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 post-adoption 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' post-adoption attitudes and behaviors, including openness toward changes in RHS, job satisfaction, and continuous usage intention. Our findings provide important theoretical and practical implications.

Keywords: *smart services, rider-hailing services, smart technology, post-adoption behaviors, openness toward changes in RHS, mixed data and method*

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 and Al-Nasrawi 2015). Given such characteristics, smart technology increasingly disrupts many business and service sectors. A representative of these technology disruptions is ride-hailing services (RHSs). A recent report from *Forbes* has indicated that RHSs accounted for 70.5% of the ground transportation market for business travelers on Q1 2018 but only 8% on Q1 2014 (Goldstein 2018). The exponential growth that RHS systems (e.g., Uber, Lyft, or Didi) experienced is attributed to smart technology or algorithmic management in some studies (e.g., Schildt 2017). Smart technology provides technological support for drivers during their riding tasks.

Although smart technology has helped RHS systems emerge, prior studies on RHSs only explored the role of smart technology with respect to either 1) multi-sided-platform strategy and dynamic pricing strategy or 2) algorithm-based internal governance (Van Alstyne et al. 2016; Hagiu and Wright 2015; Lee et al. 2015). Little is known about how smart technology is 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 policymakers 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 policymakers 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 due to their multi-sided-platform strategy; in short, the fewer drivers, the fewer passengers. Thus, 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 system (IS) post-adoption 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 an interaction with IT (Tan et al. 2013; Xu et al. 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 post-adoption behaviors during changes. Basing 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, the service quality helps RHS drivers adapt to a series of evolving changes, thereby increasing their continuous usage intention and 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 service (Tan et al. 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 after a series of newly imposed regulations on the RHS industry came into effect 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 the knowledge on 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 highlighted the role of interpersonal communication in enhancing individual attitudes toward changes (Chawla and Kelloway 2004). Our study complements the prior studies by suggesting that the provision of proper technology (e.g., smart technology in an RHS system) can effectively facilitate individual's openness to changes, even in the absence of personal communication during the changes. Finally, our work contributes to the RHS literature. Previous studies focused on either strategic perspective or internal governance of RHSs. Little attention is paid to how change is managed, although emerging smart services like RHSs constantly experience various changes. Our findings bridge this gap and explore how smart technology can be effectively deployed to alleviate the potential negativity from changes and, as a result, sustain RHS business operations.

We organize the remainder of our paper as follows. In the following section, we review the relevant literature. In the 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 the follow-up investigation. Finally, we conclude this paper by discussing the theoretical and managerial implications of our findings. We also point out the limitations and suggest future research directions.

2. Background and Literature Review

2.1 Ride-hailing Services

The rudiments of RHSs can be found in Los Angeles and Seattle in the later 1990s (Golob and Giuliano 1996). Prior studies investigated the impact of RHSs at the 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 et al. (1998) surveyed a large number of commuters in Orange County, California, and they found that solo drivers were willing to stop solo driving (i.e., provide RHS) with the provision of incentives. Furthermore, RHSs contributed to improved environmental friendliness, such as reductions in emissions and fuel consumption (Fellows and Pitfield 2000; Jacobson and King 2009).

Different from limousine or taxi dispatch systems 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. They 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 the driving fares and routes. Given such de facto merits, previous studies investigated the strategy of current RHS businesses and 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 focused on the managerial perspectives of RHSs. Lee et al. (2015) ascertained that algorithmic management served as a core innovation facilitating the operation of RHSs because drivers 1) were automatically assigned riding tasks by algorithms, 2) received evaluations by algorithms, and 3) communicated minimally with RHS firm representatives. Lee et al. (2015) revealed that although drivers acknowledged the benefits of algorithmic management, they raised several concerns about management practices, such as perceived unfairness and distrust in the performance evaluations that they received from 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, government, and organizations have set up rules and regulations to govern ride-hailing companies throughout the world (Posen 2015). Such regulatory changes impose additional costs for RHS firms and their drivers to comply. For instance, RHS firms need to redesign or re-implement a certain function 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 from RHS firms/systems and the regulations, which may eventually result in the turnover of drivers and damage to RHS businesses (Posen 2015; Weiner 2015). However, substantially less empirical work investigated how independent contractors, such as RHS drivers, responded to and coped with change, although millions of people has been working full-time in the gig economy. To address this gap in the literature, 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 willingness to leave.

2.2 Attitudes Toward Changes and Post-Adoption Behaviors

Turbulence prevails in many business environments, which urges organizations to make responsive changes and take actions accordingly (Hannan and Freeman 1984). To investigate this phenomenon, prior researchers on change management focused on the concept of individual attitude toward changes and suggested that the extent to which organizations successfully took responsive actions to cope with environmental uncertainty hinged upon their employees' attitudes toward these responsive changes (Choi 2011). A recent review article has discussed four types of attitudes toward change, namely, readiness for change, commitment to change, cynicism about organizational 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 organizational change" were developed from 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 and Banas 2000). The 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). Considering the lack of organization-specific attributes in the 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 changes" 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 toward Changes in

RHS" 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 riding 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 the Attitudes toward Changes				
Articles	Change Context	Antecedents	Attitudes toward the Changes	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 changes • 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 and Kelloway (2004)	• Merger	• Communication • Participation in the process	Openness to changes	Turnover intention
Jones et al. (2005)	• Implementation of a new end-user computing system	• Perceived organizational culture • Perceived reshaping capability	Readiness to changes	• 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 et al. (2007)	• Implementation of software	• Trust in supervisors • Trust in executive management • Participation in the process	Openness to changes	N/A
Kwahk and Kim (2008)	• Introduction of enterprise system	• Perceived personal competence • Organizational commitment (prior to change)	Readiness for change	Usage intention
Choi and Ruona (2011)	• General change in the organizational level	• Perceived change process • Perceived change context	Readiness for change	N/A

