belief in functionality quality (the RHS system), and the latter manifests a belief in the content quality (information conveyed by the RHS system).

To validate this proposition, we conducted our study following a series of newly imposed regulations on the RHS industry in mainland China. Our findings contribute to the literature and practice in four ways. First, we identify and examine the attributes of smart technology used in RHS systems. Doing so expands understanding of the design and evaluation of services driven by smart technology. Second, by using Wixom and Todd's model (2005), we theoretically develop two prominent antecedents—functionality quality and content quality—and validate their positive roles in shaping the perceived quality of smart services. Our study generalizes Wixom and Todd's model by theorizing new object-based/behavioral beliefs and attitudes in the new research context. Third, our findings contribute to the literature on change management by introducing the role of technology. Prior studies have highlighted the role of interpersonal communication in enhancing individual attitudes toward change (Chawla & Kelloway, 2004). Our study complements prior studies by suggesting that the provision of proper technology (e.g., smart technology in an RHS system) can effectively facilitate an individual's openness to change, even in the absence of personal communication during the changes. Finally, our work contributes to the RHS literature. Previous studies have focused on either strategic perspective or internal governance of RHSs. Little attention has been devoted to how change is managed, even though emerging smart services like RHSs are constantly experiencing various changes. Our findings bridge this gap and explore how smart technology can be effectively deployed to alleviate the potential negativity introduced by changes and thus sustain RHS business operations.

We organize the remainder of our paper as follows. In the following section, we review the relevant literature. In Section 3, we introduce Wixom and Todd's model and the theoretical inference for hypothesis development. In Section 4, we describe our data analysis, empirical findings, and our follow-up investigation. Finally, we conclude this paper by discussing the theoretical and managerial implications of our findings. We also point out the limitations of our study and suggest future research directions.

2 Background and Literature Review

2.1 Ride-Hailing Services

The rudimentary development of RHSs can be found in Los Angeles and Seattle in the late 1990s (Golob & Giuliano, 1996). Prior studies have investigated the impact of RHSs at individual and environmental levels. For instance, Salomon and Mokhtarian (1997) conceptualized a behavioral response model to discuss how different RHS policies influenced individual decisions and consequently reduced traffic congestion. Baldassare, Ryan, and Katz (1998) surveyed a large number of commuters in Orange County, California, and found that solo drivers would be willing to discontinue solo driving (i.e., engage RHSs) given certain incentives. Furthermore, RHSs contributed to environmental improvements such as reductions in emissions and fuel consumption (Fellows & Pitfield, 2000; Jacobson & King, 2009).

In contrast to limousine or taxi dispatch systems, which are associated with various limitations (e.g., mobility restrictions, data desynchronization, or payment limitations), current RHS systems (e.g., Uber, Lyft, or Didi) rely on smart technology to overcome such deficiencies and are currently disrupting the market. For instance, RHS systems can promptly pair passengers who are looking for a ride with drivers who are willing to provide such services. RHS systems can analyze the relevant data and then optimize driving fares and routes. Given such de facto merits, previous studies investigating the strategy of current RHS businesses have identified two intriguing strategies: value exchange (between passengers and drivers) and virtuous feedback loops (Van Alstyne et al., 2016).

In addition to examining relevant strategies for RHS businesses, prior studies have also focused on the managerial perspectives of RHSs. Lee et al. (2015) ascertained that algorithmic management serves as a core innovation facilitating the operation of RHSs because drivers (1) are automatically assigned ride tasks by algorithms, (2) are evaluated by algorithms, and (3) communicate minimally with RHS firm representatives. Although drivers participating in this study acknowledged the benefits of algorithmic management, they raised several concerns about management practices, such as perceived unfairness and distrust in the performance evaluations made by algorithms. Möhlmann and Zalmanson (2017) employed a similar research paradigm but focused on the tensions between drivers and the algorithmic management system and drivers' reactions to such tensions.

Despite the meritorious strategy and governance in the RHS business, many communities, governments, and organizations have established rules and regulations to govern ride-hailing companies throughout the world (Posen, 2015). Complying with such regulations generates additional costs for RHS firms and their drivers. For instance, RHS firms may be required to redesign or reimplement certain functions or content in the RHS system to align with the relevant regulation (Posen, 2015; Weiner 2015). Drivers have to learn to adapt to the changes imposed by RHS firms/systems and new regulations, which may eventually result in higher driver turnover and damage to RHS businesses (Posen, 2015; Weiner 2015). However, although millions of people work full-time in the gig economy, substantially less empirical work has investigated how independent contractors such as RHS drivers respond to and cope with changes. To address this research gap, we extensively review the relevant literature on change management and smart technology in the next two subsections. We subsequently demonstrate why and how smart technology helps RHS drivers adapt to constant changes, which eventually reduces their turnover intentions.

2.2 Attitudes About Change and Postadoption Behaviors

Turbulence prevails in many business environments, causing organizations to make responsive changes and take actions accordingly (Hannan & Freeman, 1984). To investigate this phenomenon, prior researchers on change management have focused on the concept of individual attitudes about change, suggesting that the extent to which organizations successfully take responsive actions to cope with environmental uncertainty hinges upon their employees' attitudes toward these responsive changes (Choi, 2011). A recent review article discusses four types of attitudes toward organizational change: readiness for change, commitment to change, cynicism about change, and openness to change (Choi, 2011). Although these four constructs of interest are similar in that they all manifest individual (positive or negative) judgment of a particular change initiative or event, these four constructs have distinct meanings or focuses. First, "readiness for change," "commitment to change," and "cynicism about change" are based on organizational theory. These three constructs primarily focus on attitudinal alignment between change and organizational attributes. By contrast, "openness to change" stems from openness to experiences (i.e., one of the Big Five personality factors) and attempts to unveil individuals' willingness to tolerate and embrace change (Wanberg & Banas, 2000). RHS drivers, as independent contractors, are not affiliated with any organization; instead, they are governed by the RHS system and algorithms (Lee et al., 2015). Given the lack of organization-specific attributes in RHS changes, we argue that "openness to change" is a more appropriate construct to represent RHS drivers' attitudes toward change. The original definition of "openness to change" depicts the extent to which individuals intend to embrace changes or their anticipation of the potential merits of such changes. To make this construct better align with our specific research context, we use and define the term "openness to RHS change" as the extent to which RHS drivers[1] embrace changes in the RHS sector. We summarize the relevant studies in Table 1.

[1] The RHS drivers in this study refer to those who merely undertake ride tasks assigned by RHS systems (e.g., Uber, Lyft, or Didi) as gig workers. Taxi or limousine service drivers using RHS system are not included.

Table 1. Summary of Previous Studies on Attitudes Toward Change

Articles	Change context	Antecedents	Attitudes toward change	Consequences
Axtell et al. (2002)	• Implementation of new technology and work practices	• Exposure to change	Openness to change	Job satisfaction and depression
Lehman et al. (2002)	• Introduction of a new program within an organization	• Motivation for change • Personality attributes • Perceived organizational climate	Readiness for change	N/A
Oreg (2003)	• Change of course schedule • Use of course websites • Office relocation	• Affective factors • Cognitive factors • Perceived functioning	Resistance to change	N/A
Chawla & Kelloway (2004)	• Merger	• Communication • Participation in the process	Openness to change	Turnover intention
Jones et al. (2005)	• Implementation of a new end-user computing system	• Perceived organizational culture • Perceived reshaping capability	Readiness to change	• System usage • Satisfaction
Oreg (2006)	• Merger	• Personality traits • Perceived threats • Trust in management • Perceived social environment	Resistance to change	• Intention to leave • Organizational commitment
Devos, Buelens, & Bouckenooghe (2007)	• Implementation of software	• Trust in supervisors • Trust in executive management • Participation in the process	Openness to change	N/A
Kwahk & Kim (2008)	• Introduction of enterprise system	• Perceived personal competence • Organizational commitment (prior to change)	Readiness for change	Usage intention
Choi & Ruona (2011)	• General change at the organizational level	• Perceived change process • Perceived change context	Readiness for change	N/A

Openness, a concept that originated in the psychological literature, is an individual attitude that captures an individual's ability to be cognitively and behaviorally flexible in dealing with new situations (McCartt & Rohrbaugh, 1995). Previous studies have investigated several antecedents of individual openness to change, including personality traits and contextual factors, finding that personality traits, such as personal resilience, change self-efficacy, and need for achievement, significantly influence individual openness to change (Lehman et al., 2002; Miller, Johnson, & Grau, 1994; Wanberg & Banas, 2000). Although these findings offer considerable theoretical contributions, applying them to shape individual attitudes toward adapting to changes remains challenging for practitioners (i.e., individual personality is difficult to alter within a short period of time). In contrast to these personality attributes, it has been argued that contextual factors afford more practical value for facilitating individual openness to change (Jones et al., 2005). For example, providing sufficient information and organizational functions during a change can encourage individuals to embrace change (Choi, 2011; Wanberg & Banas, 2000). Effective communication with individuals can improve their sense of efficacy about the change implementation, which can further promote their openness to the change (Armenakis et al., 2007). Toward this end, we infer that organizational support relating to organizational changes is the precursor to individual attitudes about such changes.

In addition to the antecedent of "openness to change," prior studies have discussed the possible consequences resulting from individuals' different attitudes (about change). Individual attitudes regarding change shape subsequent behavior (Oreg, 2006). For instance, when employees are open to change, they have more pro-change behaviors and attitudes, such as high job satisfaction or low turnover intentions (Jones et al., 2005; Kwahk & Kim, 2008; Oreg, 2006; Chawla & Kelloway, 2004; Wanberg & Banas, 2000). Thus, managing employees to facilitate adaptability to change affords significant value for organizations.

