Determinants of self-service technology adoption and implementation in hotels: The case of China

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Chun LIU[1], Kam HUNG[2], Dan WANG[3], and Sha WANG[4*]

[1] School of Tourism Sciences, Beijing International Studies University, 100024 Beijing, China;

Research Center for Beijing Tourism Development, 100024 Beijing, China;

[2, 3]School of Hotel & Tourism Management,

The Hong Kong Polytechnic University

17 Science Museum Road, TST-East, Kowloon, Hong Kong SAR, China

[4]Department of Tourism

Fudan University

No. 220 Handan Road,Shanghai, China

[1] Lecturer

Phone: (86) 10 6577 8353 Fax: (86) 10 6577 8440

E-mail: sinoliuchun@163.com

[2] Associate Professor

Phone: (852) 3400 2258 Fax: (852) 2362 9362

E-mail: kam.hung@polyu.edu.hk

[3] Associate Professor

Phone: (852) 3400 2282 Fax: (852) 2362 9362

E-mail: d.wang@polyu.edu.hk

[4] Lecturer

Phone: (86) 21 5566 5026 Fax: (86) 21 6564 2713

E-mail: shawang@fudan.edu.cn

Corresponding Author: Sha WANG

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Abstract

Few research models have examined organizational levels of self-service technology (SST) application. Based on prior research and focus-group discussions with 30 hotel practitioners, this study proposes a conceptual framework regarding the SST application process in hotels, which divides the process into three stages: adoption decision, implementation, and customer acceptance. The findings show that most hotels in China have taken wait-and-see attitudes toward innovative SSTs and that customers tend to remain unfamiliar with such devices. Results suggest that hotels should begin replacing traditional services with SSTs from non-face-to-face service encounters. The findings further indicate that the influencing factors at each stage vary somewhat, as task characteristics appear to influence the implementation stage but do not affect adoption decisions. Additionally, customers' travel purposes and their unique needs impact their acceptance of SSTs. The findings provide novel insights to guide future research on technology adoption and offer constructive practical guidance for hoteliers.

Keywords: self-service technology; application process; adoption decision; implementation; customer acceptance; determinants

Introduction

Cutting-edge technologies continue to be developed, such as driverless vehicles, mobile payment technologies, facial recognition systems, artificial-intelligence management systems, and robotic technologies. These technological interfaces, which allow customers to procure services without the direct involvement of employees, are collectively known as self-service technologies or SSTs (Meuter, Ostrom, Roundtree, & Bitner, 2000). Hotels are intrigued by the perceived benefits of these technologies—primarily reduced labor costs and improved customer satisfaction—and are therefore expected to adopt such innovations widely to attract business and enhance profitability (Brochado, Rita, & Margarido, 2016; Ivanov, Webster, & Berezina, 2017; Yu, 2019).

China has been a pioneer in testing and applying SSTs in hotels (Hertzfeld, 2018). For instance, facial recognition check-in kiosks have been introduced in approximately 50 hotels in Hainan Province, China (Hertzfeld, 2018). Other hotels in the country, such as the InterContinental One Thousand Island Lake Resort and HNA Business Hotel Kunming Airport, are testing robots. In late 2018, the Alibaba group opened its first futuristic hotel named after Flyzoo Hotel. It is fully outfitted with the latest technologies (e.g., an artificial-intelligence management system, robotic technologies, and facial recognition) and has drawn worldwide attention.

Despite the increasing adoption of SSTs, these technologies have thus far garnered scant academic interest (Shin & Perdue, 2019). In this instance, theory is lagging far behind technology development. Among the limited SST research studies, customer adoption is a popular topic, whereas organizational application, a precondition for customer adoption, remains unexplored (Shin & Perdue, 2019). Service companies are unique and much more complex than individual consumers. Although customer acceptance is certainly a key factor, hotels must consider other factors such as hotel's condition (e.g., type, grade, and budget) and environmental context (e.g., government support) when making decisions on technology adoption (Baker, 2011; Sahadev & Islam, 2005). Organizational adoption of innovation also involves more than one stage (Hameed, Counsell, & Swift, 2012). Beyond the decision whether to adopt SSTs, organizations must determine how to deploy these technologies, monitor customer acceptance, and make strategic adjustments accordingly. However, according to a recent literature review on SSTs in hospitality and tourism (Shin & Perdue, 2019), no relevant studies have focused on the organizational application of SSTs. The organizational perspective thus appears to be seriously underrepresented in academic research (Cobos, Mejia, Ozturk, & Wang, 2016; Law, Chan, & Wang, 2018; Mejia, 2018).

From a managerial perspective, hotel managers are increasingly confronted with strategic decisions related to investments in diverse technologies (Tussyadiah, Wang, Jung, & tom Dieck, 2018). Scholars have estimated that the benefits (i.e., convenience, self-control, consistency, and cost and time savings) of SSTs will quickly surpass those gained through interpersonal service (Kasavana, 2008; Oh, Jeong, & Baloglu, 2013; Selnes & Hansen, 2001) and will gradually replace traditional services (Kaushik & Rahman, 2016). However, not all operations will benefit from such technology (Ba, Stallaert, & Zhang, 2010). The use of

traditional channels (i.e., face-to-face encounters) will not disappear completely (Pieterson & Ebbers, 2008) and will continue to play an essential role in hospitality services (Lee & Yang, 2013). Managers have been advised to leverage the advantages of and the potential synergies between high-tech self-service and high-touch personal service (Oh et al., 2013; Salomann, Kolbe, & Brenner, 2006). Neither the exclusive pursuit of high-tech solutions nor too heavy focus on human touch will be the most profitable scheme; instead, maximizing profit will depend on the cost allocation between e-services and human-based services (Ba et al., 2010). However, other studies have argued that this combination cannot guarantee higher customer-perceived value (Palacios-Marques, Guijarro, & Carrilero, 2016), but might elicit challenges in managing the quality and level of service (Berry et al., 2010).

The resulting "high-tech versus high-touch" debate in hospitality services (Wei, Torres, & Hua, 2016) has presented hotels with a dilemma over whether to adopt SSTs, the extent to which to implement them, and whether customers will accept them if implemented. The studies conducted thus far have not offered satisfactory answers to these questions. An industry-oriented framework that can guide innovative technology investments is therefore urgently needed.