The concept of openness, which originated in the psychological literature, is considered an individual attitude that captures an individual's ability to be cognitively and behaviorally flexible in dealing with new situations (McCartt and Rohrbaugh 1995). Previous studies investigated several antecedents of individual openness to change, including personality traits and contextual factors. Personality traits, such as personal resilience, change self-efficacy, and need for achievement, significantly influence individual openness to changes (Lehman et al. 2002; Miller et al. 1994; Wanberg and Banas 2000). Although these findings offer considerable theoretical contributions, applying them remains challenging for practitioners in shaping individual attitudes to adapt to changes (i.e., individual personality is hardly alterable within a short period). Different from these personality attributes, contextual factors are argued to afford more practical value to facilitate individual openness to changes (Jones et al. 2005). For example, the provision of sufficient information and organizational functions during a change can encourage individuals to embrace such a change (Choi 2011; Wanberg and 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). To this end, we infer that the support from organizations for organizational changes is the precursor to individual attitudes toward such changes.

In addition to the antecedents of "openness to changes," prior studies discussed the possible consequences resulting from individuals' different attitudes (toward the changes). Individual attitude toward a change shapes subsequent behaviors (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 intention (Jones et al. 2005; Kwahk and Kim 2008; Oreg 2006; Chawla and Kelloway 2004; Wanberg and Banas 2000). In this regard, managing employees to adapt to changes affords significant value for organizations.

However, whether the tactics in change management 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 et al. 2017). Management theories and practices developed from traditional organizations may not be applicable to explaining the dynamics or business logics in 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 that offers communication and support to the drivers. To this end, whether an RHS driver can embrace the changes does not depend solely on the identified contextual factors but more on the technological support from the RHS system. A driver’s openness to changes hinges upon the extent to which their perceived quality of IT-enabled service (from the RHS system) supports the changes, which consequently influences their behavioral beliefs and attitudes, namely, job satisfaction and continuous usage intention. This aligns with the general contention about IS post-adoption behaviors, that is, whether technological features are believed to affect individual post-adoption behaviors, such as continuous usage intention (Jasperson et al. 2005).

Previous IS literature argues that post-adoption behaviors (e.g., continuous IT use with the change) should be viewed as a process of forming habituation (Jasperson et al. 2005; Park et al. 2010; Chen 2014). In such a process, individuals 1) alter their habitual behaviors, 2) experience learning of new technology, and 3) eventually form novel habitual behaviors. A feature-centric view of technology is proposed and encouraged to study this process (Jasperson et al. 2005). Specifically, 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 post-adoption behaviors (Jasperson et al. 2005). To this end, we adopt the feature-centric approach in this study to delineate different smart technological attributes from the RHS systems and discuss their impacts on drivers' post-adoption 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

Leading from the feature-centric approach, we used a top-down approach to unfold smart technological attributes. Smart technology, as a derivative of digital technology, ought to conform to a similar taxonomy/framework depicting the digital technology (Püschel et al. 2016). A recent article has conceptualized digital technology as a layered modular architecture (Yoo et al. 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 upon the service layer and content layer 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. With the equipment of smart technology, users can access advanced functions and consume their desired information effectively during 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 twofold 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 and Wilson 2017; Loock et al. 2013). Smart health care toolkits synchronize and analyze the data from multiple sources (i.e., smart functionality) and provide advice (i.e., smart content) for attending physicians to improve the quality of treatment (Sun and Medaglia 2018). To explicitly demonstrate how smart technology advances RHS systems, we compare the process in traditional cab booking systems with that in RHS systems in Figures 1a and 1b. This comparison can help us contextually detail the smart technological features in the RHS system.