However, whether change management tactics drawn from the organizational setting can inform practice in the gig economy remains unknown. For gig workers, the traditional contract or employer-employee relationship is replaced by elaborate technology-driven task-based earning (Angrist, Caldwell, & Hall, 2017). Management theories and practices developed from traditional organizations may not be applicable to explaining the dynamics or business logic of the gig economy. In change management, as depicted previously, the contextual factors like interpersonal communication or information sharing can contribute to alleviating change-related negativity. Yet, RHS drivers (a typical gig worker) rarely have bilateral conversations with RHS firms. The RHS system is the predominant medium offering communication and support to drivers. Toward this end, whether an RHS driver can embrace change depends not solely on the identified contextual factors but more on the technological support from the RHS system. A driver's openness to change hinges upon the extent to which he or she perceives that the IT-enabled service (from the RHS system) supports the changes, which consequently influences his or her behavioral beliefs and attitudes, namely, job satisfaction and continuous usage intentions. This aligns with the general contention about postadoption behaviors, that is, whether technological features are believed to affect individual postadoption behaviors, such as continuous usage intention (Jasperson et al., 2005).

Previous IS literature has argued that postadoption behaviors (e.g., continuous IT use with the change) should be viewed as a process of forming habituation (Jasperson et al., 2005; Park, Kim, & Koh, 2010; Chen, 2014). In such a process, individuals alter their habitual behaviors, experience learning new technology, and eventually form novel habitual behaviors. A feature-centric view of technology has been proposed to study this process (Jasperson et al., 2005). Accordingly, the focal technology or system, as a collection of IT features, should be decomposed for examination because individual users may have selective preferences in using different features that consequently result in different postadoption behaviors (Jasperson et al., 2005). Toward this end, we adopt the feature-centric approach in this study to delineate different smart technological attributes used in RHS systems and discuss their impacts on drivers' postadoption behaviors. In the next section, we present a comprehensive review of smart technology and our conceptualization of relevant smart technological attributes.

2.3 Unfolding Smart Technological Attributes

Based on the feature-centric approach, we use a top-down approach to identify smart technological attributes. Smart technology, as a derivative of digital technology, should conform to a similar taxonomy/framework as digital technology (Püschel, Röglinger, & Schlott, 2016). A recent article conceptualizes digital technology as a layered modular architecture (Yoo, Henfridsson, & Lyytinen, 2010). There are four layers characterizing digital technology, namely, the device, network, service, and content layers. The first two layers consist of physical machines, infrastructure, and protocols or standards. The service and content layers deal with application functionality and data/information, respectively. Smart technology can be vertically integrated with all four layers. However, users can only perceive such smart features in the service and content layers. In other words, the device and network layers pertain to the technological features not directly interacting with the users, yet the technology built on the service and content layers pervasively gratifies (or irritates) users. Specifically, the service layer is the application functionality that directly provides service to users, whereas the content layer is information that is necessary for the service. Through smart technology equipment, users can access advanced functions and effectively consume desired information while using the service. Anchoring the feature-centric approach, we first delineate smart technology into two principal features, namely, smart functionality and smart content.

Several practical cases corroborate the validity of the preceding two features (i.e., smart functionality and smart content) in the application of smart technology. For example, smart home systems monitor the status of all connected home appliances and simultaneously control energy consumption (i.e., smart functionality), which in turn provides tailored support and advice to help residents attain energy efficiency (i.e., smart content) (Hargreaves & Wilson, 2017; Loock, Staake, & Thiesse, 2013). Smart health care toolkits synchronize and analyze data from multiple sources (i.e., smart functionality) and provide advice (i.e., smart content) to attending physicians to improve the quality of treatment (Sun & Medaglia, 2019). To explicitly demonstrate how smart technology advances RHS systems, we compare the process used in traditional cab booking systems with that of RHS systems in Figures 1a and 1b. This comparison contextually illustrates the smart technological features used in RHS systems.

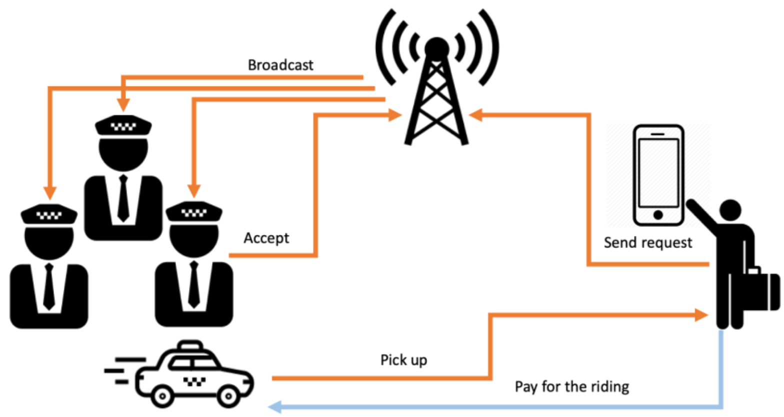

Figure 1a. Traditional Cab Booking System

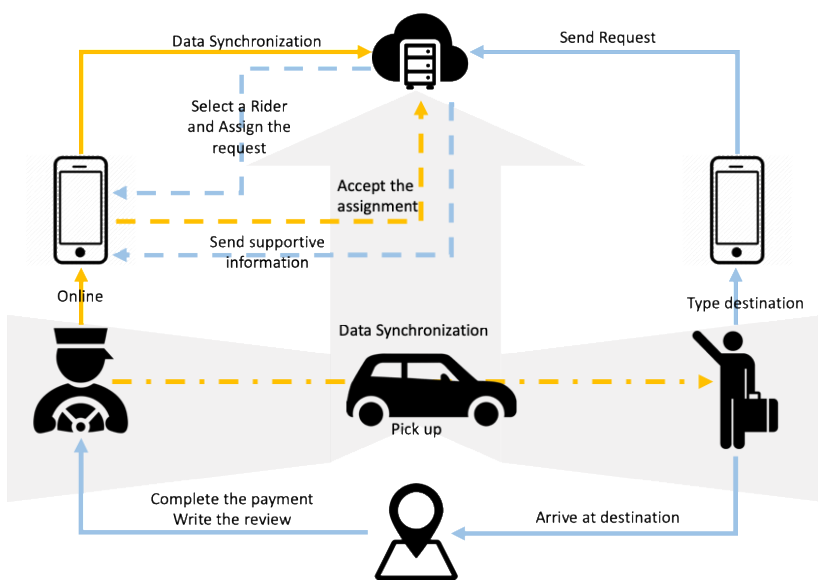

Figure 1b. RHS System

Before RHSs emerged, passengers were required to use centralized information systems (e.g., mobile app or online order system) to book a cab. These systems relied on a dispatch center to distribute requests from passengers to all cab drivers. Those nearby drivers subsequently could decide whether to accept the request. The overall process (illustrated in Figure 1a) involves two steps: (1) a broadcast from the dispatch center, and (2) a response from the cab driver. The logic in the design of this system is simple, but the performance is inefficient. To address the inefficiency, RHS firms employ systems that synchronize data tracked from drivers and passengers and optimally distribute passengers' requests to the drivers who are identified by algorithms as the best candidates. Figure 1b presents this overall process, including relevant functionality and information exchange.

Figure 1b describes the general workflow of the RHS system through four procedures. First, as soon as the driver makes her- or himself available to receive ride requests online, the RHS system starts monitoring the driver's activities and synchronizes relevant data (e.g., geolocational information or driving speed) to the central server. Second, when the driver receives an assigned real-time request by the RHS system, he or she can decide whether to accept such a request or not. Such a request assignment is then automatically processed and completed by the RHS system. Along with basic information (e.g., destination) contained in the request, the driver receives supportive information, such as traffic information, passenger information, or estimated arrival time. Third, after the driver picks up the passenger(s) and begins the trip, the RHS system starts the meter. Meanwhile, the RHS system monitors the driver's and passenger's geolocational information and constantly provides advisory information (e.g., optimal routes or justifications for ride fares). Finally, at the end of a trip, the driver receives payment and, possibly, ratings and comments from passenger(s). The RHS system can analyze relevant ratings and comments to help drivers improve their service quality in the future. Based on the RHS business process, we conclusively derive four prominent features supported by smart technology in the RHS system: monitoring, control, advisory support, and responsive support. The first two manifest smart functionality, and the last two manifest smart content, which we discuss in further detail below (Lee et al. 2015).

2.3.1 Smart Functionality

As depicted above, monitoring and control serve as essential attributes to attain smart functionality (Porter & Heppelmann, 2014). They are also important components for optimizing the information market between drivers and passengers to enhance the matching function, resulting in the RHS breakthrough (Cramer & Krueger, 2016). Monitoring enables reporting the condition and environment, which helps generate insights of performance and technology use, while control gives users the unprecedented ability to customize usage activities. The monitoring function is capable of elaborately collecting multimodal data continuously, tracking users' behavior throughout the working routines, predicting future scenarios, and facilitating desirable outcomes for users. Providing this function allows individuals to comply with regulations in their daily work activities in online and offline settings (George, 1996; Stanton, 2000; Pavlou, 2002). Simply put, the monitoring function promotes responsible behaviors. The control function grants users the unprecedented ability to master the system in real time by adapting to continuously varying environments (Porter & Heppelmann, 2014), which also contributes to bolstering individual beliefs about autonomy when interacting with the system (Möhlmann & Zalmanson, 2017). For instance, employing a smart technology to design a home energy management system capable of monitoring and controlling functions resulted in the effective attainment of the goal of saving energy (Al-Ali et al., 2017). We provide a detailed explanation of these two aspects of smart functionality in the RHS context below.