To address these identified research gaps, the present study aims to develop a holistic conceptual framework to elucidate the SST application process in hotels coupled with corresponding determinants of each stage. Specifically, by conducting focus group discussions, this research aims to explore (1) how hotels make decisions on SST adoption; (2) what are hotels' concerns regarding SST implementation; and (3) how hotels perceive customers' acceptance of SSTs. This study uses China as its research location, considering the country's unique technological landscape (e.g., its relatively rapid SST development) and the lack of related academic research conducted there.

This study contributes to the literature by outlining the nuanced and holistic mechanisms involved in organizations' SST application. Armed with relevant findings, hoteliers can make more rational decisions concerning SST adoption, implementation, and marketing to satisfy customers' needs and enhance financial performance.

Literature review

Technology adoption theories

Various theories have been applied to customer adoption of SSTs, such as theory of planned behavior, technology acceptance model (TAM), and unified theory of acceptance and use of technology (UTAUT). By contrast, few theories have been explicitly developed for organizational technology adoption. To understand how organizations apply technology, scholars have suggested borrowing theories related to customers' technology adoption. For example, Wang and Qualls (2007) proposed a modified TAM to interpret technology adoption by hospitality organizations; Herrero, San Martín, and Collado (2018) applied UTAUT to examine hospitality microenterprises' intentions to use social networking sites.

Another popular framework for organizational technology adoption is the technology, organization, and environment (TOE) framework, first developed by Tornatzky and Fleischer in 1990. As an organization-level theory, this framework posits that technological, organizational, and environmental factors each influence organizations' adoption of innovative technologies (Baker, 2011; Kurnia, Karnali, & Rahim, 2015). Factors related to technological contexts refer to the availability and attributes of technology, such as its complexity (Kurnia et al., 2015). Organizational factors include a given organization's characteristics and resources, such as its managerial structure (Baker, 2011). Environmental factors encompass industry characteristics, market structure, supporting infrastructure, and government regulations (Baker, 2011; Kurnia et al., 2015). These factors are not consistently present across all contexts; rather, scholars have assumed that different technologies or contexts involve unique factors (Baker, 2011). Studies across industries and contexts have repeatedly demonstrated the prevalence and usefulness of the TOE framework in investigating organizations' adoption of innovative technology (Baker, 2011; Racherla & Hu, 2008). Irrespective of distinct contextual factors, technological, organizational, and environmental contexts appear to deliver "both constraints and opportunities for technological innovation" (Tornatzky & Fleischer, 1990, p. 154).

Although the aforementioned theories have enhanced our understanding of organizational adoption of technology in general, organizational adoption involves more than one stage (Hameed et al., 2012). The application of innovation becomes successful only when

it is accepted and integrated into organizations and when individuals continue to use the innovation over time (Hameed et al., 2012).

Based on prior literature, Ong (2010) identified six steps to guide hoteliers in introducing SSTs in Singapore: defining the current service flow, identifying the risks and opportunities of using SSTs, determining factors that may limit hotels' SST adoption, selecting and accessing available SSTs, testing and implementation, and evaluating outcomes. Ong's conceptual framework provides a useful stepping stone toward understanding hotels' application of SSTs from a stage-based perspective. Even so, framework-driven and evidence-based research is needed to substantiate these notions. Therefore, relying on focus group discussions among hotel practitioners, the present study aims to develop an industry-oriented framework that collectively explains the technology application process in organizations along with key factors to consider.

Staged process of technology application in hotels

Research on the adoption of organizational innovations has encompassed two streams of inquiry (Cobos et al., 2016; Hameed et al., 2012). The first stream has explored the innovation adoption process in organizations, including the behavior displayed by organizations as they adopt and implement new innovations (Cobos et al., 2016; Hameed et al., 2012). The second stream has examined the determinants of innovation adoption by organizations (Cobos et al., 2016; Hameed et al., 2012). However, research that jointly explores both the adoption process and the corresponding determinants is relatively nascent.

Organizational innovation adoption has been regarded as a stage-based process that can be categorized into various phases (Hameed et al., 2012). For example, Rogers (1995) described that the innovation decision process involves five stages: knowledge, persuasion, decision, implementation, and confirmation. Based on this classification, Cobos et al. (2016) conducted interviews to explore the process by which hotels adopted radio frequency identification locking systems. Thompson (1965) and Pierce and Delbecq (1977) categorized the innovation process into three phases: generation (initiation), acceptance (adoption), and implementation. Studies in the information systems literature have similarly described the adoption of innovative information technology (IT) by organizations usually involves three stages: initiation (pre-adoption), adoption decision, and implementation (post-adoption)

(Hameed et al., 2012). The initiation stage involves forming attitudes toward the innovation concerned (Hameed et al., 2012). According to technology adoption theories (e.g., TAM), attitudes are often regarded as important antecedents of behavioral intention. Thus, this study integrates the initial stage into the adoption decision stage for the sake of simplicity. This approach is consistent with that used by Bertan, Bayram, Ozturk, and Benzergil (2016), who segmented IT application into two stages, namely IT decision and implementation.

Aside from adoption decisions, technology implementation is fundamental to ensure successful technology application in organizations (Hameed et al., 2012). The greatest challenge hoteliers have encountered is how to gain advantages from technology adoption (Mest, 2014). The performance of hospitality and tourism firms has been negatively influenced by the difficulties associated with the implementation of innovative technologies (Verreynne et al., 2019). Gaining a deep and comprehensive understanding of SST implementation in hotels and the underlying reasons for their decisions serves as a new research agendum (Shin & Perdue, 2019). Therefore, this study aims to identify hotel managers' concerns about subsequent SST implementation, which is vital to the industry and academia (Cobos et al. , 2016).

Last but not least, practitioners' understanding of customer acceptance of SSTs is important for decisions regarding further SST application (Rosenbaum & Wong, 2015). Although explorations of customer acceptance from the consumer perspective have provided first-hand data, hotel practitioners may not accurately perceive their customers' degree of acceptance. Just as differences exist between actual and perceived possibilities (Cardona-Rivera & Young, 2013), discrepancies may emerge between customers' expressed acceptance and hoteliers' perceived customer acceptance of SSTs. However, limited research has considered organizations' understanding of customer SST acceptance compared with studies from customers' perspectives. Thus, this study also aims to understand how hotels perceive customers' acceptance of SSTs.