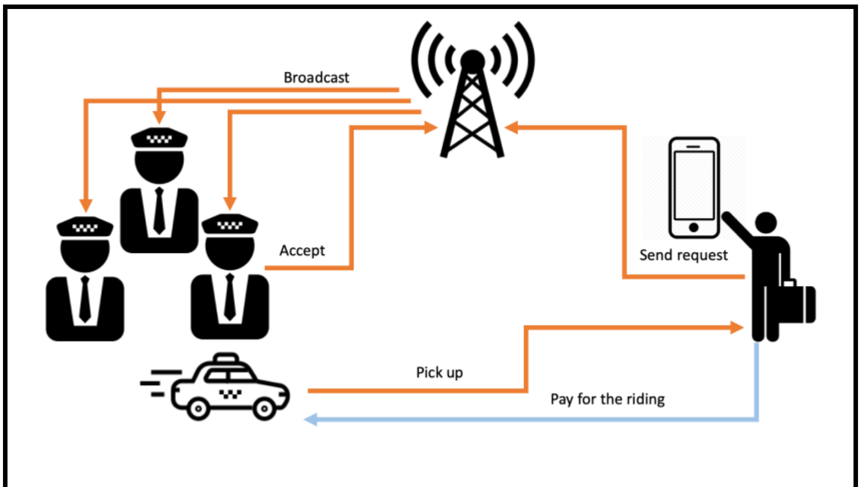

Figure 1a. Traditional Cab Booking System

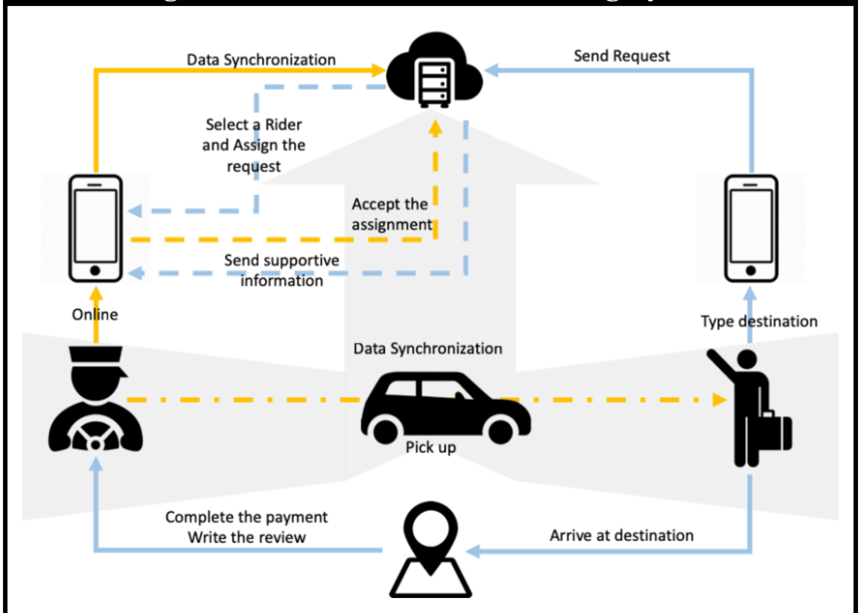

Figure 1b. RHS System

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 upon 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) 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 distributes passengers' requests to the drivers who are identified as the best candidates by algorithms. Figure 1b presents this overall process, including relevant functionality and information exchange.

Figure 1b describes the general workflow of the RHS system with four procedures. First, as soon as the driver makes her/himself available to receive riding requests online, an RHS system starts monitoring her/his activities and synchronizes relevant data (e.g., geo-locational information or driving speed) to the central server. Second, when the driver receives an assigned real-time request by the RHS system, he/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 starts the riding trip, the RHS system starts the meter. Meanwhile, the RHS system monitors the driver's and passenger's geo-locational information and constantly provides advisory information (e.g., optimal routes or justifications for riding fares). Finally, at the end of a trip, the driver can receive payment along with 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. In light of this 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 the smart functionality, and the last two manifest the smart content, which we discuss in further detail below (Lee et al. 2015).

2.3.1 Smart Functionality

As depicted previously, monitoring and control serve as essential attributes to attain smart functionality (Porter and Heppelmann 2014). They are also important components for optimizing the information market between the drivers and the passengers to enhance the matching function, which results in the breakthrough of RHS (Cramer and Krueger 2016). Monitoring enables reporting of the condition and environment, which helps to generate insights of performance and technology use, while control gives users unprecedented ability to customize the usage activities. The monitoring function is able to elaborately collect multimodal data continuously, track users' behavior throughout the working routines, predict future scenarios, and seek to produce pleasant consequences for users. Providing this function can facilitate individuals to follow the 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 continuously varying environments (Porter and Heppelmann 2014), which also contributes to building up individual belief in autonomy when interacting with the system (Möhlmann and Zalmanson 2017). For instance, smart technology was employed in designing a home energy management system to attain the monitoring and controlling functions, which conduced effective attainment of the goal of energy saving (Al-Ali et al. 2017). We provide a detailed explanation of these two aspects of smart functionality in the RHS context below.

Monitoring function, in the RHS context, is supported by the smart technological attributes and affords the assurance that the ride is being performed under a specific and predetermined set of rules. As depicted previously, to better match the 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 riding tasks through the GPS function. In addition to the real-time location, the monitoring feature collects relevant data regarding the driving speed, acceleration, and miscellaneous data from their driving activities. In short, the whole route of the riding 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 served 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 of both sides. Moreover, the monitoring feature helps optimize the dynamic pricing model in the RHS system in terms of continuously supplying the 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.

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 et al. 2016). Both aspects can be found in the RHS system with the support of smart technology. From the human-centric perspective, the RHS drivers have more flexibility to control their work routines in using RHS systems. RHS drivers have freedom to decide when, where, and how long to provide the riding services. For example, drivers can set destinations to receive riding requests that align with their preset destination, i.e. avoiding those requests departing for opposite directions. This controlling function is a useful function for drivers to cope with the "last riding requests" at the end of a driver's day. From the 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 governance principles, even ones that constantly evolve. For instance, RHS systems control riding fares dynamically with each riding request, and this function saves considerable communication costs between drivers and passengers. To an extent, the technological control enables drivers to make precise predictions and then have control over their work. To this end, we can infer that smart technology (used in RHS systems) functionally attains the autonomy of control and the technological control framework, which both help to build up drivers' beliefs in the functionality quality of RHS systems.

2.3.2 Smart Content

We refer to the previous literature and theorize that advisory support and responsive support are the essential attributes of attaining "smart content" (Nissen and 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 their desired information, the information retrieval agent employs a pull-based model to respond to the information demand. Different from 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 1) **advisory support** as the extent to which an information system is able to proactively push desired content for users in the course of performing the tasks and 2) **responsive support** as the extent to which an information system can gratify an individual with the content he/she requests (Rainer and Carr 1992), whose applications in the RHS context are elaborated below.

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 riding demand and proactively mobilize drivers to arrive by conjointly analyzing the spatial data and riding 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 cannot be properly achieved without the support of smart technology like 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 drivers improve their quality of service. In addition, drivers can proactively interact with the RHS system to optimize their riding routes and avoid traffic congestion. To this end, 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 the smart technological attributes with examples.

Table 2. Summary of Smart Technological Attributes

Attributes	Definition	Examples in RHS Context
Monitoring	Monitoring is a function that continuously and automatically collects information about users' activities, external environment, or other relevant actions.	Recording function that continuously records the voices in an entire transaction, which aims to improve safety during journeys.
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 (like 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 notify 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 she/he requests.	Request function that is a link to RHS system support for transactions or other problems.