The *monitoring* function in the RHS context is supported by smart technological attributes and affords the assurance that a ride is being performed under a specific and predetermined set of rules. As described above, to better match passengers and drivers, the RHS system uses the monitoring feature to automatically collect multimodal real-time data from both parties. For instance, the monitoring feature constantly collects the geospatial and mobility information of drivers during their ride tasks through the GPS function. In addition to the real-time location, the monitoring feature collects relevant data regarding driving speed, acceleration, and miscellaneous data about driving activities. In short, the whole route of the trip (from departure site to destination) is traced and recorded. Besides regulating drivers, the monitoring function contributes to protecting drivers. Given the lack of witness for most conflicts between passengers and drivers in the RHS, the monitoring features also serves an arbitral role in managing such conflict by supporting the evidence. For example, Didi, a leading RHS firm in mainland China, implemented a cryptographic video-recording function in the RHS system to record the conversation between drivers and passengers to assure responsible behaviors on both sides. Moreover, the monitoring feature helps optimize the dynamic pricing model in the RHS system in terms of continuously supplying real-time data. Given such de facto evidence in the practice, we can conclude that monitoring, as an essential technological feature, supports the smart functionality in the RHS system for RHS drivers.

The *control* function in the RHS context can be discussed from two perspectives: a human-centric perspective and a technology-centric perspective. The former investigates how individuals leverage technology to support their goal-oriented activities, whereas the latter attempts to understand how technology facilitates individual performance via control functions (Cram, Brohman, & Gallupe, 2016). Both aspects can be found in RHS systems with smart technology support. From the human-centric perspective, RHS drivers have more flexibility to control their work routines by using RHS systems. RHS drivers have the freedom to decide when, where, and how long to provide ride services. For example, drivers can set destinations in order to receive ride requests that align with their preset destination, e.g., to avoid requests departing in the opposite direction. This function helps drivers deal with "last ride requests" at the end of their shifts. From a technology-centric perspective, RHS systems implement a set of algorithms to impose a control framework for drivers; in turn, drivers are well managed by various constantly evolving governance principles. For instance, RHS systems control ride fares dynamically for each ride request and this function saves considerable costs generated by communication between drivers and passengers. To an extent, technological control enables drivers to make precise predictions and exert more control over their work. We thus infer that smart technology (used in RHS systems) functionally attains driver autonomy and control as well as the technological control framework, which both support drivers' beliefs in the functionality quality of RHS systems.

2.3.2 Smart Content

Referring to the previous literature, we theorize that advisory support and responsive support are the essential attributes of attaining "smart content" (Nissen & Sengupta, 2006). Nissen and Sengupta (2006) investigated the role of intelligent software agents in facilitating individual decision-making processes and conceptually classified them into information retrieval, advisory, and performative agents. With the exception of the performative agent pertaining to functional logic in the intelligent system, the informational retrieval and advisory agents conduce the presentation of smart content for the users. Specifically, the informational retrieval agent automates gaining and processing data and helps users effectively gain relevant information and content. When users request desired information, the information retrieval agent employs a pull-based model to respond to the information demand. In contrast to the informational retrieval agent, the advisory agent is designed on a push-based mechanism, from which users receive advisory recommendations automatically. From an informational perspective, the retrieval agent affords responsive support and the advisory agent provides advisory support. Referring to previous literature, we define *advisory support* as the extent to which an information system is able to proactively push desired content for users in the course of performing tasks, and *responsive support* as the extent to which an information system can gratify an individual with the requested content (Rainer & Carr, 1992).

Advisory support in the RHS context uses smart technology to collect and analyze multisource data and predictively offer advisory content for drivers during their rides. For example, RHS systems can detect regions with high ride demand and proactively mobilize drivers to arrive by conjointly analyzing spatial data and ride requests from passengers. Drivers also receive various advisory reminders to facilitate the efficiency of their rides, such as special requests from passengers or information about prospective rides (from the next passenger). Such advisory support requires the support of smart technology such as real-time data synchronization or big data analytics, which eventually gives drivers access to more and richer content.

Responsive support in the RHS context is manifested by various facets. For instance, the RHS system, equipped with text analytics, enables drivers to retrieve fine-grained content from a massive number of passenger reviews, which then helps them improve their quality of service. In addition, drivers can proactively interact with the RHS system to optimize their ride routes and avoid traffic congestion. As such, smart technology advances the responsive support function in the RHS system, which benefits drivers by improving the service quality in the end. In Table 2, we summarize and give examples of the smart technological attributes addressed here.

Table 2. Summary of Smart Technological Attributes

Attributes	Definition	Examples in the RHS context
Monitoring	Monitoring is a function that continuously and automatically collects information about users' activities, external environments, or other relevant information.	Recording function that continuously records the voices in an entire transaction, which aims to improve safety during trips.
Control	Control (in the IS context) is described as a functional approach that grants the privilege for individuals to control their use of IT artifacts.	Destination filter function that enables drivers to receive trip orders only from a route leading to one's destination (such as drivers' homes).
Advisory support	Advisory support is defined as the extent to which an IS can proactively push desired content for users in the course of performing tasks.	Promotions announcement function that may provide information about upcoming location-sensitive special promotions like one-time incentives or incentive increases.
Responsive support	Responsive support refers to the extent to which an information system can gratify an individual with the content that she or he requests.	Request function that is a link to RHS system support for transactions or problems.

3 Hypothesis Development

As discussed above, changes in regulations or the business environment in the RHS sector may impact drivers' intentions to continue pursuing their jobs in this industry. Referring to the findings from the literature on change management and IS postadaptive behavior, we argued that the RHS system, as the primary medium with which drivers interact, serves an important role in determining individual adaption to changes (Kwahk & Kim, 2008; Jasperson et al., 2005). How drivers adapt to these changes hinges on how effectively RHS systems support their adaptation.

Therefore, the smart technological attributes of RHS systems actually characterize drivers' attitudes toward change. To understand how technological attributes from an IT artifact influence individual attitudes and behaviors, we anchored our research model in the theoretical paradigm proposed by Wixom and Todd (2005).

Wixom and Todd's model is an extension of the IS success model. The IS success model theorizes that system acceptance and user satisfaction result from the alignment among system quality, information quality, and service quality. Wixom and Todd revise and extend this model by separating beliefs and attitudes, respectively, into object-based and behavioral beliefs and attitudes related to assessing the quality of IT artifacts and estimating the acceptance by intended users (Wixom & Todd, 2005). Specifically, the focal IT artifact is conceptualized as an "object," whose technological features, i.e., system-specific or information-specific attributes, influence individual beliefs about the object, named as object-based belief. Object-based belief further influences users' attitudes about the system and their subsequent behaviors. Given the relatively flexible specification of technological attributes and the generalizability of the conceptual logic, Wixom and Todd's model has been widely extended and applied to understand IS user behaviors in many different contexts, such as e-government (Tan, Benbasat, & Cenfetelli, 2013) and e-commerce (Wang & Benbasat, 2016; Xu et al., 2013).

Despite the well-established paradigm, the application of Wixom and Todd's model can still be improved, especially given that smart technology now inundates the IT-enabled service market (Kleinschmidt, Peters, & Leimeister, 2016). The original Wixom and Todd model only included fundamental technological attributes depicting system quality (i.e., reliability, flexibility, accessibility, response time, and integration) and information quality (i.e., completeness, accuracy, format, and currency) (Nelson, Todd, & Wixom, 2005; Wixom & Todd, 2005). Although a core set of system or information characteristics accounts for the fundamental functionality and content delivery of any IT artifact, these characteristics cannot precisely reflect either the contextual aspects of an IT artifact or the substantial recent evolution of technological attributes. In particular, despite the prevalence of smart technology in various IT-enabled service sectors, the relevant attributes manifesting smart technology are still absent in the existing literature. Therefore, we attempt to bridge this gap by characterizing smart technological attributes in the RHS system and discussing how they influence drivers' behaviors.

After extensively reviewing prior literature, we found that the technological attributes depicting both system quality and information quality could be adapted to align with the research context. For instance, Tan, Benbasat, and Cenfetelli (2013) revised the original model and replaced the original attributes with new ones in the e-government service context, such as needing service acquisition functions, service ownership functions, and efficient IT-mediated service delivery. Vance et al. (2008) described the system quality of a mobile commerce portal using only two self-developed technological attributes, i.e., navigational structure and visual appeal. Sedera and Gabel (2004) contextualized the system and information quality in a governmental enterprise system and accordingly created three technological attributes, i.e., user requirement, system features, and customization for system quality and availability for information quality. Similarly, we develop four attributes (i.e., monitoring, control, advisory support, and responsive support) characterizing the smart technology used in RHS systems and integrated them into the original paradigm in Wixom and Todd's model to develop our hypotheses. In addition, we contextually theorized two object-based beliefs—functionality quality and content quality. These two object-based beliefs are theorized and measured as summative beliefs instead of multidimensional constructs (Wixom & Todd, 2005; Nelson et al., 2005), improving the possibility of generalizing the smart technological attributes described above. Such attributes are likely generalizable across various research contexts.

In sum, we expect smart technological attributes to impact individual perceptions in terms of the functionality quality, content quality, and service quality of an RHS system (i.e., object-based beliefs and attitudes in our study). Functionality quality refers to the quality of an IT artifact's technical performance, whereas content quality refers to the value of information gained from the IT artifact. These two object-based beliefs reflect the extent to which the functionality embedded in the RHS system and informational content conveyed by the RHS system helps drivers provide better service to passengers. Conforming Wixom and Todd's model, object-based beliefs and attitudes subsequently influence individual behavioral beliefs and attitudes. In our study, behavioral beliefs and attitudes include drivers' openness to RHS change, job satisfaction, and continuous usage intention (of an RHS system). We provide an overview of our research model in Figure 2. In the following, we discuss in detail how monitoring and control are related to functionality quality how advisory support and responsive support are related to content quality.

