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EMPIRICAL ARTICLE

Technology- or human-related service innovation? Enhancing customer satisfaction, delight, and loyalty in the hospitality industry

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Abstract
To sustain a company's competitive advantage, providing innovative products or services is inevitable. Previous researches mainly focused on technology-related service innovation (TRSI), letting human-related service innovation (HRSI) remain largely unstudied. However, the authors believe that human service is the vital factor affecting customers' experiences and thus cannot be overlooked. This study applied the PLS-SEM method to examine the role of TRSI and HRSI and conclude that HRSI applications have a stronger effect on satisfaction and delight. TRSI also moderates the relationship between HRSI applications and delight. Our results provide new information and meaningful guidelines to hospitality practitioners and academic research.

Keywords Technology-related service innovation · Human-related service innovation · Satisfaction · Delight · SmartPLS

1 Introduction

The service industry is experiencing a major paradigm shift in the twenty-first century due to the rapid development of technology. The introduction and popularization of many cutting edge technologies, such as wireless broadband internet, mobile devices, AI, VR/AR, and Internet of Things (IoT) have affected almost every service industry, including hospitality (Tung and Law 2017; Wolfe 2018), and will continue

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to profoundly transform service design and delivery (Hotel News Resource 2017; Lema and Agrusa 2009). The continuous advancement of technology has largely reduced barriers to technology adoption and thus dramatically changed consumer behaviors. Accordingly, increased proficiency and reliance on pervasive technology by a growing population have become a common norm in today's society. Rosenbaum and Wong (2015, p. 1863) indicated that "many travelers now consider hotel technology offerings routine business practice." These include computerized reservation systems (Meuter et al. 2003), mobile information guides (Riebeck et al. 2008), wireless internet (DiPietro and Wang 2010), check-in and checkout self-service kiosks (Griffy-Brown Chun and Machen 2008), and robot applications (Chiang and Trimi 2020; Kervenoael et al. 2020). Yeh et al. (2005) also specify that the use of the Internet, e-commerce, and information technology would become the core competency for any hospitality company to stay competitive due to customers' increasing demand for convenience, easy use, hassle-free service, and immediate accurate information. Given the growing trend of adopting and increasing usage of technology, a hybrid term "untact" service (Lee and Lee 2020; Kim et al. 2018) was introduced in South Korea in the year 2018 to depict the current service delivery style driven by the shift of consumer behavior. According to Lee and Lee (2020, p. 3), "untact service refers to service that is provided without fact-to-face encounters between employees and customers through the use of digital technologies." Untact service is especially preferred by certain types of customers (i.e., technology-savvy professionals, young consumers, one-person household dwellers, introvert persons, and/or public figures) who tend to feel uncomfortable around people and prefer "solo shopping" (Kim et al. 2018). In addition, the increasing acceptance and preference for technology are especially salient during the COVID-19 pandemic. The research result from Kim et al. (2021) demonstrated a preference shift from human service to robot service during the COVID-19 pandemic, which was opposite to the previous researches conducted before the COVID-19 pandemic. This result indicates that the global health crisis will accelerate the pace of technology acceptance and adoption in more industries in the future (Chiang and Trimi 2020).

Responding to the shift in consumer behavior, more and more advanced self-service technologies (SST) are implemented in the hospitality industry. For example, Starwood Hotels invested in mobile check-in technology and replaced traditional keycards with mobile entry devices (Chahal and Kumar 2014). Silk Place, Tainan, introduced a robot delivery service for amenities to hotel guests. Other self-service devices, such as restaurant order tablets and airport check-in kiosks have become a common scenario in today's service settings. The major strengths of self-service technology applications stem from their ability to customize service experiences by tracking customers' preferences (Yeh et al. 2005), increasing service choices, and expanding interactions between customers and organizations (Davis et al. 2011). This inevitable trend of technology adoption is transforming the service industry from a traditional "high-touch and low-tech" into a "low-touch and high-tech" environment, as supported by Bitner et al. (2000). Lee and Lee (2020) also indicated that customers may regard friendly service persons as the minimal requirement of good-quality service as they increasingly adopt and rely on services provided by big-data-supported technology.