Methodology

To fully understand why and how hotels apply SSTs, a qualitative approach was adopted because of its fit with the abovementioned research goals (Waller, Farquharson, & Dempsey, 2016). As a prerequisite for generalization (Waller et al., 2016), an inductive approach is

suitable for delving into as-yet-unknown reasons for using or avoiding technology (Rosenbaum & Wong, 2015). More specifically, this study adopts a grounded theory research design through focus groups to understand SST application in hotels. Grounded theory is a method used to "develop fresh insights about a phenomenon and to offer theoretical propositions where little is known" (Matteucci & Gnoth, 2017, p. 50). This method has proven its usefulness in developing conceptual models for research in the fields of hospitality and tourism (Mehmetoglu & Altinay, 2006; Pamela, Severt, & Dickson, 2010). As this research attempts to generate a holistic understanding of unexplored technology adoption by hotels, grounded theory can guide the data analysis so as to organize the raw qualitative data into meaningful categories and to compare the findings with those in the literature.

Focus group discussions were conducted to collect data as suggested by Oh, Jeong, Lee, and Warnick (2016). A focus group involves informal discussions in which a few group participants interact with others regarding a particular topic (Edmunds, 1999; Harding, 2013). Such interactions allow participants to explore and reconsider their views (Edmunds, 1999; Waller et al., 2016). Another advantage of focus groups is that shared brainstorming can generate fresh ideas, which helps researchers reach a deeper understanding of participants' views than typically results from conducting individual interviews (Edmunds, 1999; Waller et al., 2016). Therefore, we held focus groups to uncover organizational behaviors associated with each SST application stage along with relevant influencing factors.

The core of triangulation is multiple viewpoints which can be collected across information sources (e.g., recruiting different types of participants) (Willis, 2007).In this case, "multiple comparison groups" within a given method (e.g., focus groups) were adopted to guarantee internal reliability (Jick, 1979, p. 603). To do so, we purposefully selected and invited 30 hotel practitioners from different hotels, departments, and positions in China (Table 1). A diverse set of hotels was chosen, based on recommendations to eliminate the limitations of examining only one hospitality organization (Cobos et al., 2016). Twenty-six of the 30 participants were managers or directors, 2 were vice presidents, and 2 were owners' representatives. Eighteen of the 30 participants were women; the rest were men. Their ages ranged from 29 to 45 (M = 36), and their work experience ranged from 4 to 22 years with an average of 14 years.

*Insert **Table 1.** Demographics of participants*

Prior to formal data collection, an initial focus group was conducted to assess the appropriateness of discussion questions. Five doctoral students were invited to participate in the pilot test. After obtaining their consent, one of the authors made appointments with each pilot subject and then conducted the pilot test on February 23, 2017. At the end of the discussion, the researcher asked the participants about the suitability of the discussion questions and research method. Minor wording modifications were made based on the participants' feedback. The researcher also listened to audio recordings of the discussion and checked the validity of questions and methods. The revised questions were then reviewed by the other authors. The pilot discussion was excluded from the final data analysis because its participants were Ph.D. students rather than hotel practitioners.

After the pilot study, formal data collection was conducted on February 27, 2017 in Shenzhen, China. Each focus group consisted of six or seven participants and a moderator, satisfying the requirement that a focus group should normally have six to eight members (Waller et al., 2016). Each group contained a diversity of members according to gender, employment position, hotel affiliation, and work experience (Table 1). The moderators were trained researchers with moderating skills and prior knowledge of the research objectives and discussion questions.

After a brief introduction to the study, six main questions were discussed from two perspectives (Table 2). The first perspective concentrated on organizational behaviors at each of the three stages (i.e., adoption decisions, implementation strategies, and perceived customer acceptance) (Cobos et al., 2016; Hameed et al., 2012). The second perspective sought insights on the underlying factors that influenced the organizational behaviors exhibited at each stage (Cobos et al., 2016; Hameed et al., 2012). The pre-categorized application process was based on the suggestion of Cobos et al. (2016), who encountered difficulties when classifying codes; participants in that study provided information that covered two or more phases because they did not deconstruct the application process during interviews.

*Insert **Table 2.** Focus group discussion questions from two perspectives*

The discussions were audio-recorded with participants' approval so as to capture the richness of the conversations and enable the researchers to identify supporting quotations (Edmunds, 1999; Waller et al., 2016). The length of the discussions ranged from 59 to 90 minutes (M = 72.5 minutes). That time frame is considered appropriate, as "Typically it takes between one to two hours to conduct a focus group" (Nuttavuthisit, 2019, p. 148). The recordings were then transcribed with the help of a professional company, after which one of the authors reviewed the transcriptions word by word.

Thematic analysis was adopted to analyze the data, since this approach has proven its usefulness in evaluating data collected through focus group discussions (Harding, 2013). The analysis procedures were drawn from grounded theory and from techniques suggested by Gioia, Corley, and Hamilton (2013). The first step in our thematic analysis was to code the raw data and label each code to reflect what it represented; the results appear in the "Open code" columns in Appendices 1, 2, and 3. Next, codes were allocated to corresponding themes as shown in the "Axial code" columns in the Appendices. Then the themes were further distilled into aggregate dimensions as listed in the "Selective code" columns in the Appendices. All comments that generated the same code and theme were grouped. Codes, themes, and dimensions were continually adjusted on the basis of similarities and differences until the authors reached a consensus (Harding, 2013). To further guarantee the reliability of the data, we ensured consistency over time (Prothro, 1956) by performing and discussing the initial coding and data analysis in July 2017 and then repeating the analysis in February 2018 and again in September 2018.

Finally, with the help of NVivo 11 and on the basis of the keywords and original meanings expressed by participants, 18 determinants of hotels' adoption decisions related to SSTs were divided into 4 groups (Appendix 1), 19 determinants of SST implementation in hotels were divided into 5 groups (Appendix 2), and 7 determinants of customer acceptance of SSTs in hotels were extracted and divided into 2 groups (Appendix 3).

Findings

The data analysis uncovered organizational behaviors associated with each SST application stage, along with relevant determinants. The following discussion presents examples and

quotations from focus groups to illustrate these behaviors and their determinants by stage.