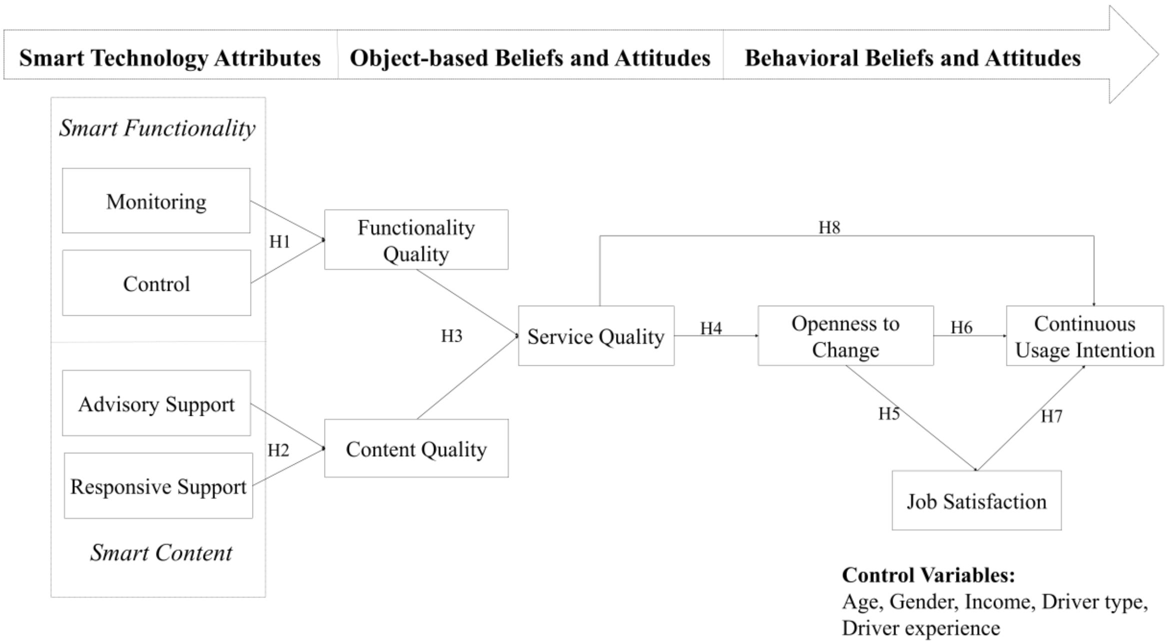

Figure 2. Research Model

3.1 Antecedent of Functionality Quality and Content Quality

We argue that the smart technological attributes of monitoring and control are the antecedents of an RHS system's functionality quality. As depicted in the preceding statements, monitoring is an effective functional attribute preventing users from violating the agreement and promoting responsible behaviors. Before the inundation of smart technology, the monitoring function has prevailed in supporting various application scenarios, such as customer service, employee feedback, security protection, and productivity enhancements (Pavlou, 2003; Holman et al., 2002). In the RHS system, the monitoring function affords the guarantee of safety for both passengers and drivers by continuously tracking ride routes, audio data, and visual information. The control function in this study is a situational enabler facilitating driver control of the ride through the RHS system. By effectively using the control function, drivers can gain more autonomy by, for example, choosing preferred service times or ride routes.

Collectively, the monitoring function can provide a protective mechanism for drivers during rides, whereas the control function grants drivers substantial autonomy in planning their daily routines. Despite the difference in the provision of functional support, monitoring and control attributes afford technical assistance for drivers to render better services. Functionality quality is contextually defined as the extent to which drivers believe that an RHS system's advanced functionality supports their RHS. Thus, providing the two smart technological attributes of monitoring and control can improve driver interactions with RHS systems, which would further strengthen their beliefs in the technical performance of the system. Therefore, we posit the positive roles of monitoring and control in perceived functionality quality.

H1: Monitoring and control attributes are positively related to the functionality quality of RHS systems.

Different from functionality quality, content quality, in our context, reflects the extent to which drivers believe the RHS system provides valuable information to support their ride tasks. Previous literature has suggested that the informational content of an IT system should satisfy two key conditions to demonstrate its quality. First, the information delivered by an IT system should be relevant to a user's task (DeLone & McLean, 1992). Second, such information should be objective and credible (Jarke & Vassiliou, 1999; Wang & Strong, 1996). We argued that advisory support and responsive support from RHS systems contribute to satisfying both conditions with the support of smart technology.

As explained above, advisory support and responsive support were respectively designed using push-based and pull-based mechanisms for informational support. These two smart technological attributes collectively interact with drivers by providing relevant content to support ride tasks. In particular, advisory support attempts to proactively deliver drivers' desired content, such as suggestions regarding high-demand regions, while responsive support responds to drivers' content requests (e.g., traffic information or regulatory policies) through feedback during rides. In addition, smart technology allows RHS systems to synchronize multisource information in real time. This synchronization not only contributes to strengthening the credibility of the information presented to drivers but also helps drivers complete ride tasks more effectively. For instance, traffic information can be collected from authoritative sources and can then be further analyzed and presented as real-time advice for drivers, helping drivers avoid traffic congestion so that they can arrive at their destinations on time. Relevant information can also be retrieved by using responsive support functions. Thus, we hypothesize:

H2: Advisory support and responsive support are positively related to the content quality of RHS systems.

Service quality, also known as perceived service quality, is theorized as the assessment of the overall excellence or superiority of the service (Zeithaml, 1988). In the context of IT-enabled service, service quality reflects an individual's assessment of the quality of interactions with IT artifacts, including the extent to which specific service needs are fulfilled (Cenfetelli, Benbasat, & Al-Natour, 2008). Prior studies have demonstrated that system quality and information quality influence the quality of IT-enabled services (Cenfetelli et al., 2008; Xu et al., 2013). This positive relationship is grounded in the theory of reasoned action (TRA; Ajzen, 1991). TRA posits that human beings form beliefs salient to a context of interest and that these beliefs, in turn, influence individual attitudes and behavior within such a context. Measurements of system quality and information quality represent belief (Rai et al., 2002), but service quality is an attitudinal construct (Tan, Benbasat, & Cenfetelli, 2013). Thus, as a number of studies have verified, system quality and information quality serve as antecedents to service quality in the context of IT-enabled services (Wixom & Todd, 2005; Tan, Benbasat, & Cenfetelli, 2013; Xu et al., 2013).

Beyond system quality and information quality, prior literature has developed or employed other constructs that precisely reflect individual beliefs about IT-artifact-specific characteristics, focusing particularly on the constructs of functionality quality and content quality (Johnston, 1995; Cenfetelli et al., 2008; Tan, Benbasat, & Cenfetelli, 2013). As a broad-level construct, it has been demonstrated that functionality quality improves the quality of IT-enabled services. For instance, Cenfetelli et al. (2008) argue that functionality quality "describes the features, methods, and/or means of providing supporting services, whereas service quality describes the evaluation characteristics of those features, methods, and/or means" (p. 166). In this regard, functionality quality reflects how well an IT artifact is leveraged to provide services that are discretionary, which improves users' perception of service quality. In a similar vein, Tan, Benbasat, and Cenfetelli (2013) conceptualized content quality (of e-government service) as positively associated with service quality. The general argument aligns with Wixom and Todd's model (2005) that object-based beliefs (i.e., functionality quality or content quality) consistently influence a user's attitudes toward a focal object (i.e., service quality).

Applying these conclusions into our context, functionality quality pertains to how well the RHS systems' functionality supports drivers in completing ride tasks, whereas content quality addresses the extent to which drivers can access informational content support to complete ride tasks. Service quality represents the extent to which RHS drivers perceive that their needs are fulfilled by using RHS systems. Specifically, drivers, as consumers of a service delivered by RHS systems, seek support from RHS systems to successfully complete ride tasks (on behalf of passengers). Collectively, a high level of functionality and content quality indicates that RHS drivers believe that the RHS system provides helpful information and offers a variety of useful functions, which enhances drivers' perceptions of the system's service quality. For example, drivers may rely on RHS systems to receive optimal assignments for ride requests from selected passengers and may also rely on updated information to avoid congested traffic. Such technological advancements help fulfill drivers' needs through the use of RHS systems. Consequently, drivers' beliefs in functionality quality and the content quality of RHS systems can strengthen their attitudes regarding the value delivered by the RHS systems. Thus, we hypothesize:

H3: The functionality quality and content quality of an RHS system are positively related to the service quality of an RHS system.

3.2 Role of Openness to Change in Ride-Hailing Services

Some examples of change include the introduction of new technology, the enactment of new regulations, and the implementation of new managerial practices such as mergers and acquisitions (Chawla & Kelloway, 2004; Choi & Ruona, 2011; Lehman et al., 2002). To understand how an individual responds to change, the theoretical concept of "openness to change" was developed to measure the extent to which an individual intends to embrace change or her or his anticipation of the potential merits of such change (Wanberg & Banas, 2000). In the RHS context, drivers' openness to change in an RHS demonstrates their positive outlook toward change in various aspects of the RHS business.