3. Hypothesis Development

As depicted previously, the changes in regulations or the business environment in the RHS sector may impact drivers' intentions to continue pursuing this business/job. By referring to the findings from the literature on change management and IS post-adaptive behavior, we argued that the RHS system, as the primary medium that drivers interact with, served an important role in determining individual adaption to changes (Kwahk and Kim 2008; Jasperson et al. 2005). How drivers can adapt to these changes hinges on how effectively RHS systems support their adaptation. To this end, the smart technological attributes of RHS systems actually characterize drivers' attitudes toward changes. To understand how technological attributes from an IT artifact influence individual attitudes and behaviors, we anchored the theoretical paradigm proposed by Wixom and Todd (2005) to develop our research model.

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 the overall beliefs and attitudes into object-based and behavioral beliefs and attitudes in assessing the quality of IT artifacts and estimating the acceptance by intended users (Wixom and 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 toward the system and their subsequent behaviors. Given the relatively flexible specification of technological attributes and the generalizability of the conceptual logics, 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 et al. 2013) and e-commerce (Wang and Benbasat 2016; Xu et al. 2013).

Despite the well-established paradigm, the application of Wixom and Todd's model can still be improved, especially in this age when smart technology inundates the IT-enabled service market (Kleinschmidt et al. 2016). The original Wixom and Todd's model only included the 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 et al. 2005; Wixom and Todd 2005). Although such 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 technological attributes which have substantially evolved recently. In particular, for smart technology, despite its prevalence in various sectors of IT-enabled service, the relevant attributes manifesting smart technology are still missing 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 in this work.

After extensively reviewing prior literature, we found the technological attributes depicting both system quality and information quality could be molded to align with the research context. For instance, Tan et al. (2013) revised the original model and replaced the original attributes with new ones in the e-government service context, such as needing function, service acquisition functions, service ownership functions, and efficient IT-mediated service delivery. Vance et al. (2008) depicted system quality of a mobile commerce portal by using only two self-developed technological attributes, i.e. navigational structure and visual appeal. Sedera and Gabel (2004) contextualized the system quality and information quality in the enterprise system used by government and accordingly created three technological attributes, i.e. "user requirement," "system features," and "customization," for system quality and “availability” for information quality. Likewise, we developed four attributes (i.e. monitoring, control, advisory support, and responsive support) depicting the smart technology used in RHS systems and integrated them into the original paradigm in Wixom and Todd’s model to develop 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 and Todd 2005; Nelson et al. 2005), improving the possibility of generalizing the preceding smart technological attributes. Such attributes ought to persist across various research contexts.

In sum, smart technological attributes should impact individual perceptions with respect to 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 that 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 help drivers provide better service to their passengers. Conforming to Wixom and Todd’s model, the object-based beliefs and attitudes subsequently influence individual behavioral beliefs and attitudes. In our study, behavioral beliefs and attitudes include drivers’ openness toward changes in RHS, job satisfaction, and continuous usage intention (of an RHS system). We provide an overview of our research model in Figure 2 below. In the following, we discuss in detail how 1) monitoring and control are related to functionality quality and 2) how advisory support and responsive support are related to content quality.

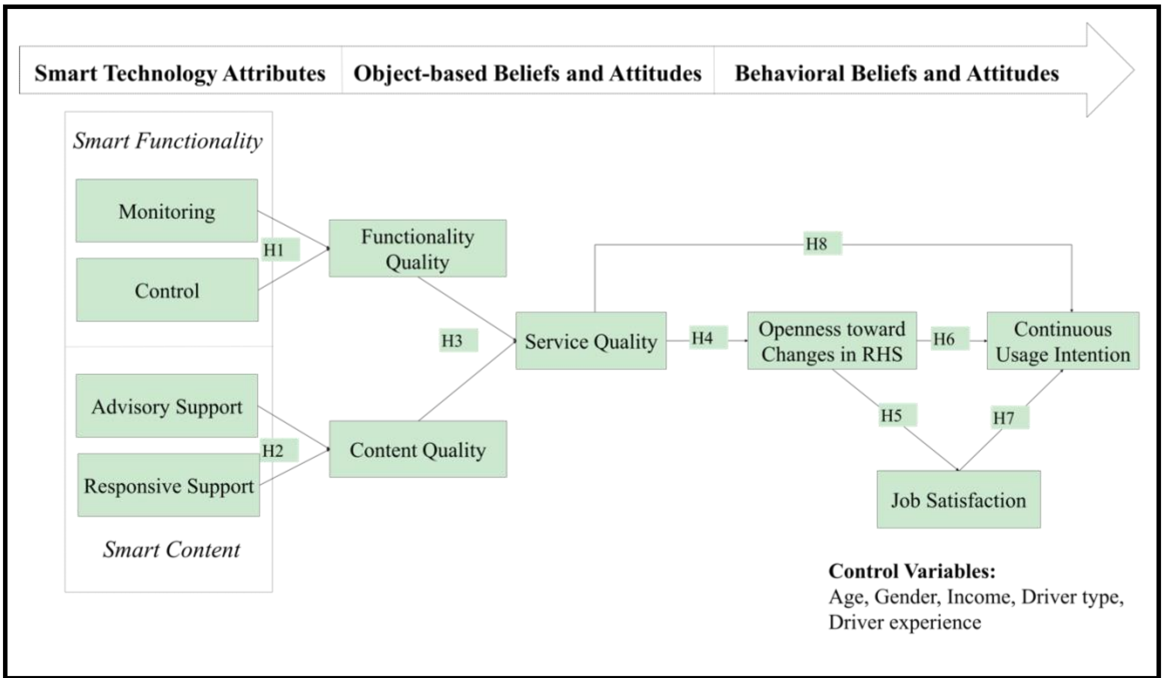

Figure 2. Research Model

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, 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 the riding route, audio data, and visual information. The control function in this study is a situational enabler from which drivers are more liable to control their riding tasks by operating the RHS system. By effectively using the control function, drivers can gain more autonomy in their service provision, such as choosing their preferred service times or riding routes.