In stark contrast, strong opinion supports the vital role human factors play during service encounters (Kandampully et al. 2016; Luo et al. 2019; Shin et al. 2019). Service encounters are viewed by customers as a social experience, and, therefore, they may prefer human interaction during the encounter process (Curran and Meuter 2005; Zeithaml and Gilly 1987). Hospitality, by its definition, is a shared experience between a host and a guest, and therefore the foundation of hospitality service is on "hospitableness" denoting the positive attitudes of service providers to make their guests feel cared for, welcome, and valued (Kim et al. 2020). According to Golubovskaya et al. (2017), hospitableness signifies the service offered by humans and is characterized by emotional treatment and emotional interaction between service staff and the guest. Accordingly, unique and authentic human interaction, even minor gestures by employees, can differentiate offerings in the marketplace (Bowen 2016) and build a distinctive brand image for the company (Bolton et al. 2014). Despite technology often outperforming humans, empathy and creativity are two areas where humans remain superior to technology (Larivière et al. 2017). Technology can achieve operational outcomes of efficiency, consistency, and reliability that meet customer expectations, but service employees' displays of assurance, responsiveness, and empathy can initiate a warm exchange between people, thus meeting customers' emotional needs and exceeding their expectations (Parasuraman et al. 1991). In other words, human services are more effective in providing unique and memorable experiences through addressing customer emotional needs and forming an emotional connection with customers. (Chan and Tung 2019; Kim et al. 2021; Wang et al. 2015). In addition, human beings are capable of self-learning meaning that by accumulating work experiences, service personnel are constantly learning and evolving their service skills so that they are capable of coming up with creative ways of service based on each unique service encounter to satisfy customer's different needs and to further provide unique experiences to customers. As Miles (2010) indicated that innovation as creativity often derives from frontline employees through their creative discretion during the service encounter. This advanced self-learning and constant service-improving capability are so far unachievable by technology. Even though customers increasingly adopt SSTs and perform service by themselves, consumer satisfaction and retention may be impaired by the loss of the social bond and the lack of interpersonal interaction during service encounters (Beatson et al. 2007). Chiang and Trimi (2020) also specified that today's service robots are capable of performing the first two levels of AI (i.e., mechanical and analytical) but still lack proficiency in the two high-order intelligence (i.e., intuitive and empathetic). While the application of technology has attracted much attention and resources in the hospitality industry, the human factor cannot, and should not, be overlooked.

Recent studies regarding service innovation in service and hospitality industries mainly focus on technology-related innovation. Topics include technology adoption processes (Kaushik et al. 2015; Lopez-Bonilla and Lopez-Bonilla 2015); technology acceptance behaviors (Weijters et al. 2007); service innovation archetypes (Helkkula et al. 2018); and technology readiness (Zhu et al. 2007); among others. Hertog et al. (2011) pointed out that the hospitality industry is relatively strongly focused on innovations in assortment and technology leaving