Hotels' adoption decisions about self-service technology

According to the participants, SST application in hotels in China lags behind that in other countries. Although some hotels have attempted to deploy SSTs, the technologies were far from fully developed, and the application of such devices in hotels in China remains immature. Most hotels have therefore taken a wait-and-see approach. However, the participants anticipated that most hotels in China would deploy SSTs within the next five years. A participant from Group 3 explained, *"These days, hotels are still in an infancy stage. Within five years, in my opinion, most hotels will certainly apply SSTs."* These attitudes emerged from comprehensive and simultaneous consideration of characteristics of environment, hotel conditions, SSTs, and customers; see Appendix 1.

The environmental context was found to influence hotels' adoption of SSTs. Hotel practitioners remarked that technological development incites industry progress. By contrast, a lack of technological progress can spark regression. According to participants, China is a world leader in Internet development, and this strength has contributed to SST implementation in the nation's hotels. However, Chinese government regulations on hotel check-in pose barriers. According to the rules of the Ministry of Public Security in China, when checking in to a hotel, guests must provide their identity cards, and hotels must upload guests' identification documents in real time. All four focus groups concurred that this requirement presents a major constraint for hotels in China. However, they expected this regulation to be relaxed in the coming years, and some hotels have already obtained government approval to pilot self-service check-in kiosks.

High labor costs, recruitment challenges, and a lack of suitable employees also encouraged hotels to adopt SSTs. A participant from Group 2 proposed that *"There may be a lack [of competent employees] in the population. When there are not enough human resources, you will be faced with a deficient labor force and thus you must properly introduce some SSTs."* However, a member of Group 1 stated, "*The labor cost in China is relatively low [compared with Europe]*", which may partially explain hoteliers' wait-and-see attitudes toward SSTs. In addition, some participants expressed concerns about employment rates. As mentioned by a participant from Group 2, *"If the entire hotel is self-service, what about the*

numerous members of the working population in China? I think we need to consider this issue as well." Group 4 cited similar concerns.

Furthermore, a member of Group 1 indicated that *"Hotels should decide whether to adopt SSTs according to their own conditions."* Similar views were expressed by members of Group 4. Respondents indicated that hotel managers should be able to weigh the trade-offs between human-delivered and SST-based services according to their hotel's conditions. For example, participants believed that SSTs were best suited for mid-scale and economy hotels, whereas luxury hotels should emphasize high-touch and face-to-face services. A member of Group 3 commented, *"People are emotional animals. Thus, luxury hotels rely on emotional service to provide a premium product to raise their room rate to 1000CNY or 2000CNY."* In addition, chain hotels should consider group regulations. According to practitioners, since a hotel group seeks to maintain uniform standards, a single hotel may not introduce SSTs alone. Although individual hotels can apply to their headquarters for permission to adopt SSTs, the process is time-consuming and tedious.

Technology-related elements also influenced hotels' SST adoption. First, the limited availability of SSTs often kept hotels from adopting these technologies. An informant from Group 3 pointed out, *"There are few intelligent products. The types of SST products are also limited."* Regarding cost, practitioners noted that SSTs reduce labor costs by replacing human labor. The cost of employing people exceeds that of using SSTs, similar to the difference between cheap mechanical products versus expensive handcrafts. Although participants expressed concerns about the investment, maintenance, and upgrade costs of SSTs, they said that as hotel SSTs scale, associated costs will decline.

Participants from Groups 1 and 2 also believed that technological maturity can shape hotels' preferences for SSTs. Many participants lamented that current SSTs are not yet refined and still require a "human in the loop." A participant from Group 2 added, *"It is troublesome to allocate employees to take care of robots."* Participants also worried about SSTs' lack of warmth. A practitioner in Group 4 stated, *"Substituting service employees with SSTs may seem to be as cold as ice to customers."* Group 3 shared similar sentiments. However, the perceived benefits of SSTs, such as convenience, efficiency, and freedom from human physical constraints (e.g., requiring people to work overnight shifts), encouraged hotels to adopt such devices.

Participants also emphasized that customer acceptance plays an important role in hotels' decisions to adopt SSTs. An informant from Group 1 said, *"Nowadays, many customers in China do not use digital check-in. What if every Chinese used digital check-in? … Currently, 80% of American customers use digital check-in."* Oracle, a database management system, has reported that 84% of guests who used digital keys were likely to use them again (Zaplox, 2019). Low Chinese customer acceptance may result from customers' perceptions of the hotel industry and their consumption habits. A participant from Group 2 explained, *"Customers think that service employees should be responsible for everything in a hotel, whereas they have to learn how to use SSTs in a hospital."* Participants from Groups 3 and 4 added that current customers are unfamiliar with SSTs and are therefore not in the habit of using them. As such, the question of how to cultivate customers' habit of using SSTs should be carefully considered. Furthermore, a participant from Group 3 stated, *"The adoption of SSTs by hotels is closely related to the kinds of experiences they want to offer their customers."* In most participants' opinion, SSTs can offer customers convenience, efficiency, and a sense of surprise. However, it would be risky for hotels to focus exclusively on efficiency while neglecting customer satisfaction issues and customers' need for interaction.

Implementing self-service technology versus use of employees in hotels in China

An informant from Group 1 remarked, *"Hotels are expected to introduce high technology";* however, this does not mean that more SSTs are better. Instead, SSTs cannot replace all human staff—a human touch is still required. Participants agreed that hotels should strive to maintain an ideal balance between high technology and high touch. They also highlighted the synergy between these two poles:

> Technology is developed to serve people. If manpower and SSTs are balanced properly, then labor costs will be saved, and convenience will be created by technologies. Meanwhile, socialization and comfort can still be achieved by communicating with humans. (informant from Group 1)

In terms of how to balance SSTs and employees, participants presented several considerations (see Appendix 2). First, *"No one can stop technicalization"* (informant from Group 4). Increasing use of SST applications is an inevitable trend. Although current SSTs (e.g., robots) are not as intelligent as humans, *"They will provide more personalized services in the future … and gradually replace employees"* (informant from Group 4). Even so, practitioners stated that the nature of the industry would keep hotels from becoming staffed entirely by SSTs. The basic function of hotels is to serve guests, and this purpose should not be overwhelmed by technology. People-oriented services can hardly be offered without employee involvement, just as *"fish cannot live without water"* (informant from Group 3).