Collectively, the monitoring function can provide a protective mechanism for drivers during their 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 how drivers perceive the RHS systems affording of advanced functionality to assure the RHS business. Thus, the provision of the two smart technological attributes of monitoring and control can make drivers better interact with the RHS systems in their service, which further strengthens their beliefs in the technical performance of the system. Therefore, we posit the positive roles of monitoring and control in constructing the perceived functionality quality.

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

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

As we explained previously, advisory support and responsive support were designed by push-based and pull-based mechanisms, respectively, for informational support. These two smart technological attributes collectively interact with drivers by providing relevant content to support their riding 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 their rides. In addition, smart technology makes the RHS system synchronize multisource information in real time. This synchronization not only contributes to strengthening the credibility of the information presented to drivers but also helps them better complete their riding tasks. For instance, traffic information can be promptly collected from authoritative sources, which can be further analyzed and produced as real-time advice for drivers. This notion can help drivers avoid traffic congestion to arrive at their destinations. Relevant information may also be retrieved via the functions of responsive support. Thus, we hypothesized the following:

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

Service quality, also known as perceived service quality, is theorized as 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 an interaction with IT artifacts, including the extent to which specific service needs are fulfilled (Cenfetelli et al. 2008). Prior studies demonstrated that system quality and information quality influence the quality of IT-enabled service (Cenfetelli et al. 2008; Xu et al. 2013). Such a positive relationship is grounded in the theory of reasoned action, i.e. TRA, (Ajzen 1991). TRA posits that human beings form beliefs salient to a context of interest, and these beliefs, in turn, influence individual attitude and behavior within such a context. The measurement of system quality and information quality represents belief (Rai et al. 2002), but the service quality is the attitudinal construct (Tan et al. 2013). Thus, the system quality and information quality ought to be the antecedents to service quality in the context of IT-enabled service, which has been verified by a number of studies as well (Wixom and Todd 2005; Tan et al. 2013; Xu et al. 2013).

Besides system quality and information quality, prior literature developed or employed other constructs to precisely reflect individual belief toward IT-artifact-specific characteristics. Among these constructs, functionality quality and content quality were the most discussed (Johnston 1995; Cenfetelli et al. 2008; Tan et al. 2013). As a broad-level construct, functionality quality was demonstrated to improve the quality of IT-enabled service. For instance, Cenfetelli et al. (2008) argued 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 et al. (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 can support drivers to complete the riding tasks, whereas content quality deals with how well drivers can gain the support of informational content in the course of their riding tasks. Service quality represents the extent to which RHS drivers perceive their needs as being fulfilled by using the RHS systems. Specifically, drivers, as consumers of a service delivered by RHS systems, seek support from the RHS system to successfully complete their riding tasks (for passengers). Collectively, a high level of functionality and content quality indicates that RHS drivers perceive the RHS systems as providers of many helpful functions and information, which enhances the drivers' perceptions on the system's service quality. For example, drivers rely on 1) RHS systems to receive optimal assignments for riding requests from selected passengers and 2) updated information to help themselves avoid congested traffic. These technological advancements help to fulfill drivers' needs through RHS systems. Consequently, drivers' beliefs in functionality quality and content quality of RHS systems can strengthen their attitudes toward the value delivered by the RHS systems. Thus, we hypothesize:

H3: 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 Toward Changes in Ride-Hailing Service

The concept of change was originally developed by Lewin (1947) as a relative state of constancy in the social equilibria, including the introduction of new technology, the enactment of new regulation, or the implementation of new managerial practices like mergers and acquisitions (Chawla and Kelloway 2004; Choi and Ruona 2011; Lehman et al. 2002). To understand how individual responds to change, the theoretical concept "openness to changes" was developed to measure the extent to which individual intends to embrace changes or her/his anticipation of the potential merits of such change (Wanberg and Banas 2000). In the context of RHS service, drivers' openness toward changes in RHS demonstrates their positive reaction to the changes in many aspects of the RHS business.

Openness to changes is associated with different antecedents and has different consequences in different contexts (Oreg 2003, 2006; Lines et al. 2015). Given that the literature contextualizes changes mostly in organizational settings, these findings may not be useful for interpreting changes in the RHS sector. Specifically, organizational change was viewed as a one-off event (e.g., introduction of new systems or governance policies) in previous studies. However, changes in the RHS sector reflect back-and-forth dynamics in regulations and responses between policymakers and RHS firms. These intertwined activities suggest that changes in RHS systems are continuously evolving. In addition, given the different nature of the work, the traditional employment relationship of the employer and employee is inapplicable to the relationship between drivers and RHS firms (Angrist et al. 2017). Thus, antecedents such as organizational culture and capability or communication models may not help alter drivers' attitudes toward the changes (Chawla and Kelloway 2004; Choi 2011; Jones et al. 2005).

Given that an RHS system is the predominant medium with which drivers interact daily, drivers' attitudes toward the changes ought to depend on how effectively they perceive that the RHS service helps them adapt to such changes. Since the service quality of an RHS system pertains to drivers' assessment of interactions with it (Cenfetelli et al. 2008; Xu et al. 2013), we posit that higher service quality of an RHS system serves as a contextual antecedent of openness toward changes in RHS.

From previous literature, we theoretically deduce the relationship between service quality and openness toward changes in RHS using three aspects: affective, cognitive, and behavioral aspects (Oreg 2003). First, the provision of high service quality reflects RHS firms' care for drivers, which can arouse affection and promote openness toward changes in RHS. Second, high service quality assures the sufficiency of informational content, creating substantial support for drivers to conduct cognitive evaluations (i.e., rational assessments of changes and intrinsic motives of changes). Finally, high service quality can better guide drivers to adopt such changes. For example, drivers can receive reminders from RHS systems about the details of the changes. Thus, high service quality can trigger positive attitudes toward the changes. To this end, we hypothesize:

H4: The service quality of an RHS system is positively related to drivers' openness toward changes in RHS.