non-technological innovation largely unobserved. Very limited research has compared and distinguished the roles different types of innovation (i.e., technology-related service innovation (TRSI) and human-related service innovation (HRSI)) play in desired outcomes such as customer satisfaction and delight. Fernandes and Pedroso (2017) also mentioned that while many studies focus on reasons for adoption and intention to use SSTs, very little research investigates the impact of SST on customer satisfaction and retention (Beatson et al 2007; Lee et al. 2009; Wang 2012; Orel and Kara 2014). It is widely acknowledged that an emotionally enriched experience characterized with intense positive emotions and fulfillment of customers' higher-order needs can sustain a long-term relationship with customers. However, there is no empirical evidence to suggest what type of service innovation (i.e., TRSI or HRSI) is more effective to provide emotionally enriched experiences. In addition to the direct effect of TRSI and HRSI on customer satisfaction and delight, we also suspect the existence of a moderating effect of TRSI between HRSI and customer satisfaction and delight. Certain types of extraordinary human services (e.g., empathetic attitude and elaborative thinking ability) can be performed independently by service employees based on their ability, attitude, and experience and therefore the facilitation of technology on providing detailed customer information may provide limited value. However, other types of services (e.g., personalized services) may rely heavily on technology to provide service personnel with detailed customer information so that they can know the customer in great detail and make highly personalized services possible. This information is believed to be useful and valuable to industry practitioners, especially small business operators with limited company resources so that they can smartly invest resources to the more effective innovation mechanism to achieve higher customer satisfaction and maintain sustainable relationships with customers. In response to many scholars calling for more specific investigations into different types of service innovations and their relations with desired service outcomes (i.e., satisfaction, delight, and loyalty) (Shin and Perdue 2019; Victorino et al. 2009), this study is dedicated to providing a clear understanding of the function of two types of service innovation (TRSI vs. HRSI) on satisfying customers' cognitive needs and eliciting customers' state of delight. The results of this study are expected to contribute managerially to hospitality practitioners through valuable insights into the function of various service innovation mechanisms, and the resultant impact on customer satisfaction, delight, and loyalty. This information can assist management in better allocating limited company resources to the appropriate service innovation mechanism. Additionally, this study contributes academically by supplementing empirical evidence on the relationship between service innovation mechanisms and customer satisfaction, delight, and loyalty. Accordingly, the following objectives are proposed:

(1) To understand customers' reactions toward various hospitality-specific technology-related service innovation applications.
(2) To study the function of different types of service innovation (TRSI and HRSI) on customer satisfaction and delight.
(3) To examine the moderating effect of TRSI mechanisms.

This paper is organized as follows. A review of relevant literature and hypotheses are presented in Sect. 2. The data collection method and results are then described. The article concludes with a discussion of the research findings, implications, and directions of future research.

2 Theoretical foundations and hypotheses

2.1 An overview of service innovation

To satisfy customers' rapidly changing needs and sustain long-term customer relationships, innovation is the pivotal component for every organization in adapting to this fast-evolving environment. Innovation was defined by Schumpeter (1934, p.66) as "a separate activity through which inventions are carried out in the market for a commercial purpose." Two inferred conditions include an actual market launch and profit generation for the company (Synder et al. 2016). Witell et al. (2016) referenced the study of Coombs and Miles (2000) and categorized existing service innovation research into three perspectives: assimilation, demarcation, and synthesis. The assimilation perspective suggests that knowledge of product innovation is applicable to all types of offerings (Witell et al. 2016). Studies applying the assimilation perspective focus heavily on the impact of new technology (Gallouj 2002) and suggest that the service sector is becoming more technology- and capital-intensive (Gallouj and Savona 2008), and supplier-dominated, suggesting that service firms are passive receivers of innovation from other sectors (Pavitt 1984). The demarcation perspective proposes that "innovation in service industries is unique and needs to be treated differently from other types of offerings" (Witell et al. 2016, p.2870). Researchers taking demarcation perspectives argue that the assimilation perspective has failed to recognize the specificities of services (Gadrey et al. 1995) such as the intangible nature of services, the need for customer integration, and the impacts of organizational knowledge and non-technological elements (Hipp and Grupp 2005). Therefore, demarcation researchers propose a perspective of service innovation, distinct from manufacturing innovation, focusing heavily on the different features of service. Finally, the synthesis perspective contends that service innovation theories should be inclusive to cover both services and manufacturing (Coombs and Miles 2000) and should not limit its perspective only to technological innovations.

This study believes that service innovation should be treated differently from other types of innovation due to the unique characteristics of service namely intangibility, inseparability, perishability, and variability (Zeithaml et al. 1985). If attention is paid to those qualities, it may be possible for ideas and applications that are even more creative to thrive. Therefore, this study defines service innovation as technological and non-technological-related new services, as well as a renewal of an existing service, that is implemented in the market and generates benefits to the organization and customers.