Openness to change is associated with different antecedents and has different consequences in different contexts (Oreg, 2003, 2006; Lines, Sullivan, & Wiezel, 2015). Given that the literature contextualizes changes mostly in terms of organizational settings, these findings may not be useful for interpreting changes in the RHS sector. Specifically, previous studies have presented organizational change as a one-off event (e.g., caused by the introduction of new systems or governance policies). However, change in the RHS sector represents back-and-forth dynamics related to regulations and negotiations between policy makers and RHS firms. Such intertwined activities suggest that change in RHS systems is continuously evolving. In addition, given the different nature of the work, the traditional employment relationship between the employer and employee cannot be applied to the relationship between drivers and RHS firms (Angrist et al., 2017). Thus, antecedents such as organizational culture, capability, and communication models may not affect drivers' attitudes about change (Chawla & Kelloway, 2004; Choi, 2011; Jones et al., 2005).

Given that the RHS system is the predominant medium with which drivers interact daily, drivers' attitudes toward change likely depend on how effectively they think the RHS system is in helping them adapt to changes. Since the service quality of an RHS system pertains to drivers' assessment of their interactions with it (Cenfetelli et al., 2008; Xu et al., 2013), we posit that higher-service-quality RHS systems serve as an antecedent to openness to RHS change.

Based on previous literature, we theoretically deduce the relationship between service quality and openness to RHS change using three aspects: affective, cognitive, and behavioral aspects (Oreg 2003). First, the provision of high levels of service quality reflects RHS firms' care for their drivers, which may potentially arouse positive feelings about the firm and promote openness to change in the RHS context. Second, high levels of service quality likely correlate with sufficient of informational content, creating the necessary support needed by drivers to conduct cognitive evaluations (i.e., rational assessments of changes and intrinsic motives for changes). Finally, high service quality can better guide drivers to adopt changes. For example, drivers receiving reminders from RHS systems about change details may develop more positive attitudes toward change. We thus hypothesize:

H4: The service quality of an RHS system is positively related to drivers' openness to change in the RHS context.

Openness to RHS change helps explain the success of change documented by prior studies (Choi 2011). In particular, individuals with a high degree of openness to change are more inclined to accept or adopt changes and are more likely to focus on the positive consequences of change (Chawla and Kelloway 2004; Jones et al. 2005; Devos et al. 2007). As stated previously, the contexts of change in prior studies are different from those explored in this work; while previous literature has focused on one-off events, we focus on evolving change in the current study. However, we expect the consequences of openness to change in the RHS context to be analogous. The previous literature has demonstrated that employees' openness to organizational change is negatively related to their turnover intentions and positively related to their job satisfaction (Oreg 2006). Given that drivers are not formal employees of RHS firms, it is not appropriate to use turnover intention to explain the consequences of change. If drivers cannot cope well with evolving change in the RHS sector, then they may complain about their jobs or even decide to discontinue working in the RHS sector. We thus contend that there are two consequences of openness to change in the RHS sector. The first consequence pertains to RHS drivers' attitudes about their existing jobs—i.e., their job satisfaction—and the other is related to their intention to continue using the RHS system—their intention of continuous usage. Thus, we hypothesize:

H5: Openness to RHS change is positively related to a driver's job satisfaction.

H6: Openness to RHS change is positively related to a driver's continuous usage intention of an RHS system.

Hellman (1997) demonstrated that increasing employee dissatisfaction leads to higher intentions of leaving a job. In a similar vein, job satisfaction underscores the extent to which individuals are content with their roles as RHS drivers (Seibert, Wang, & Courtright, 2011). Thus, if RHS drivers are dissatisfied with their jobs, then they are more likely to stop providing RHS. However, as previously discussed, RHS drivers are not employees of RHS firms but independent contractors partnering with the firms. Therefore, their turnover intentions can be manifested by their intent to continue using RHS systems. In contrast, their inactivity as RHS drivers may imply their termination of service. In addition, the literature on IS adoption and usage indicates that satisfaction is positively related to continuous usage intentions of an IT artifact (Guinea, Ortiz, & Markus, 2009; Hayashi et al., 2004). Thus, we hypothesize:

H7: Job satisfaction is positively related to drivers' continuous usage intention of an RHS system.

Service quality, a highly relevant construct, has been widely discussed and integrated into the application of Wixom and Todd's model in existing literature (Xu et al., 2013; Tan, Benbasat, & Cenfetelli, 2013). However, whether this construct reflects an object-based belief or an object-based attitude remains unclear. Xu et al. (2013) recognized service quality as an object-based belief in their 3Q model, whereas Tan, Benbasat, and Cenfetelli (2013) theorized the quality of electronic service as an object-based attitude. Tan, Benbasat, and Cenfetelli (2013, p. 81) further explained the difference between object-based beliefs and object-based attitudes, stating that "object-based beliefs reflect users' evaluation of the design attributes (or features) embodied within a technological innovation, whereas object-based attitudes mirror the value they attached to the technology given these properties (Wixom and Todd 2005)." We therefore contextually theorize service quality as an object-based attitude that depicts drivers' valuation of smart attributes accessed from RHS systems. Given that object-based attitudes impact behavioral attitudes and intentions, we expect service quality to influence drivers' continuous use intention in relation to RHS systems. As a form of postadoption behavior, in this context, continuous use describes drivers' behavioral patterns reflecting repeated acceptance of RHS systems. Collectively, we hypothesize that:

H8: Service quality is positively related to a driver's continuous usage intention of an RHS system.

4 Research Method

4.1 Data Collection

We conducted a field study to validate the proposed hypotheses. We recruited 25 research assistants to collect primary data from RHS drivers in major cities in China, including Beijing, Shanghai, Nanjing, among others. Each assistant was asked to approach at least 40 RHS drivers by randomly sending a ride request via mobile app and then inviting each responding driver to participate in our study. The general procedure included two primary steps. First, the assistant, acting as a normal passenger, started chatting with the driver according to our predefined guidelines. This action helped us understand drivers' general opinions about the RHS business. At the end of each conversion, the drivers were informed that the conversations had been recorded and asked whether they would consent to analysis of the recordings. All drivers consented. Second, after arriving at the destination, the research assistant presented a questionnaire containing the measurements of our focal constructs to the driver and invited him or her to complete it. Participating drivers were also given information about general privacy concerns, such as anonymity and confidentiality. Additionally, respondents were assured that there were no right or wrong answers for the questions and were asked to answer each question as honestly as possible. Demographic information and work experience were also collected. As an incentive, each participating driver was compensated with an amount equivalent to USD 5. The survey method is one of the most commonly used data collection approaches in studies of RHSs and other similar services (McKerlich, Ives, & McGreal, 2013; Murphy 2008). The data collected from our survey ensured sampling validity in terms of subject identity and response rate because of the nature of the field setting.

We adapted our established measurements from the literature and revised them to measure the studied constructs in the research model presented in Figure 1. The measurement scales are provided in the Appendix. All items were measured using a 7-point Likert scale, ranges from *1 = strongly disagree* to *7 = strongly agree*. All constructs were represented in this study.

To examine the content validity of our measurement, we sent the questionnaire to 10 IS researchers who were asked to comment and assess the questionnaire. Based on the researchers' comments and concerns regarding the wording of the measurement scales, we further improved the questionnaire. We also conducted a pilot survey using 26 RHS drivers to ensure the validity of the updated questionnaire. Since no critical issues were raised during the pilot study, we determined that the measurements used in our research were appropriate and that the questionnaire was effective.

4.2 Data Analysis

Among the 1,000 sampled drivers, 443 agreed to participate. Among these participants, 63 did not complete all survey items and were dropped in the following analysis. Thus, the total sample contained 380 RHS drivers. We evaluated nonresponse bias by comparing early and late respondents in terms of demographic characteristics and model variables. For demographic characteristics, *t*-test comparisons between means of each of the two groups showed no significant differences on the basis of age ($t = -0.84$, $p > 0.05$), gender ($t = 0.39$, $p > 0.05$), income ($t = 1.48$, $p > 0.05$), working hours per week ($t = 0.04$, $p > 0.05$), driver type ($t = 0.51$, $p > 0.05$), or driver experience ($t = 1.04$, $p > 0.05$). Further analysis also showed that the two groups of participants did not differ across any studied variables. Thus, we determined that nonresponse bias was not a threat in this study. We list participant demographics in Table 3. We included age and gender as control variables, as previous studies suggest that age and gender play an important role in user acceptance and usage of online technology (Venkatesh, 2000). The other four variables—income, working hours per week, driver type, and driver experience—were added as control variables because these variables may impact continuous usage intentions.

Table 3. Demographics

Demographics	**Count (%) (*n* = 380)**
Gender	Male, 352 (92.6%) Female, 28 (7.4%)
Age	Range 22-52 Mean 32.58, standard deviation 5.80 Median 32
Income per month	<1000 RMB, 39 (10.3%) 1000-3000 RMB, 112 (29.5%) 3000-5000 RMB, 121 (31.8%) >5000 RMB, 108 (28.4%)
Working hours per week	<8 hours, 51 (13.4%) 8-24 hours, 151 (39.7%) 24-40 hours, 86 (22.6%) 40-60 hours, 50 (13.2%) >60 hours, 42 (11.1%)
Driver type	Part-time, 201 (52.9%) Full-time, 179 (47.1%)
Driver experience	<6 months, 26 (6.8%) 6 months-1 year, 110 (28.9%) 1 year-3 years, 209 (55.0%) >3 years, 35 (9.3%)

As our data were collected through self-reported surveys, common method variance (CMV) could affect the validity of our findings. Therefore, we estimated CMV in our study by using three methods. First, we evaluated CMV using Harman's single-factor test. CMV is believed to exist when a single factor accounts for the majority of the covariance among variables (Podsakoff et al., 2003). We conducted factor analysis on all of our variables. Since the first unrotated factor accounted for less than 50% of the total variance, this indicates that common method variance is not likely to be a serious problem. Finally, our analysis yielded 11 distinct factors with eigenvalues of greater than 1, the largest of which only accounted for 11.5% of the variance. Hence, the majority of the variance was unexplained.