Openness toward changes in RHS helps explain the success of change in prior studies (Choi 2011). In particular, individuals with a high degree of openness to changes are more inclined to accept or adopt changes, underscoring their positive consequences (Chawla and Kelloway 2004; Jones et al. 2005; Devos et al. 2007). As stated previously, the contexts of changes in prior studies are different from those explored in this work; that is, one-off events in prior literature versus evolving ones in the current study. However, the consequences of openness toward changes in RHS should be analogous. In the literature, employees' openness to organizational changes is negatively related to their turnover intention 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 the changes. If drivers cannot cope well with evolving changes in the RHS sector, then they may complain about their jobs or even decide to stop serving by discontinuing the use of RHS systems. To this end, we contend that there are two consequences of openness toward changes in RHS. The first consequence pertains to RHS drivers' attitudes toward their existing jobs—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 toward changes in RHS is positively related to a driver's job satisfaction.

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

Hellman (1997) demonstrated that increasing employee dissatisfaction leads to a higher chance of intent to leave a job. In a similar vein, job satisfaction underscores the extent to which individuals are content with their roles as RHS drivers (Seibert et al. 2011). Thus, if RHS drivers are dissatisfied with their jobs, then they are more likely to stop providing the service. However, as previously discussed, RHS drivers are not employees of RHS firms but independent contractors partnering with the firms. Therefore, their turnover intention can be manifested by their intent to continue using RHS systems. On the contrary, their inactivity in RHS systems as drivers can imply their termination of service. In addition, the literature on IS adoption and usage indicates that satisfaction is positively related with continuous usage intention of an IT artifact (Guinea et al. 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 et al. 2013). However, whether this construct reflects an object-based belief or an object-based attitude remains under debate. Xu et al. (2013) recognized service quality as an object-based belief in their 3Q model, whereas Tan et al. (2013) theorized the quality of electronic service as an object-based attitude. Tan et al. (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).” By referring to this statement, we 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, service quality ought to influence drivers' intention of continuous use of RHS systems. As a form of post-adoption behavior, continuous use describes drivers' behavioral patterns of 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, and other metropolises. Each assistant was asked to approach at least 40 RHS drivers. To do so, each of them randomly sent a request for a ride via his or her mobile app and then invited 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 toward the RHS business; the conversations were recorded. At the end of the conversion, the drivers were informed about the recordings and none of them were against analyzing the recordings. Second, after arriving at the destination, the assistant presented a questionnaire containing the measurement of our focal constructs to the driver and invited him or her to complete it. General privacy concerns, such as anonymity and confidentiality, were also explained to participating drivers. 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 in this process. As an incentive, each participating driver was awarded 5 USD. The survey method is one of the most commonly used data collection approaches in the studies of RHSs and other similar services (McKerlich et al. 2013; Murphy 2008). The data collected from our survey ensured the sampling validity in terms of subject identity and response rate due to 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, which ranges from "1 = strongly disagree" to "7 = strongly agree." All constructs were represented in this study.

To examine the content validity of our measurement, the questionnaire was first sent to 10 researchers in the domain of information systems. Researchers were asked to comment and assess the questionnaire. Based on the researchers' comments and concerns regarding the expression or wording of measurement scales, we further improved the questionnaire. We also conducted a pilot survey with 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 measurement in our research was appropriate and that the questionnaire was effective.

4.2 Data Analysis

Table 2. 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%)

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 the 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 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 ($t = 0.51$, $p > 0.05$), and 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, and thus nonresponse bias was not a threat in this study. We listed participant demographics in Table 2. 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 intention.

As our data was 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 our variables. If the first unrotated factor accounted for less than 50% of the total variance, then the common method variance was not likely to be a serious problem. Finally, our analysis yielded 11 distinct factors with eigenvalues 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 indicated that the explained variance was 0.451, and the original variance was 0.431. This finding showed 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 3 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, all three analyses showed that our study did not suffer from CMV.

Due to the exploratory nature of our study, we used partial least square structural equation modeling (PLS-SEM) to analyze our data. PLS analysis was 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 3 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, 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 3, the composite reliability of all constructs was greater than the recommended threshold of 0.7. Additionally, the AVEs of all constructs exceeded 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 were higher than the benchmark of 0.7; all of these examinations show that convergent validity was deemed to be acceptable. Discriminant validity indicates the extent to which the measurements of a construct were 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 3, we showed that the square roots of the AVE values were all above 0.80, which was greater than all other cross-correlations. We further confirmed discriminant validity because the loadings for the items for their corresponding constructs were higher than the loadings for the other constructs in our analysis. Therefore, this result demonstrated satisfactory discriminant validity at the construct level. Given that all of Cronbach's alpha scores were above 0.70, we met the reliability criteria of measurement as well. The results indicated that our measurement model was appropriate.

Table 3. 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 toward Changes in RHS	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.

Next, we analyzed the structural model to test our proposed hypotheses. In Figure 3, we presented the results from our PLS-SEM approach. The R^2 and path coefficients (significance) showed how well our empirical analysis supported 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 toward changes in RHS ($\beta = 0.62$, $p < 0.001$) and explained 39% of variance in this construct, rendering support for H4. In addition, openness toward changes in RHS significantly predicted both job satisfaction ($\beta = 0.67$, $p < 0.001$) and continuous usage intention ($\beta = 0.42$, $p < 0.001$), lending strong support to H5 and H6. Similarly, job satisfaction had a significant impact on continuous usage intention ($\beta = 0.31$, $p < 0.001$), supporting H7. Service quality had a significant positive influence on continuous usage intention ($\beta = 0.12$, $p < 0.05$), which supported H8. Overall, a significant extent of the variance of continuous usage intention was explained by openness toward changes in RHS and job satisfaction (46%).