The divergence of service innovation research exists in both its core concepts and its typology. Four main types of service innovation can be identified in previous research (Kahn 2018) including product/service-, process-, marketing-, and

organizational innovation. In addition, Snyder et al. (2016) did a comprehensive literature review and proposed four service innovation categorization including the degree of change (radical vs. incremental), type of change (product vs. process), newness (new to the market vs. new to the firm), and means of provision (technology vs. organization). The researchers find the means of the provision is especially relevant to this research since the objectives of the present study are to study customers' reactions and acceptance to different types of service innovation. Dotzel et al. (2013) proposed e-innovations and p-innovations to emphasize the key role that the Internet (technological element) and human interactions (human service element) play in service innovation. According to Snyder et al. (2016, p. 2405) "e-innovations are new services that provide customer benefits primarily through the Internet, whereas p-innovations are new services delivered primarily through human interactions." By adopting previous scholars' categorizations, this study divides service innovation in the hospitality industry into two categories, being including technology-related service innovation (TRSI) and human-related service innovation (HRSI), and studies customers' reactions and acceptance of these two types of service innovation mechanisms.

2.2 Technology-related service innovation applications in the hotel industry

As suggested by Tether (2005), and Toivonen and Tuominen (2009), new technology is considered by early studies as the main driver of service innovation. The impacts of new technologies in enhancing an organization's operational efficiency, facilitating better communication quality with customers, and improving service efficiency are apparent. The study conducted by Piccoli et al. (2017) specifically asserted that IT-enabled customer service systems (CSS) can increase customer preference elicitation by offering appropriate signifiers to aid users in formulating and recording their preferences. By better presenting and organizing service options, customers can find it relatively easier to choose from, and match, the services offered with their needs, and therefore increase their degree of satisfaction. Overby(2008) also depicted that IT-enabled CSS facilitates customers to better match their preferences with service offerings by providing better presentation and reducing the disambiguation of a large number of options. Bitner et al. (2000) indicated that customers' service experience and satisfaction could be improved, through efficiency and effectiveness with the assistance of technology on customization, improving service recovery, and providing spontaneous delight. Yang et al. (2003) asserted similarly that, with the facilitation of IT-enabled CSS, customers' satisfaction with the shopping experience can be attained through experiencing a higher degree of personalization and individual attention. In addition, researchers also suggested that self-service technology (SST) could provide a more reliable service atmosphere and stable service standard by reducing problems of heterogeneity and perishability (Beatson et al. 2007; Elliott et al. 2013) and thus increase customer satisfaction. Therefore, we proposed:

Hypothesis 1a TRSI elements have a positive effect on customer satisfaction.

Few studies can be found regarding the impact of TRSI on customer delight. Only a handful of previous research addresses the indirect relationship through customization or personalization. For example, Piccoli et al. (2017) suggested IT-enabled CSS can assist customers to find better-matched services to satisfy their latent preferences and unexpressed needs by presenting more appropriate signifiers that can provide customers with guidance and direction during shopping episodes. With customers' latent or unexpressed needs being fulfilled, their positive states of emotion (customer delight) can be aroused as indicated by previous scholars that personalized services can induce desired emotions and build stronger emotional links between service providers and customers (Liang et al. 2012). In addition, De Kervenoael et al. (2020) in their study of human–robot interaction indicated that the presence of social robots brings about a sense of cool, novelty, and "wow" experience leading to the increase of intention to use social robots and also delivering a delightful experience to customers. Due to the lack of researches on the relationship between TRSI and customer delight, this study finds it necessary to provide further empirical evidence to elucidate this relationship. Consequently, we proposed:

Hypothesis 1b TRSI applications have a positive effect on customer delight.

2.3 Human service-related innovation applications in the hotel industry

Human service deserves more attention in the academic research of service innovation. As claimed by Howells and Tether (2004), service innovations include both technological and non-technological innovations (i.e., organizational and relational change), and such approaches aim to accentuate the importance of human and organizational capabilities in service innovations. Ottenbacher and Gnoth (2005, p. 218) indicated, "Technology offers little competitive advantage for hospitality services because competitors are likely to obtain similar resources and technology." Human service, on the other hand, is suggested to represent the important cornerstone for service innovation (Lee and Hyun 2016) because innovation as creativity often derives from frontline employees through their creative discretion during the service encounter (Miles 2010). Martin-Rios et al. (2019) also specified that new or improved workplace practices, among other non-technological innovations, are more likely to be successful for innovation performance. Human interaction is proposed as the dominant factor that affects consumer experiences of satisfaction and delight (Arnould and Price 1993; Hinkin and Tracey 1998; Wang et al. 2015; Luo et al. 2019). The most desirable outcome of forming a genuine emotional connection with customers can be more effectively achieved through exceptionally positive human interaction (Berry and Carbone 2007; Berry et al. 2006). Even though the service innovation research on the human service element is relatively scant, some scholars are addressing the importance of human service on service innovation. Ryu and Lee (2018, p. 305) indicated that "nontechnological innovation factors – such as information-intangible contents of service products, highly qualified employees, efficient delivery processes, service delights, and intensive customer interactions – are more critical for service innovation success than technological ones." Harris