Second, *"the degree to which SSTs are implemented depends on the conditions of each hotel"* (informant from Group 3; participants in Group 1 said the same). According to practitioners, hotels should consider their size and location when configuring SSTs. For example, a practitioner from Group 1 stated, *"Our installation of intelligent air conditioners is determined by location. The sea breeze will damage our wooden furniture if we do not implement intelligent air conditioners."* Employees' service quality also influences SST implementation. On one hand, service employees can provide high-touch and personalized service; on the other hand, if service employees are overbearing, customers may feel uncomfortable and turn to SSTs. Participants thus recommended retaining both SSTs and service employees and offering customers options. As mentioned by a member of Group 2, hotels *"provide self-service, but customers have the right not to choose it."* Members of Group 3 shared similar statements. Furthermore, hotels should provide clear guidelines to help customers use SSTs rather than deploying these technologies blindly.

Third, the characteristics of SSTs should be taken into consideration. An informant from Group 1 said, *"Hotels should choose mature and proper SSTs that will not bother customers."* Another member of the same group added, *"Intelligent SSTs are supposed to be user-friendly and easily accepted by customers."* Participants further emphasized that hotels should implement SSTs that can benefit both hotels and their customers by improving efficiency, saving money and time, attracting customers, and offering customers convenience and privacy. The prices of SST-delivered services and personalized human-based services represent another consideration. Participants suggested that hotels could offer SST services for free but charge for customized and human-delivered services.

Fourth, hotels ought to consider *"how to configure SSTs without influencing customer experience"* (practitioner from Group 3) or *"how to use SSTs to enhance customer experience"* (informant from Group 2). To improve the customer experience, participants recommended selecting SSTs according to customers' needs:

> The hotel industry is ultimately oriented to satisfy customers' needs. If customers are accustomed to using SSTs, then employees will ultimately be eliminated. Therefore, the selective use of intelligent technologies should follow customers' needs. (informant from Group 4)

Lastly, hotels should carefully consider which tasks can be handled by SSTs, as different services require distinct methods. Participants noted that SSTs are better suited for tasks that can be standardized and do not involve emotional expression. For instance, standardized (e.g., Western) food can be cooked by technology, whereas Chinese food cannot. Additionally, SSTs can replace employees who perform repetitive but simple tasks, fixed but elaborate work, and pure manual labor (e.g., housekeeping, washing dishes, and checking minibars). By contrast, *"Services that require [more advanced] skills should be performed by humans"* (informant from Group 1).

Hotels also need to consider *"The point at which hotels can implement SSTs. If the whole service delivery process of hotels is filled with SSTs, service quality will decline"* (informant from Group 3; members of Groups 2 and 4 made similar remarks). Participants mentioned that it would be better for hotels to implement SSTs gradually and sequentially. For example, implementation could begin with back-office services and hardware (e.g., financial work, human resource management, sales orders, and decorating conference rooms). Modernization of front-line and soft services should be undertaken at a comparatively slow pace. That is, humanistic care should be prioritized in face-to-face and soft services, and service employees should thus be retained in these areas. An informant from Group 2 said, *"The software of a hotel is its services, and services cannot be performed without humans"*; this opinion was also voiced in the other three groups. Alternatively, it would be better for hotels to place SSTs in positions that are hard to fill through employee recruitment.

Customer acceptance from hotel practitioners' perspectives

According to participants, Chinese customers accept SSTs to varying degrees depending on the particular technology, whereas overall consumer acceptance is growing. For example, customers enjoy and accept intelligent toilet, but tend to reject intelligent lighting. In spite of this, hoteliers anticipated that customers would become accustomed to using SSTs in the future. A member of Group 1 said:

> I have data on hand. We started digital check-in in 2015. At that time, Chinese guests' acceptance was low. However, now, according to customer ratings, their satisfaction is relatively high, at around 70% or 80%. (practitioner from Group 1)

Different levels of acceptance may be due to particular characteristics of SSTs as well as customer differences (see Appendix 3). In terms of SST characteristics, the design and learning cost associated with SSTs each play important roles. For example, customers tend to appreciate intelligent toilet' characteristics of self-heating, automatic flushing, and energy conservation, while regard intelligent lighting as unusual and complain that they cannot find the light switch. A participant from Group 1 shared the following customer review: *"The customer comments said that the weird lighting design prevented them from sleeping. They were miserable because they could not find the switch. Chinese guests are not willing to accept this technology."* Hotel practitioners also mentioned that the perceived benefits and costs of adopting SSTs influenced customer acceptance. Participants believed that customers would be inclined to adopt SSTs if they could gain convenience, comfort, efficiency, and privacy. On the other hand, the lack of emotion may deter customers from using SSTs. A participant from Group 1 said, *"Machines are as cold as ice. Their expressions are programmed. There are no authentic human-to-human interactions."*

As for individual customer differences, hotel practitioners stated that youth and older people hold different attitudes toward advanced technology. Older adults are more inclined to socialize with personnel and are less competent with technology. For instance, elderly adults attempting to use advanced technology may ask numerous questions, which could overwhelm hotel staff. Additionally, customers' acceptance may differ by gender. According to hotel practitioners from Group 2, women are less likely to be intrigued by SSTs and

inclined to hold neutral attitudes towards them. A practitioner from Group 2 cited herself as an example: "*[An SST] will not attract me to come here, but I do not hate it.*" Another practitioner from Group 2 stated that some women may feel afraid when staying at a hotel without staff.

Customer acceptance of SSTs is also associated with the purpose of travel. Business travelers who emphasize efficiency and convenience are more likely to accept SSTs. In addition, the hotel grade is another factor; a Group 2 participant said it would be impossible to ask a guest at a Ritz-Carlton to use SSTs:

> They [guests] paid a lot of money and thus, they expect to and should enjoy high-quality human services. By contrast, customers of Hilton Garden Inn and Hyatt Place can accept SSTs. The values provided and money paid should be equal. (informant from Group 2)

Customers' needs influence their acceptance of SSTs as well. If customers have no special requirements, the service delivery channel (i.e., service employees or SSTs) does not matter as long as the service is delivered. If customers need to interact with service employees, they tend to reject SSTs. Conversely, if customers find socializing with employees to be bothersome, they tend to accept SSTs.