We also tested the mediation effect of openness toward changes in RHS by using alternative models and by examining the strength of the relationships among service quality, openness toward changes in RHS, 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 and Karjaluoto 2015). Specifically, we created the first alternative model by excluding openness toward changes in RHS to examine whether service quality significantly affects continuous usage intention in the absence of a mediator (i.e., openness toward changes in RHS). 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 toward changes in RHS ($\beta = 0.62$, $p < 0.001$), which in turn, significantly influenced continuous usage intention ($\beta = 0.61$, $p < 0.001$). The third alternative model linked service quality and openness toward changes in RHS with continuous usage intention. The estimated results from this model indicated that service quality still had a significant impact on continuous usage intention ($\beta = 0.22$, $p < 0.001$) after controlling the relationship between openness toward changes in RHS and continuous usage intention ($\beta = 0.48$, $p < 0.001$). These results indicated that the relationship between service quality and continuous usage intention significantly reduced path coefficients ($\beta = 0.51$ vs. β

= 0.22) after we included openness toward changes in RHS as the mediator, supporting partial mediation. The Sobel mediation test was also applied to assess the mediating role of openness toward changes in RHS. The results showed that the total effect of service quality on continuous usage intention is 29.05%, mediated by openness toward changes in RHS ($z = 4.52$, $p < 0.001$).

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 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 ($\beta = 0.15$, $p < 0.01$) and control ($\beta = 0.85$, $p < 0.001$) significantly influenced functionality quality, whereas advisory support ($\beta = 0.54$, $p < 0.001$) and responsive support ($\beta = 0.50$, $p < 0.001$) significantly affected content quality. Functionality quality ($\beta = 0.16$, $p < 0.01$) and content quality ($\beta = 0.87$, $p < 0.001$) significantly influenced service quality, which in turn, had a positive impact on openness toward changes in RHS ($\beta = 0.61$, $p < 0.001$) but not on continuous usage intention ($\beta = 0.07$, $p > 0.05$). The impact of openness toward changes in RHS on continuous usage intention ($\beta = 0.58$, $p < 0.001$) and job satisfaction ($\beta = 0.94$, $p < 0.001$) were significant. The positive relationship between job satisfaction and continuous usage intention was confirmed ($\beta = 0.26$, $p < 0.001$). Except for H8, all other hypotheses were confirmed. The rejection of H8 was caused by the fact that openness toward changes in RHS served as the full mediator between itself and continuous usage intention in the CB-SEM analysis.

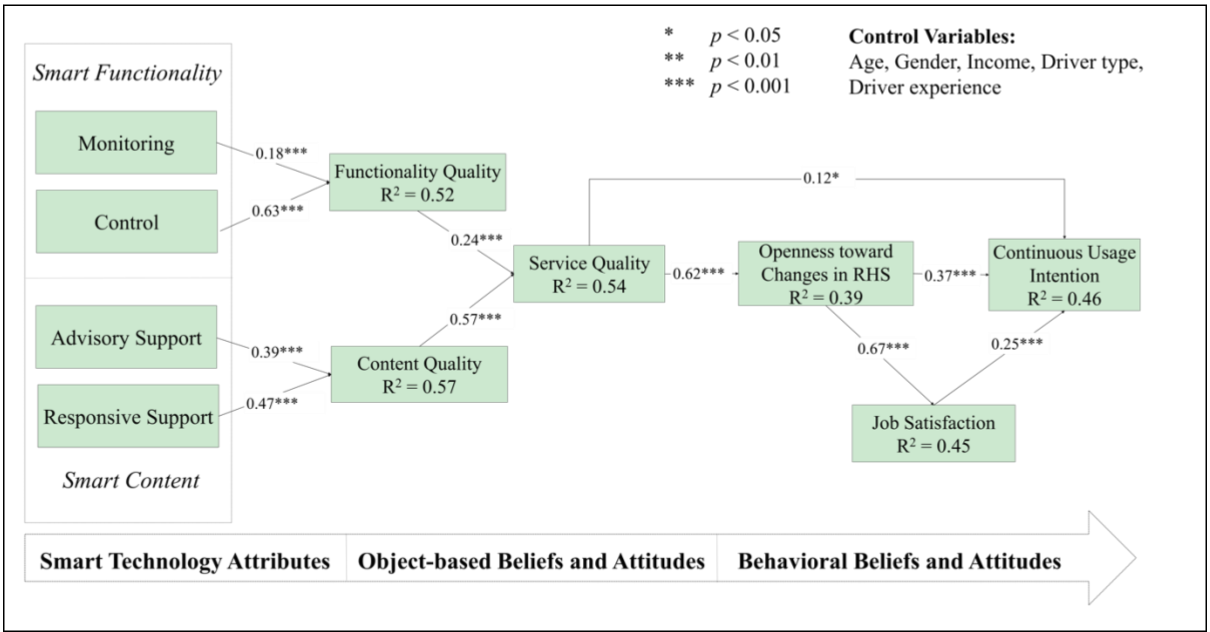

Figure 3. Results of Research Model

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 when they went aboard 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 riding tasks.*" This excerpt showed that control is recognized as an essential function for some drivers, who benefit from control over more aspects of their work. This instance promoted 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 necessarily richer information. Our interviews indicated that advisory support and responsive support were 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 on searching for the best route by myself. When I have difficulty, the app will give me guidelines and solve the conflicts.*"

The drivers also expressed negative attitudes or 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 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 echoed prior studies that discussed 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 serving as RHS drivers, although some of them expressed interest in "wait-and-see" strategies. Thus, RHS firms should take actions and strengthen drivers' confidence accordingly.