and Ogbonna (2001) also contended that the attitudes and behaviors of frontline service employees have an extreme effect on customer perception and interpretation of new service encounters. Especially in the experiential era, customers seek to obtain values through unique experiences from every service encounter. Human service may outperform technology in the aspect that human interaction can attend to customers' emotional needs by delivering a sense of empathy, desired social identity, and a sense of exclusivity through having personal attentions. As Champiss et al. (2015) depicted that service consumption will create values for customers when the consumption experience reinforces a customer's identity or a customer may attain a desired social identity. Chan and Tung (2019) also stated that human employees were better than service robots in providing enriching experiences and forming an emotional connection with customers. The intense emotional contentment delivered through interpersonal interactions is the area where technology is unable to achieve. This study thus believes that human service may have stronger influences on customer satisfaction and delight than technology does. It is crucial to get a better understanding of the effect that human service and technology have on customer satisfaction and delight, so industry managers can have a better judgment on strategic planning.

The non-technological element of service innovation in this study particularly refers to the extraordinary service actions as evidenced in service employees' absolute professionalism (both behaviorally and attitudinally), exceptional empathetic and attentive behaviors, and extreme helpfulness in providing one-stop services (Luo et al. 2019). As specified by Martin-Rios et al. (2019) that non-technological service innovation includes new or improved workplace practices. Ryu and Lee (2018) also specified that non-technological innovation includes information-intangible contents of service products, highly qualified employees, efficient delivery processes, service delights, and intensive customer interactions. By providing customers an extensive degree of caring, respect, attentiveness, and help that customers have never experienced before, the service provider may deliver a sense of WOW and novel feeling. Accordingly, service staff's extraordinary service offerings can be considered as new or improved workplace practices and thus is an innovative way of service. Besides, since the service staff's exceptional service is beyond customers' expectations, it can initiate strong affective feelings to achieve customer delight. Therefore, we define HRSI as service employees' ability to upgrade or to advance their service offerings to an extraordinary level by providing customers an exceptional degree of care, respect, and extreme help that vastly exceeds beyond customers' expectations and has never been experienced before. Thus it can elicit a strong sense of WOW and novel feeling to achieve customer delight.

The main differentiators between extraordinary service and ordinary service rely on the frontline employees' empathetic and attentive behaviors, keen sensitivity, sharp observation skills, elaborative thinking ability, and proactive and quick response ability (Luo et al. 2019). The above-described attributes are similar to the element proposed by Sorensen et al. (2013) as social intelligence. According to Sorensen et al. (2013, p. 1451) "social intelligence requires, more importantly than traditional communicative skills, a type of anthropological expertise that makes employees capable of 'reading' and understanding users' needs and satisfaction with

different aspects of service by interpreting their behavior during service encounters." Employees possessing social intelligence are capable of understanding, observing, and taking seriously the needs of the guest by being able to put oneself in his/her place, which is an important element of being able to get ideas or to create new practices, based on service encounters (Sorensen, et al. 2013). Extraordinary service performance is, therefore, not only able to satisfy customers' apparent needs but also capable of eliciting customers' positive state of delight by detecting their hidden desires and actively providing appropriate service to satisfy their unexpressed requirements (Mattila and Enz 2002; Menon and Dube 2000; Torres and Kline 2006, 2013; Tung 2012; Wang et al. 2015). In other words, service employees with better social intelligence are capable of reacting more promptly and adjust their service offerings more appropriately and creatively through observing customers' subtle changes of gestures or facial expressions to satisfy customers' hidden emotional needs. These instant service adjustments especially tailoring to attend to customers' unspoken emotional needs are beyond customers' expectations and have never been experienced before. Therefore, the exceptional service offerings can deliver a sense of novelty and elicit a strong emotional feeling of delight in customers. As human service or human interaction is suggested, by various researchers, as the dominant factor affecting consumer experience (Arnould and Price 1993; Hinkin and Tracey 1998), and plays a critical role in creating customer delight (Berry et al. 2006; Wang et al. 2015, 2017), we propose:

Hypothesis 2a HRSIs have a positive effect on customer satisfaction.

Hypothesis 2b HRSIs have a positive effect on customer delight.

Hypothesis 2c The effects of HRSIs on customer satisfaction will be stronger than the effects of TRSI applications.

Hypothesis 2d The effects of HRSIs on customer delight will be stronger than the effects of TRSI applications.

2.4 Customer satisfaction, delight, and loyal behaviors

The positive relationships between satisfaction and loyalty (Ganesh et al. 2000), satisfaction and delight (Eisenbeiss et al. 2014; Kumar et al. 2013; Ranaweera and Menon 2013) as well as delight and loyalty (Kumar et al. 2001; Pine and Gilmore 1999; Torres and Kline 2006) have been well documented in previous studies. Schiffman and Kanuk (2004) defined customer satisfaction as a customer's perception of the product or service compared with his or her expectations. When customers' perception outperforms their expectation, satisfaction can be attained, driving customers' willingness to stay with the company to sustain their positive experience and thus secure the company's profitability. Accordingly, customer satisfaction has long been proposed to have a positive effect on inducing desirable customer loyal behaviors such as repeat purchase behavior (Bearden and Teel 1983), and positive

word-of-mouth (Ganesh et al. 2000). The relationship between satisfaction and delight is also suggested. Customer delight is defined by Crotts and Magnini (2011) as a customer's experience of a product or service that provides an unanticipated level of value or satisfaction. Customer delight is conceptualized by some researchers as a positive, non-linear response to satisfaction at very high levels (i.e., the delight zone of satisfaction; Eisenbeiss, et al. 2014; Kumar et al. 2013; Ranaweera and Menon, 2013). That is when customers' perceived experience vastly exceeds beyond the upper thresholds of their zone of tolerance or comfort level (Keinningham et al. 1999), a strong pleasurable affective state will be aroused, which leads to customer delight. In addition, delight is also proposed to have a positive relationship with loyalty. According to Finn (2005, 2012), unlike satisfaction which involves cognitive evaluation of a service's performance, delight is the "key emotional response" to a consumption experience. Delight is defined by some researchers as a pure emotional element that can be attained by satisfying customers' higher-order, hedonic (enjoyment-related) needs (Augustin & Singh, 2005; Chitturi, et al. 2008; Eisenbeiss et al. 2014) and can result in the elicitation of strong positive emotions of joy, thrill, and exhilaration in customers (Kumar et al. 2001). As a positively valenced state, delight corresponds to a strong desire for future recurrences (Chitturi et al. 2008; Oliver 2010). However, previous research results regarding the effect of satisfaction and delight on loyalty are divergent. Some researchers suggested that delight is a positive, non-linear response to satisfaction at very high levels (i.e., the delight zone of satisfaction; Eisenbeiss, et al. 2014; Kumar et al. 2013; Ranaweera and Menon, 2013), while others accentuated the parallel and separate role of delight to that of satisfaction on loyalty (Ahrholdt et al. 2019). In addition, some researchers found that satisfaction has a stronger effect on customer loyalty than delight does (Kim et al. 2015; Loureiro 2010) but others discover the opposite (i.e., delight exert a stronger effect on loyalty than satisfaction does) (Bartl et al. 2013; Kim 2011; Wang 2011). This study believes that it is crucial to investigate which element (satisfaction vs. delight) exerts a stronger impact on loyalty to reinforce the significance of customer delight. As suggested by previous scholars that with increasing competitive intensity in the current marketplace, ensuring customer satisfaction through the provision of products or services that merely meet their expectations is no longer adequate to maintain long-lasting customer relationships (Deming, 1986; Torres and Kline 2006, 2013). To sustain a long-term relationship with customers, companies are required to go a step further to attain customer delight that can build a strong emotional bond with customers and thus secure customers' long-term loyalty (Kandampully, 1998). This information is useful and practical for industry practitioners, as they need to have better understandings of the differentiation in effect between these two elements so that they can implement strategies that are more effective in eliciting positive emotions in customers to sustain customer loyalty. Since the academic understanding of the effect of satisfaction and delight on loyalty remains inconclusive and divergent, this study focuses our attention on providing additional empirical data to investigate the role of satisfaction and delight on customer loyalty.