Second, we used a partial correlation method to examine CMV (Podsakoff et al., 2003). We added another factor—the factor with the highest loading from a principal component factor analysis—to predict the dependent variable (continuous usage intention). Our results indicate an explained variance of 0.451 and an original variance of 0.431. This finding shows that the new factor did not significantly increase the variance explained in continuous usage intention, thus suggesting the absence of CMV. Third, the correlations between studied constructs in Table 4 did not indicate any highly correlated factors. CMV may result in much higher correlations (r > 0.900). The highest correlation in our data was 0.70. Therefore, taken together, our three analyses indicate that our study does not suffer from CMV.

Because of the exploratory nature of our study, we used partial least square structural equation modeling (PLS-SEM) to analyze our data. PLS analysis was also used to test the research model. PLS can simultaneously assess the reliability and validity of the measurement model, as well as test the structural model. Table 4 lists the means, standard deviations, correlations, and other indicators of items of all the constructs. Following the two-stage analytical approach, we first examined the measurement model and then tested the structural model.

In PLS analysis, the measurement model evaluation includes testing for convergent validity and evaluating discriminant validity. We tested the convergent validity by using three indicators: the composite reliability of constructs, the average variance extracted (AVE), and item loadings. As shown in Table 4, the composite reliability of all constructs is greater than the recommended threshold of 0.7. Additionally, the AVEs of all constructs exceed the cutoff value of 0.5. We also examined the item loadings of each construct in the PLS analysis. All item loadings on the corresponding constructs are higher than the benchmark of 0.7. These tests reveal acceptable convergent validity. Discriminant validity indicates the extent to which the measurements of a construct are different from the other constructs. Following Fornell and Larcker (1981), we evaluated discriminant validity by adopting AVE to estimate the variance between a construct and its measures. In Table 4, we show that the square roots of the AVE values are almost all above 0.80, which is greater than all other cross-correlations. We further confirmed discriminant validity because the loadings for the items for their corresponding constructs are higher than the loadings for the other constructs in our analysis. Therefore, this result demonstrates satisfactory discriminant validity at the construct level. Given that all of the Cronbach's alpha scores are above 0.70, our measurements also meet the reliability criteria. The results indicate that our measurement model is appropriate.

Table 4. Correlations, Internal Consistency, and Discriminant Validity of Constructs

		Mean	SD	CA	CR	AVE	1	2	3	4	5	6	7	8	9	10
1	Monitoring	5.04	1.19	0.84	0.89	0.68	**0.82**									
2	Control	4.37	1.12	0.85	0.90	0.69	0.41	**0.83**								
3	Advisory Support	4.90	1.23	0.92	0.93	0.63	0.40	0.53	**0.79**							
4	Responsive Support	4.74	1.25	0.94	0.95	0.68	0.50	0.63	0.54	**0.82**						
5	Functionality Quality	4.26	1.18	0.90	0.94	0.83	0.43	0.70	0.50	0.68	**0.91**					
6	Content Quality	5.03	1.26	0.85	0.91	0.77	0.58	0.58	0.64	0.68	0.58	**0.88**				
7	Service Quality	4.77	1.35	0.86	0.92	0.78	0.45	0.51	0.56	0.64	0.57	0.70	**0.89**			
8	Openness to RHS Change	5.10	1.13	0.91	0.93	0.66	0.47	0.49	0.56	0.61	0.46	0.63	0.62	**0.81**		
9	Job Satisfaction	4.38	1.31	0.94	0.95	0.66	0.41	0.61	0.54	0.64	0.60	0.63	0.66	0.67	**0.81**	
10	Continuous Usage Intention	4.39	1.35	0.90	0.93	0.72	0.33	0.41	0.33	0.43	0.38	0.47	0.53	0.61	0.59	**0.85**

Note: The diagonal elements are the square roots of AVE. CA = Cronbach's Alpha, CR = Composite Reliability, and SD = Standard Deviation.

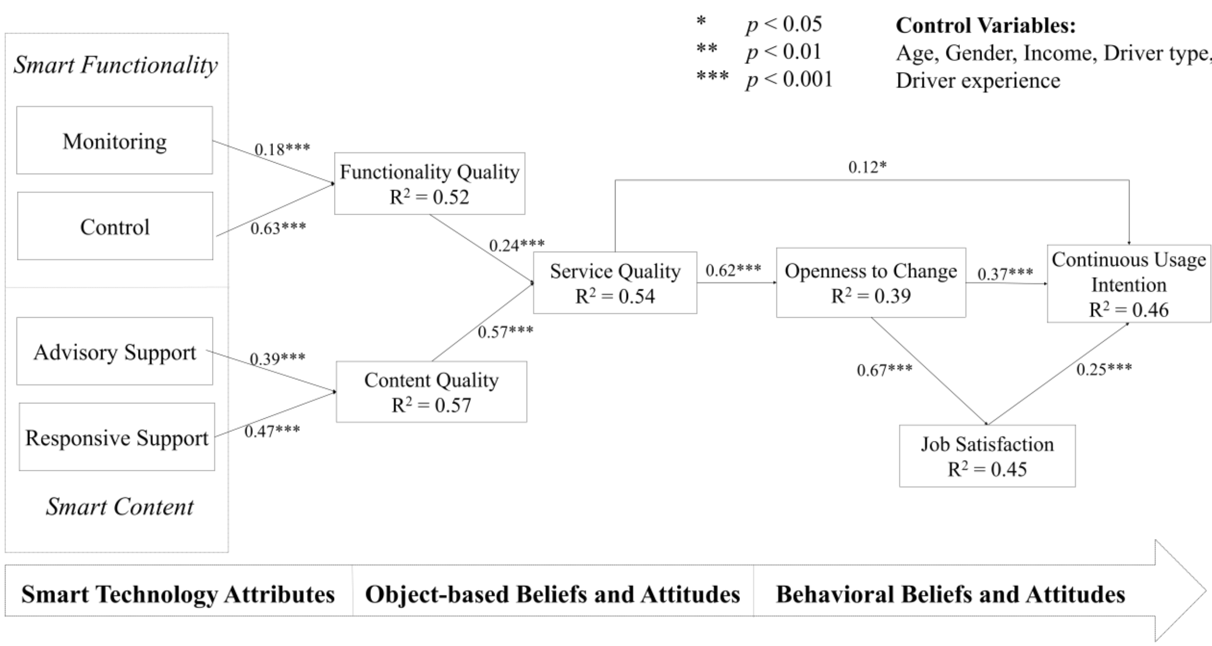

Figure 3. Results of Research Model

Next, we analyzed the structural model to test our proposed hypotheses. In Figure 3, we present the results from our PLS-SEM approach. The R^2 and path coefficients (significance) show how well our empirical analysis supports the hypothesized model in this approach. Regarding the four smart technological attributes, we concluded that the empirical evidence influenced both functionality quality and content quality. Specifically, monitoring ($\beta = 0.18$, $p < 0.001$) and control ($\beta = 0.63$, $p < 0.001$) had significant positive impacts on functionality quality, whereas advisory support ($\beta = 0.39$, $p < 0.001$) and responsive support ($\beta = 0.47$, $p < 0.001$) had significant positive impacts on content quality. The explained variances of functionality quality and content quality were as high as 0.52 and 0.57, respectively, supporting H1 and H2. Moreover, both functionality quality ($\beta = 0.24$, $p < 0.001$) and content quality ($\beta = 0.57$, $p < 0.001$) positively impacted service quality, explaining 54% of variance in the construct and largely supporting H3. Furthermore, service quality had a significant impact on openness to change in the RHS context ($\beta = 0.62$, $p < 0.001$) and explained 39% of variance in this construct, rendering support for H4. In addition, openness to RHS change significantly predicted both job satisfaction (β = 0.67, $p < 0.001$) and continuous usage intention (β = 0.37, $p < 0.001$), lending strong support to H5 and H6. Similarly, job satisfaction had a significant impact on continuous usage intention (β = 0.25, $p < 0.001$), supporting H7. Service quality had a significant positive influence on continuous usage intention (β = 0.12, $p < 0.05$), supporting H8. Overall, a significant extent of the variance of continuous usage intention was explained by openness to change in the RHS context and job satisfaction (46%).

We also tested the mediation effect of openness to change in the RHS context by using alternative models and by examining the strength of the relationships among service quality, openness to RHS change, and continuous usage intention. Job satisfaction was not included in our subsequent examination, as continuous usage intention satisfied our primary interest in the IS studies (Shaikh & Karjaluoto, 2015). Specifically, we created the first alternative model by excluding openness to RHS change to examine whether service quality significantly affects continuous usage intention in the absence of a mediator (i.e., openness to RHS change). This model resulted in a coefficient between service quality and continuous usage intention of 0.51 with $p < 0.001$. We created the second alternative model by removing the connection between service quality and continuous usage intention based on the original model. The estimated results indicated that service quality had a significant impact on openness to RHS change (β = 0.62, $p < 0.001$), which, in turn, significantly influenced continuous usage intention (β = 0.61, $p < 0.001$). The third alternative model linked service quality and openness to RHS change with continuous usage intention. The estimated results from this model indicated that service quality still had a significant impact on continuous usage intention (β = 0.22, p < 0.001) after controlling the relationship between openness to RHS change and continuous usage intention (β = 0.48, p < 0.001). These results indicated that the relationship between service quality and continuous usage intention significantly reduced path coefficients (β = 0.51 vs. β = 0.22) after we included openness to RHS change as the mediator, supporting partial mediation. The Sobel mediation test was also applied to assess the mediating role of openness to RHS change. The results showed that the total effect of service quality on continuous usage intention is 29.05%, mediated by openness to RHS change ($z = 4.52$, $p < 0.001$).