Unexpectedly, several driver respondents pointed out that they did not even view these regulations seriously because they get used to such campaign-like regulations in China for a long time. 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 well- or permanently implemented. Drivers can always find some creative ways to avoid them. For instance, one new policy requires that RHS drivers should be 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/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/services as well as to the openness toward changes in RHSs by exploring how smart technology in RHSs helps 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 changes by positing that drivers' openness toward changes in RHS 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 and 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 defined and exemplified what these smart technological attributes were and how they were applied in smart service. In particular, the smart technological attributes that we identified in this study can complement the technological attributes detected in the design of IT-enabled services in prior studies (Tan et al. 2013; Xu et al. 2013). Individuals keen on integrating smart technology into the design of

IT-enabled services can refer to our work to assess the adequacy of technological attributes in their service design. 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 argued that smart technology could facilitate and advance digital transformation, the adoption of smart technology that can restrain the potential negativity from digital transformation has not been well discussed (Majchrzak et al. 2012). Our findings in this study contribute to alleviating this dilemma, especially in the IT-enabled service sector. In particular, our exploratory findings indicate that people positively embrace change with the assurance 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 that has employed Wixom and Todd's model. In other words, few studies are dedicated to revisiting the technological attributes in the original model irrespective of different contexts or application scenarios. In this study, we explore the smart technological attributes and contextually remodel object-based beliefs and their antecedents. Specifically, monitoring and control were inferred as primary attributes to attaining smart functionality, and advisory support and responsive support are the essential attributes to acquiring "smart content." Continuing from 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, whether the service quality should be classified as an object-based belief or object-based attitude remains unresolved (Xu et al. 2013; Tan et al. 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 et al. 2013). In particular, for researchers who survey IT-enabled service quality from the perspectives of direct users of an IT artifact, (e.g., drivers in RHS systems), service quality should be considered as a construct reflecting object-based attitudes. However, service quality could be regarded as an object-based belief when participants acted as evaluators in lieu of real users. We thus extended the understanding of Wixom and Todd’s model by 1) integrating technological features from smart technology and 2) alleviating the debate about the construct nature of service quality in the application of this theoretical model.

Third, our findings contribute to the literature by applying the concept of openness toward changes in the RHS sectors. Previous studies 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 and Kim 2008). These findings, however, cannot be used to understand how individuals cope with changes 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 the new types of organizations. This study attempts to fill this void by understanding how to manage gig economy labor to adapt to evolving changes in turbulent environments with the support of smart technology. Furthermore, information technology or the IT artifact was widely studied as a black box in the prior literature on change management. This approach is contradictory to the proposition in IS literature which suggests using a feature-centric approach to delaminate IT artifacts and study post-adoption behaviors (Jasperson et al. 2005). Our work bridged this research gap by characterizing different smart technological attributes and discussing their impact on promoting individual attitudes toward change in the context of RHSs.

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 and Wright 2015; Lee et al. 2015; Möhlmann and Zalmanson 2017). Given our minimal knowledge about how RHS drivers deal with business changes, our work fills this gap by examining how smart technology could be used to effectively prevent the turnover of RHS drivers. In turn, such prevention sustains an RHS business.

5.2 Practical Implications

This work presents significant implications for practitioners. First, our findings can guide RHS firms or other smart service companies as they design and evaluate their smart-technology-enabled services. Practitioners should pay attention to whether they include important attributes (e.g., monitoring, control, advisory support, and responsive support) in their smart technology-equipped services. Second, our findings suggest that the service quality of an RHS system plays a critical role in the survival of its service providers. To attain the provision of qualified service, service providers must adopt smart technology that affords smart functionality and smart content with excellent quality, thereby effectively helping individuals adapt well to changes or similarly fluctuating situations. Third, our findings confirm that RHS firms that encourage drivers' openness toward changes in RHS can reduce their drivers' intentions to leave; RHS firms that support drivers with high service quality help drivers cope well 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 the firms are encountering. Inappropriate regulations may limit the development of the sharing economy, as firms and their service suppliers may not be ready for regulatory changes.

5.3 Limitations and Future Research

This study has some limitations that create avenues for future studies. 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, present slight differences. In addition, users with different cultural backgrounds or who experience different types of changes could have dissimilar beliefs and attitudes toward 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 unveiled its role in affecting individual attitudes toward change.

Second, although we used the 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 can still characterize individual attitudes and beliefs when they interact with the new technology must be examined further. Such methodology can adequately address the proposition by Wixom and Todd (2005) to "investigate whether there is a core set of system characteristics that apply broadly across a wide range of systems" (p. 100). We highlighted this caveat for inspiring future investigation.

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7. Appendix

Measurement Items for the Constructs

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 et al. 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 and 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	RS1: I can find a considerable amount of information	Self-

Support	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.	developed
Functionality Quality	FQ1: In terms of functionality quality, I would rate the RHS system highly for providing RHS service. FQ2: Overall, the RHS system provides high-quality RHS service. FQ3: Overall, I would give the quality of the RHS system a high rating for providing RHS service.	Xu et al. 2013; Wixom and 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 quality of the content provided by the RHS system. CQ3: In general, the RHS system provides me with high-quality information for providing RHS service.	Xu et al. 2013; Wixom and 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 toward Changes in RHS	OC1: I would consider myself open to changes in the RHS service. OC2: I am looking forward to changes in the RHS service. OC3: From my perspective, the proposed changes in the RHS service will be for the better. OC4: I think the proposed changes in the RHS service will have a positive effect. OC5: I support new ideas for the RHS service provision. OC6: I intend to do whatever is possible to support	Kwahk and Lee 2008; Jones et al. 2005

	changes in the RHS service. OC7: I am inclined to try new features in the RHS service.	
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 and Venkatesh (2010); Closon et al. (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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