Discussion and conclusion

General discussion

On the basis of prior research and the findings of this study, we have proposed a conceptual framework guiding hotels' SST application (Figure 1). This framework clarifies behaviors and their determinants across the three stages of SST application in hotels: adoption decisions, implementation, and customer acceptance. The practitioners consulted in this study indicated that most hotels in China continue to hold wait-and-see attitudes toward innovative SSTs, whereas more and more hotels are expected to adopt SSTs in the near future (e.g., within the next 5 years). This finding confirms an earlier observation that SST application in hotels is a relatively new phenomenon (Kim & Qu, 2014). Contrary to prior work, the future of SSTs has been revealed and is no longer unclear (Kasavana, 2008).

*Insert **Figure 1.** A conceptual framework for the application process of self-service technology in hotels*

Aside from adoption decisions, hotels must also consider how to configure SSTs. Hotel practitioners concurred on the need to prudently combine high-tech with high-touch, suggesting that hotels should implement SSTs gradually and sequentially. SST introduction should begin with forms of service that have no face-to-face component (e.g., decorating conference rooms) while humans continue to handle face-to-face encounters. The employees supplanted by technology can be allocated to provide humanistic care, supporting the prior statement that saved labor can be used to satisfy customers (Oh et al., 2016). This configuration of SSTs and service employees supports the synergy between high-tech and high-touch (Oh et al., 2013; Salomann et al., 2006), while addressing the incompatibilities between SSTs and service employees (Kokkinou & Cranage, 2013; Kucukusta, Heung, & Hui, 2014). In this respect, our study offers valuable insights on how to transform SST adoption into an advantage (Mest, 2014) and contributes to the debate on the appropriate use of high-tech and high-touch.

Overall, our findings indicate that SST adoption decisions and subsequent implementation appear to be associated with SST features, hotel conditions, environmental characteristics, and target customers, while task characteristics were found to influence only the implementation phase. These results concur well with the TOE framework, which contends that technological, organizational, and environmental factors all influence organizations' technology adoption (Baker, 2011). This study also underscores the usefulness of TOE in explaining organizational implementation behavior aside from adoption behavior. More importantly, it extends the TOE framework into a TOECT framework by identifying the influences of customer (C) and task (T) characteristics. The identified customer and task characteristics reinforce the prior suggestion that future research should consider task characteristics when exploring organizational application of SSTs (Baker, 2011; Hameed et al., 2012).

The last stage is customer acceptance. Although Chinese customers were still largely unfamiliar with hotel SSTs at the time of our study, respondents anticipated that people would become accustomed to using SSTs in the near future. This indicated the importance of

cultivating customer habit. The findings also indicate that Chinese customers' acceptance may vary by SST, consistent with the social appropriation of technology. Not all technologies will be used by all consumers. A set of factors (i.e., attractors, repellents, appropriation and disappropriation criteria, and reinforces) influence the appropriation of technology from the design and supply of technology to customers' adoption, which shapes and encourages technology use (Carroll et al., 2002). The result also suggests that customer acceptance can differ by customer demographics, trip profile, customer needs, and SST characteristics (see Appendix 3).

Our findings are consistent with previous studies regarding the influences of perceived privacy (Oh et al., 2013), the need for personal interaction (Oh et al., 2013), demographic factors such as gender and age (Lee, Cho, Xu, & Fairhurst, 2010), and love of technology (Lee et al., 2010), which were derived from customers' perspectives. Additionally, this study reveals that the purpose of travel, the hotel grade, the presence of any special service requirements, and SSTs' lack of emotion can influence customers' acceptance of SSTs; these factors have not previously been mentioned in the customer adoption literature. These newly identified factors confirm the existence of discrepancies between customers' expressed acceptance and hotel practitioners' perceived customer acceptance. Conversely, situational influences (e.g., waiting in line) have been found to influence customer adoption in previous research (Oh et al., 2016; Selnes & Hansen, 2001) but were not mentioned by hotel participants in this study. The differences in the results highlight the importance of understanding practitioners' perceptions of customer acceptance of SSTs (Rosenbaum & Wong, 2015) and reflect the need to integrate organizational and customer opinions when exploring customer acceptance of technology.

Theoretical implications

The theoretical significance of this study is threefold. First, the staged process framework proposed here extends previous theories from the examination of behavioral intention (i.e., adoption decisions) to investigating the post-adoption phase, including the examination of SST implementation and customer feedback (customer acceptance). In the limited literature to date, most researchers have focused on either customers' adoption of hotel SSTs (e.g., Oh et al., 2013) or organizations' decisions to adopt technology, without

making judgements on the subsequent implementation or customer feedback. An exploration of the organizational application of SSTs via anatomizing the application process into distinct stages (e.g., adoption decisions, implementation, and customer acceptance) provides a more detailed understanding of the mechanisms that drive SST application in organizations, along with new research directions.

Second, this study expands our knowledge of technology adoption by organizations and customers. In addition to confirming the influences of technology, organization, and environment on organizational adoption decisions, our findings reveal the influences of other factors (e.g., customer differences), generating a more comprehensive portrayal of previously undetected issues. Moreover, the study identifies determinants of implementation tactics and of end users' acceptance, thereby giving a more holistic picture of SST applications in hotels. Furthermore, it reveals differences among the determinants of adoption decisions and subsequent implementations, providing empirical support for the assertion by Marler, Fisher, and Ke (2009) that differences may exist among the determinants at each stage. The findings further suggest that task characteristics exert influence only at the implementation stage, rather than on the hotels' adoption decisions. Moreover, the study's results indicate that customers' travel purposes and unique needs shape customer acceptance. These considerations have been overlooked in previous studies on customer adoption of technology. The identified discrepancies between the customers' expressed views and hotel practitioners' perceptions of customer acceptance help to enrich our knowledge of customer adoption. They also demonstrate the importance of understanding the practitioners' perceptions of customer acceptance.