The original model was also reexamined with covariance-based structural equation modeling (CB-SEM) to mitigate the debate between CB-SEM and PLS-SEM in the literature. The results were highly consistent. The CFI, TLI, and RMSEA values were 0.92, 0.91, and 0.05, respectively, indicating a good fit of the proposed model of this study ($\chi 2 = 3120.15$, $df = 1773$, $p < 0.001$). Monitoring (β = 0.15, $p < 0.01$) and control (β = 0.85, $p < 0.001$) significantly influenced functionality quality, whereas advisory support (β = 0.54, $p < 0.001$) and responsive support (β = 0.50, $p < 0.001$) significantly affected content quality. Functionality quality (β = 0.16, $p < 0.01$) and content quality (β = 0.87, $p < 0.001$) significantly influenced service quality, which in turn, had a positive impact on openness to RHS change (β = 0.61, $p < 0.001$) but not on continuous usage intention (β = 0.07, $p > 0.05$). The impact of openness to RHS change on continuous usage intention (β = 0.58, $p < 0.001$) and job satisfaction (β = 0.94, $p < 0.001$) were significant. The positive relationship between job satisfaction and continuous usage intention was confirmed (β = 0.26, $p < 0.001$). Except for H8, all other hypotheses were confirmed. The rejection of H8 was caused by the fact that openness to RHS change served as the full mediator between itself and continuous usage intention in the CB-SEM analysis.

4.3 Follow-Up Investigation

Aside from the quantitative verifications discussed in the previous section, we examined our qualitative data as a follow-up investigation to further understand how smart technology helped drivers cope with a series of changes. In particular, we revisited our field interview logs to gain more in-depth understanding. As discussed in the Methods section, prior to asking drivers to complete our survey, our research assistants interviewed RHS drivers as passengers. The interviews lasted 12 minutes on average. The findings revealed several merits with respect to exemplary smart technology in RHS systems.

With respect to smart technological attributes, "monitoring" is recognized as an antecedent of functionality quality. For instance, one respondent driver commented:

> *Do you know [the RHS system] has a function called dispatch? We are guided to areas with high demands because they [the RHS systems] simultaneously monitor all drivers' real-time locations. I like this function because it helps me to get more orders [by avoiding the fierce competition].*

Such comments offered evidence that supported the positive relationship between monitoring and functionality quality.

The positive impact of control on functionality quality was also supported by the interviews. One RHS driver shared the following:

> *I am not a full-time RHS driver; I usually drive before and after my daily work. I can set the preferred route [between my residence and workplace] in the RHS*

system, which can avoid detours during my commute. This is super convenient. I have full autonomy to manage my ride tasks.

This excerpt shows that control is recognized as an essential function for certain drivers who benefit from control over more aspects of their work, which promotes higher perceptions of functionality quality.

Our theoretical deduction and empirical analysis found that two content support constructs—advisory support and responsive support—enable drivers to obtain richer information. Our interviews indicate that advisory support and responsive support are achieved with various functions embedded in the RHS software. According to two drivers, these functions help them achieve a competitive advantage in the market. One driver said:

I am not a local. I work as a full-time RHS driver because my friend tells me the salary of this work is good. Actually, it's my first time working in this city, but I have never made a wrong turn. I have no difficulty performing as a good RHS driver because the RHS system can give me all the necessary information in real-time. The supportive content includes real-time routine guidelines, urgent notifications, service process suggestions, and so on. These functions provide high-quality information for me.

Another driver gave clear examples of advisory support and responsive support in an interview:

The informational content may be pulled up by me or pushed by the [RHS] app. When I get an order, the route information is automatically pushed to me in the app. I do not need to spend more time searching for the best route by myself. When I have difficulties, the app gives me guidelines and resolves the conflicts.

The drivers also expressed negative attitudes and concerns regarding these smart attributes. For instance, one respondent complained:

The monitoring function should be improved by implementing a real-time adaption mode [by updating the information more accurately]. For example, the advisory support regarding a route [from the RHS app] is given according to the location where the passengers send the request. However, many passengers move around after sending their requests. The advisory support does not update accordingly in real time. Thus, sometimes, I cannot find them. They [RHS apps] should immediately improve this by providing more intelligent functions.

Another respondent offered similar suggestions:

Sometimes, the responsive information does not perform excellently. Sometimes, I cannot get timely support, though I can understand the [RHS apps'] need to process thousands of requests every minute. But I still think they should improve and develop more intelligent chatbots to provide better service.

Such findings echo prior studies that discuss several caveats for algorithmic management in RHS contexts.

Moreover, interviewed drivers also expressed their opinions about the recent (at that time) regulations/policies imposed by the government and RHS firms. Interestingly, most of the drivers were relatively optimistic about such back-and-forth changes. As one respondent stated:

The changes, such as new regulations from the government, are good news for me. It means that the RHS business is now legalized by the government. Such tight regulations and other changes will sustain the business and make it orderly. Additionally, the new regulations will kick out some unqualified RHS drivers. Qualified [hardworking] drivers, like me, support the changes and are more motivated to continue delivering good service in the future.

Another respondent expressed his confidence in the RHS system and believed that no significant influences existed on his rideshare business because "the RHS system was also updated and synchronized [according to the new rules]." Overall, few drivers expressed intentions to discontinue working as RHS drivers, although some of them expressed interest in "wait-and-see" strategies. Thus, RHS firms should take actions seeking to strengthen drivers' confidence accordingly.

Unexpectedly, several driver respondents pointed out that they did not even take such regulations seriously because they have gotten used to such campaign-like regulations in China. Thus, they believed that regulations or changes might not last permanently or be executed thoroughly in the future. As one respondent stated:

It [new regulations and other changes] is not a big deal. I've served as an RHS driver ever since Didi (a leading RHS firm in mainland China) initiated their business in this city. You know Didi and the government continuously change their RHS rules. At the beginning, Didi used the Red Pocket Policy

> *(a marketing campaign offering monetary incentives) to attract drivers to use the RHS system and participate in the RHS business. This policy lasted only a few months. According to my experience, most policies regarding the RHS business cannot be permanently well-implemented. Drivers can always find creative ways to avoid them. For instance, one new policy requires that RHS drivers are local residents (according to the Hukou system used in mainland China). If this new policy were rigorously followed, Didi might lose most of its RHS drivers. So, almost nothing happened after this new policy was announced.*

Although unexpected, this finding is rational and consistent with the discussion about the short- and long-term effectiveness of public policies and regulations in mainland China. Although we did not consider these factors in our research model, these findings outcomes offer potential directions for future studies.

5 Discussion

Our work contributes to the literature on smart technology and services as well as the literature on openness to change in the RHS context by exploring how smart technology in RHSs help drivers adapt to business changes in a turbulent environment. We identify and discuss four smart technological attributes in the RHS system (monitoring, control, advisory support, and responsive support). We also complement Wixom and Todd's model by discussing the influence of those attributes on functionality quality and content quality, which, in turn, affect the service quality of an RHS system, a typical smart service. Furthermore, we extend the literature on openness to change by positing that drivers' openness to change in the RHS context mediates the relationship between service quality and drivers' behaviors (i.e., between continuous usage intention of an RHS system and job satisfaction). Our empirical analysis of data collected from 380 RHS drivers provides sound evidence supporting our proposed theoretical model. The qualitative evidence also generates a deeper understanding of our theoretical deductions. In sum, our results, which illustrate the important role that smart technology plays with respect to RHSs, have important implications for both theory and practice.

5.1 Theoretical Contributions

This study offers several contributions to the literature. First, we establish a theoretical foundation to investigate the application of smart technology in the service sector. The existing research suggests that smart technology influences the business practices of RHSs (Möhlmann & Zalmanson, 2017; Lee et al., 2015). We contribute to the literature by further identifying the attributes of smart technology and exploring how these attributes affect smart service performance. For instance, we explicitly define and exemplify what these smart technological attributes are and how they have been applied in smart services. In particular, the smart technological attributes that we identified in this study may complement the technological attributes detected in the design of IT-enabled services in prior studies (Tan, Benbasat, & Cenfetelli, 2013; Xu et al., 2013). Individuals interested in integrating smart technology into the design of IT-enabled services may refer to our work to assess the adequacy of technological attributes in their service designs. Our findings can likewise provide inspiration for digital transformation research. Indeed, digital transformation as a strategic change inevitably encounters resistance from different stakeholders. Although previous studies have argued that smart technology can facilitate and advance digital transformation, the adoption of smart technology capable of restraining the potential negativity arising from digital transformation has not been sufficiently addressed (Majchrzak, Markus, & Wareham, 2012). Our findings in this study contribute to alleviating this gap in the research, especially in terms of the IT-enabled service sector. In particular, our exploratory findings indicate that people positively embrace change when assured of technological quality (i.e., functionality quality and content quality) and service quality.