Third, this study confirms the importance of national context (Fisher & Beatson, 2002) and enhances our understanding of SST applications in hotels in China. Few studies have examined the use of SSTs in China, and those that did usually focused on the field of finance or libraries (e.g.,Wang, 2016). The participants in this study indicated that SSTs are more prevalent outside China, supporting previous findings that nationality greatly influences SST adoption (Fisher & Beatson, 2002; Lu, Choi, & Tseng, 2011). In participants' opinions, foreign customers place a high value on privacy and are accustomed to using SSTs, whereas Chinese customers are not yet familiar with such technologies. However, an

informant from Group 3 explained that *"with the passage of time, more and more [Chinese] people will develop a habit of utilizing [technologies]... as self-check in at airport."*

Another interesting point was that Chinese customers seem quite selective about services (A practitioner from Group 1). This finding is consistent with the observation by Mattila (1999) that Asian customers tend to have high service expectations, and that this expectation tends to reduce their appreciation for SST-based services. Moreover, hotel guests in China must display their identity cards to check in, and hotels must upload their guests' identification documents in real time, a process not required in other countries. All four participant groups concurred that this type of government regulation inhibited self-check-in. Furthermore, overseas labor costs are generally higher than those in China, resulting in greater recruitment challenges, whereas Chinese labor costs are not high enough to necessitate the use of SST. Consequently, the application of SSTs in China's hospitality industry is likely to be colored by national characteristics.

Practical implications

This study provides four novel insights for hotels regarding the acquisition and appropriate structure of SSTs. First, identified behavior patterns offer valuable references for real-world applications. SSTs are developing so rapidly that hotels may encounter difficulties in updating their knowledge. In this study, up-to-date and integrated information about SSTs was obtained via comments from hotel practitioners. Such timely information enhances our knowledge of SSTs. For example, the findings indicated that hotels should carefully consider the time required to introduce SSTs. Participants also commented that although hotel SSTs are increasingly popular, most are not perfect. Therefore, hotels should test SSTs thoroughly before implementation or wait to introduce them until the devices have been better developed.

Second, given the determinants of each stage, hotel practitioners are advised to make more rational decisions when introducing SSTs, instead of blindly accepting the purported benefits. Trade press reports and social media posts tend to overpromote the benefits of innovative technologies. Hotels may be attracted by these overpublicized claims and may blindly introduce SSTs (Ivanov & Webster, 2017). The identified deterrents (e.g., Chinese government regulations, the people-oriented nature of the hotel industry, and the need to keep

human actors in the loop) should convince hoteliers to carefully examine SST features, hotel conditions, environmental characteristics, customer differences, and task characteristics so as to reach more rational decisions on SST adoption.

Third, more effective strategies can be applied to manage and deploy multiple channels during hotel service delivery. Effective management of service delivery channels increases a hotel's likelihood of success and profitability in an increasingly competitive marketplace (Meuter et al., 2000). The study's participants suggested that managers should consider the service delivery process when making decisions on implementation tactics. These informants implied that hotels should begin SST implementation from back-up departments or hardware (e.g., handling financial work), while take a slow pace in face-to-face service encounters. This approach can help hoteliers to determine the appropriate extent of SST application, which is closely associated with financial performance (Hung, Yen, & Ou, 2012). Additionally, customers tend to view hotel business as a people-oriented industry and thus expect to be served by people. Therefore, hotels should pay attention to improving customer participation with SSTs, as consumers may argue that hotels should not shift their responsibilities to customers. This observation is consistent with the findings of Hilton, Hughes, Little, and Marandi (2013), who asserted that the value customers gain from SSTs should be no less than the value of their co-production role. In this respect, a hotel with a sufficient budget should retain both SSTs and service employees and leave the choice of which service to use to the customers. Alternatively, hotels could consider offering free SST-based services while charging for high-touch human services.

These findings also serve as valuable guidance to help hotels cultivate their customers' habits of using SST devices via appropriate promotions. For instance, hotels can provide detailed instructions, promote the ease of using SSTs, or offer incentives to encourage their customers to use such technologies. Incentives have proven effective in fostering customer habits. For example, three years ago, Chinese people were unfamiliar with take-out apps such as Meituan and Eleme or ridesharing apps like Didi. However, discounted pricing and coupons incentivized rapid uptake, and most residents of mainland China cannot live without these apps today.

Limitations and future research

Two limitations of this study, which imply opportunities for future research, should be noted. First, we explored hotel practitioners' opinions of SST application in hotels in China using a qualitative approach, which tempers generalization. Future work should incorporate quantitative research to validate the findings of this study across other industries and countries or to examine the generalizability of our proposed framework across various types of technologies. Second, the effectiveness of the proposed strategies for integrating SSTs with service employees was not empirically tested in this study. In the future, scholars could conduct case studies to explore examples of hotels that have successfully combined innovative SSTs with traditional manpower. Notably, previous studies have focused exclusively on SST applications in customer service encounters; however, this study confirmed that SSTs are highly suitable for back-office applications as well. This option offers a new research direction: future studies can investigate the application of SSTs in non-face-to-face encounters. Finally, the apparent discrepancies between customers' expressed views and hoteliers' perceptions of customer opinions highlight the need for future research that integrates organizational and customer perspectives when exploring consumer acceptance of technology.

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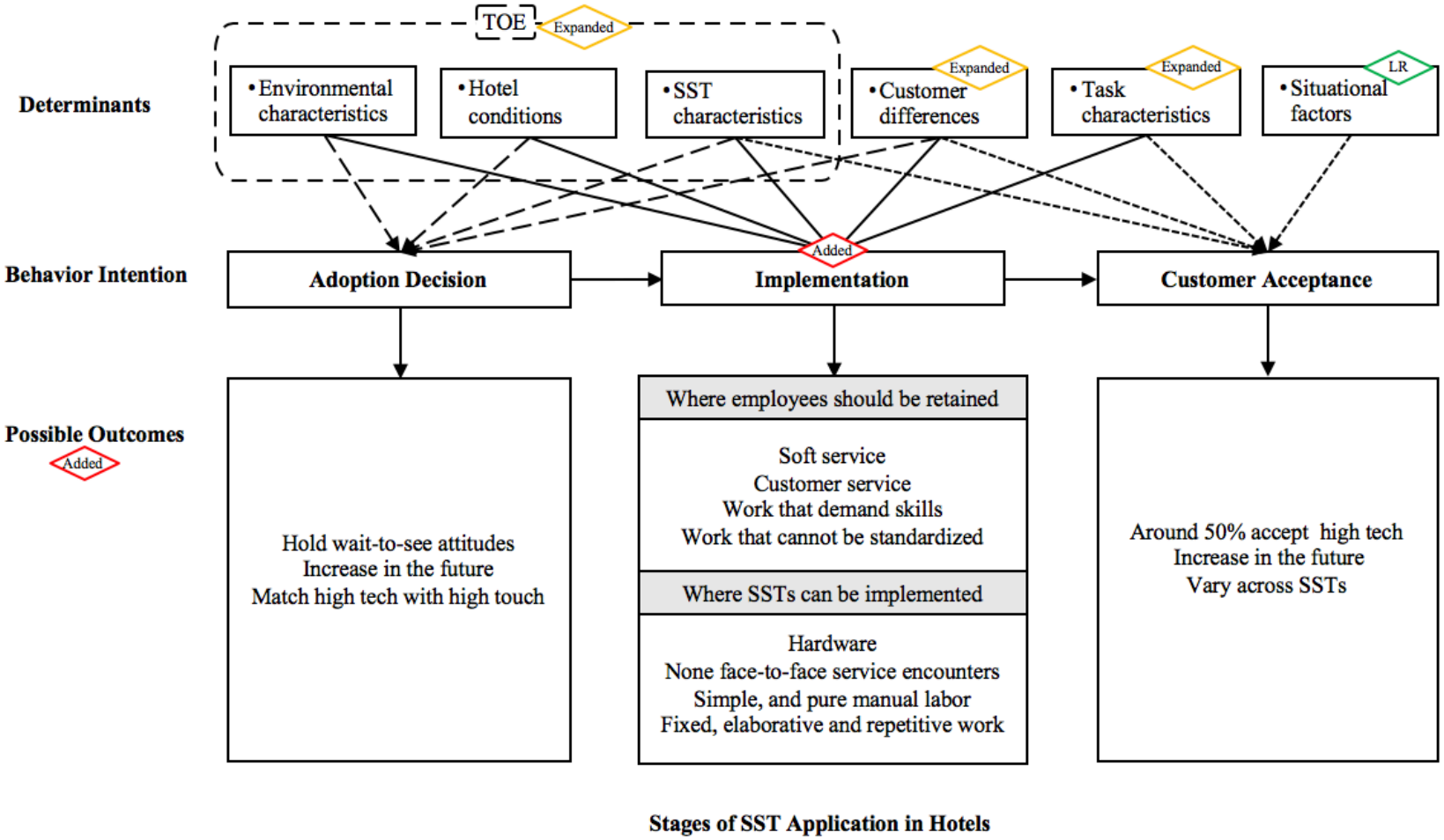

Figure 1. A conceptual framework for the application process of self-service technology in hotels
"Added" means that the relationships and the stage were newly explored.
"Expanded" means that new factors were identified under this dimension.
"LR" means that this dimension was derived from literature review rather than findings.

Table 1. Demographics of participants

Group number	Gender	Age	Job location	Type of organization	Brand affiliation	Position	Years of working experience
Group 1							
Moderator	Male	33	Zhuhai	Luxury hotel	Domestic chain	General manager	12
Informant 1	Female	31	Shenzhen	Luxury hotel	Domestic chain	Assistant human resources manager	10
Informant 2	Female	45	Shenzhen	Luxury hotel	International chain	Finance director	22
Informant 3	Male	42	Kunming	Luxury hotel	Independent	Vice general manager	20
Informant 4	Female	29	Shenzhen	Luxury hotel	International chain	Front office manager	9
Informant 5	Female	44	Sanya	Luxury hotel	Independent	Operation director & executive assistant	15
Informant 6	Female	42	Beijing	Hotel Group	International chain	General manager	20
Informant 7	Male	30	Beijing	Hotel Group	International chain	Administrative director	4
Group2							
Moderator	Male	45	Shenzhen	Luxury hotel	International chain	General manager	22
Informant 1	Male	40	Xiamen	Luxury hotel	Domestic chain	General manager	20
Informant 2	Female	31	Shenzhen	Owner Company	NA	Finance manager	8
Informant 3	Male	32	Shanghai	Luxury hotel	Independent	Director of sales & marketing	10
Informant 4	Female	39	Shenzhen	Hotel Group	Domestic Chain	Project manger	15
Informant 5	Male	32	Changsha	Owner Company	NA	Owners' representative	8
Informant 6	Female	32	Shenzhen	Luxury hotel	International chain	Learning and development manager	11
Informant 7	Female	36	Mudanjiang	Hotel Group	Domestic chain	Owners' representative	13
Group 3							
Moderator	Female	32	Dongguan	Upscale hotel	International chain	Manager	8
Informant 1	Female	46	Shenyang	NA	NA	General Manager	20
Informant 2	Male	33	Beijing	Upscale hotel	International chain	Front office manager	13
Informant 3	Male	39	Shanghai	Group	Domestic Chain	Vice president	18
Informant 4	Male	34	Guangzhou	Owner Company	NA	Purchasing manager	9
Informant 5	Female	40	Guizhou	Luxury hotel	International chain	Finance director	20
Informant 6	Female	33	Shenzhen	NA	NA	Training manager	8
Group 4							
Moderator	Male	40	Guizhou	Hotel Group	Domestic chain	General manager	19
Informant 1	Female	38	Shenzhen	Hotel Group	Domestic chain	Director of human resources	20
Informant 2	Female	30	Beijing	Hotel Group	Domestic chain	Senior administration manager	7
Informant 3	Male	44	Beijing	Hotel Group	Domestic chain	Executive vice president	20
Informant 4	Female	31	Beijing	Luxury hotel	Independent	Accounting manager	9
Informant 5	Female	35	Sanya	Luxury hotel	International	Sales director	13
Informant 6	Female	30	Beijing	Owner Company	NA	Senior purchasing manager	8

NA: Not applicable

Table 2. Focus group discussion questions from two perspectives

Process perspective	Q1: As a result of self-service technology development, some debates on the preference for high-tech over high-touch have emerged in managing hotels in China. We would like to understand your views on this issue. Should the hotels in China pursue high-tech or high-touch?	Q3: If the preference is to pursue high-tech, high-touch, or both, what are the key tactics that China hotels need to implement to produce memorable and satisfying customer experience?	Q5: How is Chinese consumers' acceptance of self-service technology in hotels in China?
Factor perspective	Q2: What are the key concerns in deciding which way to go for, high-tech or high-touch? Please rank top 5 concerns.	Q4: Why?	Q6: What are the factors that influence consumers' acceptance?