Second, our study extends Wixom and Todd's model by incorporating smart technological attributes. The progression of information technology is not precisely reflected in the existing literature employing Wixom and Todd's model. In other words, few studies have been dedicated to revisiting the technological attributes in the original model irrespective of different contexts or application scenarios. In this study, we explore smart technological attributes and contextually remodel object-based beliefs and their antecedents. Specifically, monitoring and control have been inferred as primary attributes necessary for attaining smart functionality, and advisory support and responsive support are the essential attributes associated with acquiring "smart content." Based on these theoretical deductions, we further consolidated the research model by arguing that (1) providing monitoring and control strengthened the perceived quality of smart functionality, and (2) providing advisory support and responsive support enhanced the perceived quality of smart content. Additionally, our work presents sound evidence and theorization about the nature of service quality in the application of Wixom and Todd's model. Given the high relevance of the issue, it remains unresolved whether service quality should be classified as an object-based belief or object-based attitude (Xu et al., 2013; Tan, Benbasat, & Cenfetelli, 2013). We revisited the definition of object-based beliefs and attitudes and concluded that the classification of service quality should hinge upon the role of users' interactions with the IT artifact (Tan, Benbasat, & Cenfetelli, 2013). In particular, for researchers who survey IT-enabled service quality from the perspective of direct users of an IT artifact, (e.g., drivers in RHS systems), service quality should be considered to be a construct reflecting object-based attitudes. However, service quality could be regarded as an object-based belief when participants act as evaluators in lieu of real users. We thus extend the understanding of Wixom and Todd's model by integrating technological features from smart technology and resolving the debate about the construct nature of service quality regarding the application of this theoretical model.

Third, our findings contribute to the literature by applying the concept of openness to change in the RHS sector. Previous studies have viewed information technology as the source of organizational change (e.g., the introduction of an enterprise system or the implementation of a new computer program supporting certain tasks) (Devos et al., 2007; Jones et al., 2005; Kwahk & Kim, 2008). These findings, however, cannot be used to understand how individuals cope with change in a "new" type of organization such as an RHS company. Several prominent antecedents from prior research (e.g., trust in colleagues, organizational culture, and communication models) are rarely found in such new organizational types. This study attempts to fill this research gap by articulating how to manage gig economy labor to adapt to evolving change in turbulent environments with the support of smart technology. Furthermore, information technology or the IT artifact has been widely studied as a black box in the prior literature on change management. This approach is contradictory to the proposition in IS literature that suggests using a feature-centric approach to delaminate IT artifacts and study postadoption behaviors (Jasperson et al., 2005). Our work bridges this research gap by characterizing different smart technological attributes and discussing their impact on promoting individual attitudes about change in the RHS context.

Finally, our study contributes to the literature on RHSs. Previous studies have focused on studying RHSs' business strategies and their state-of-the-art algorithmic management practices from an RHS firm perspective (Van Alstyne et al., 2016; Hagiu & Wright, 2015; Lee et al., 2015; Möhlmann & Zalmanson, 2017). Given our minimal knowledge about how RHS drivers deal with business changes, our work clarifies this by examining how smart technology could be used to effectively prevent the turnover of RHS drivers, which can help sustain RHS businesses.

5.2 Practical Implications

This work presents significant implications for practitioners. First, our findings can guide RHS firms or other smart-service companies in the design and evaluation of smart-technology-enabled services. Practitioners should pay attention to whether the important attributes we discuss here (e.g., monitoring, control, advisory support, and responsive support) are included in their smart-technology-equipped services. Second, our findings suggest that the service quality of RHS systems play a critical role in the survival of service providers. To provide qualified service, service providers must adopt smart technology that affords smart functionality and top-quality smart content in order to effectively help individuals adapt well to changes or other fluctuating situations. Third, our findings confirm that RHS firms that encourage drivers' openness to change in the RHS context can reduce their drivers' intentions to leave because RHS firms that support drivers with high service quality help drivers cope with the various changes. Finally, policymakers who plan to regulate RHS firms or other firms with emerging business models should consult firms and understand the changes that such firms are encountering. Inappropriate regulations may limit the development of the sharing economy, as firms and their service suppliers may not be adequately prepared for regulatory changes.

5.3 Limitations and Future Research

This study has some limitations that create avenues for future research. First, our empirical investigations were contextualized in China, where the RHS market is dominated by Didi. However, RHS systems in other countries, such as Uber in the USA, Ola in India, or Grab in most southeastern Asian countries, may present differences. In addition, users with different cultural backgrounds or those who experience different types of changes could have dissimilar beliefs and attitudes about smart technology (Keil et al., 2000). Thus, future studies should further examine the impacts of the smart technological attributes identified in our study with respect to a more universal setting. In addition, including questions measuring personality traits is also encouraged because prior literature revealed that personality traits affect individual attitudes about change.

Second, although we used a mixed-methods (surveys and pilot interviews) approach to empirically validate our research model, more pluralistic methods should be considered in future studies. For instance, researchers could consider first quantifying the relationship between smart technological attributes, feedback on service, individual decisions through observational data, and commingling quantitative findings with qualitative evidence to further unveil the internal mechanisms behind behavioral patterns and economic consequences (Mingers, 2001). We also urge future researchers to employ other methodologies or datasets to empirically address the issue of causality.

Finally, given that our research model is an extensive application of Wixom and Todd's model in the RHS context, the original technological attributes are excluded in our empirics. However, whether the original IT attributes will still characterize individual attitudes and beliefs when they interact with new technologies must be further examined. Such methodology should seek to adequately address Wixom and Todd's (2005) proposal to "investigate whether there is a core set of system characteristics that apply broadly across a wide range of systems" (p. 100). Additionally, this study investigates continuous behavior from the functional perspective and does not cover behavior based on symbolic meaning and values derived from signaling and herding (e.g. Grover et al., 2018). Thus, our findings may not be applicable to the symbolic adoption of smart technologies that is also common in certain domains. We highlight this caveat in order to inspire future investigation of this topic.

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Appendix

Table A1. Measurement Items for Constructs

Construct	Item	Reference
Monitoring	M1: The RHS system monitors all activities in the service. M2: The RHS system ensures that all of the service's activities are conducted properly. M3: The frequency of RHS system monitoring is intense. M4: I cannot avoid being monitored by the RHS system while using the service.	Pavlou et al. (2002); Holman, Chissick, & Totterdell (2002)
Control	C1: With the support of the RHS system, I really had control over my work situation while improving the service. C2: With the support of the RHS system, I felt that I could control my work rate. C3: With the support of the RHS system, I felt that I could slow down when I needed to. C4: With the support of the RHS system, I could determine my work routine according to my needs.	Stanton & Barnes-Farrell (1996)
Advisory support	AS1: The RHS system automatically provides me with information. AS2: Some related information automatically pops up in the RHS system. AS3: The RHS system automatically makes announcements. AS4: When changes happen, the RHS system actively informs me. AS5: Real-time information is immediately delivered to me in the RHS system. AS6: The RHS system automatically warns me when something undesirable happens. AS7: The RHS system automatically adjusts the information delivered according to real-time situations. AS8: The RHS system automatically offers suggestions according to the context. AS9: The RHS system has a very high frequency of push notifications.	Self-developed
Responsive support	RS1: I can find a considerable amount of information about the transaction history via the RHS system. RS2: The RHS system provides a reliable mechanism of informational support to handle my requests. RS3: When I initiate a request, I obtain immediate response from the RHS system. RS4: I can find rich information via the RHS system. RS5: I can receive customer feedback via the RHS system. RS6: When I have difficulty, I receive responsive help from the RHS system. RS7: The RHS system supports me in obtaining various responses from stakeholders. RS8: The RHS system offers a very high frequency of response.	Self-developed
Functionality quality	FQ1: In terms of functionality quality, I would rate the RHS system highly for providing RHS. FQ2: Overall, the RHS system provides high-quality RHS. FQ3: Overall, I would give the quality of the RHS system a high rating for providing RHS.	Xu et al. (2013); Wixom & Todd, (2005)
Content quality	CQ1: Overall, I would give high marks for the content of the RHS system. CQ2: Overall, I would give high marks for the quality of the content provided by the RHS system. CQ3: In general, the RHS system provides me with high-quality information for providing RHS.	Xu et al. (2013); Wixom & Todd (2005)
Service quality	SQ1: Overall, I received a good level of service quality from the RHS system during the service process. SQ2: Overall, I received a high level of service quality from the RHS system during the service process. SQ3: Overall, I received an excellent level of service quality from the RHS system during the service process.	Xu et al. 2013

Openness to RHS change	OC1: I would consider myself open to change in the RHS context. OC2: I am looking forward to changes in the RHS. OC3: From my perspective, the proposed changes in the RHS will be for the better. OC4: I think the proposed changes in the RHS will have a positive effect. OC5: I support new ideas for the RHS provision. OC6: I intend to do whatever is possible to support changes in the RHS. OC7: I am inclined to try new features in the RHS.	Kwahk & Lee (2008); Jones, Jimmieson, & Griffiths (2005)
Job Satisfaction	JS1: As an RHS driver, my job is very interesting, relative to most occupations. JS2: As an RHS driver, I am satisfied with my work climate. JS3: As an RHS driver, I am satisfied with my professional activities. JS4: As an RHS driver, I am satisfied with my working conditions. JS5: As an RHS driver, I am satisfied with the understanding that I have with other people. JS6: As an RHS driver, I am satisfied with the responsibilities entrusted to me. JS7: As an RHS driver, I am satisfied with the understanding that I have with RHS corporations. JS8: As an RHS driver, I am satisfied with the important aspects of my job. JS9: As an RHS driver, I feel good about my job. JS10: As an RHS driver, I am generally satisfied with my job.	Morris & Venkatesh (2010); Closon, Leys, & Hellemans (2015)
Continuous usage intention	CU1: As a driver, I will use the RHS system continuously. CU2: As a driver, I have not considered any alternative RHS systems. CU3: As a driver, I tend to recommend the RHS system I use to other drivers. CU4: As a driver, using the RHS system is something I would like to do. CU5: I see myself continuing to use RHS systems for various reasons.	Park et al. (2010); Chen (2014)

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