According to Crotts and Magnini (2011), delight is a customer's experience of a product or service that provides an unanticipated level of value or satisfaction, which results in the elicitation of strong positive emotions of joy, thrill, and

exhilaration in customers (Kumar et al. 2001). Because of the high level of positive emotion, customer delight has been suggested to be able to induce memorable experiences (Kumar et al. 2001; Torres and Kline 2006), create an emotional bond between customers and providers (Pine and Gilmore 1999), and increase customers' intentions to repurchase and recommend (Pine and Gilmore 1999). Cohen and Areni (1991) also indicated that human emotions including delight have a significant impact on episodic memory and are greatly correlated with cognitive evaluations. That is customers' emotional experiences, created through delight, can be retrieved and integrated into people's evaluation (Arora and Singer 2006), which in turn affect customers' return decisions. Customer delight, as a result, is suggested to have a stronger correlation with customer loyal behaviors. The following hypotheses are drawn, and the conceptual framework is depicted in Fig. 1.

Hypothesis 3 Customer delight (3b) has a stronger effect on customers' loyal behaviors than customer satisfaction (3a) does.

Except for the direct effect that TRSI may have on customer satisfaction and delight, we are also interested in the moderating role TRSI may have between HRSI and customer satisfaction and delight. Based on the researchers' observation and understanding, certain types of extraordinary human services (e.g., empathetic attitude and elaborative thinking ability) can be performed independently by service employees based on their ability, attitude, and experience and therefore the facilitation of technology on providing detailed customer information may play a limited role. However, other types of services (e.g., personalized services) may rely heavily on technology to provide service personnel with detailed customer information so that they can know the customer in detail and make highly personalized services possible. Previous researchers suggest that customers can better match service offerings with their needs by the facilitation of IT-enabled customer service systems (CSS) and thus increase their satisfaction (Piccoli et al. 2017). We suspect that the same facilitation can also be provided to service personnel to assist their job

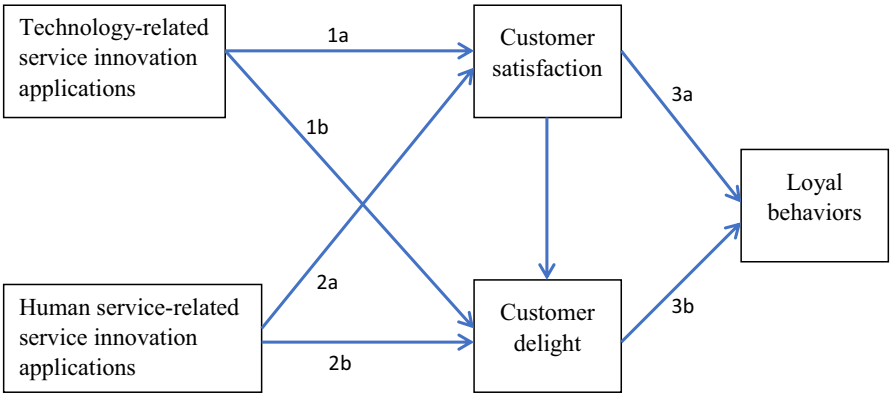

Fig. 1 Conceptual framework

performance. That is with the assistance of various applications of TRSI, frontline service employees may find it easier to understand customers' preferences and to provide better quality and more personalized service to customers, which can then attain higher customer satisfaction and delight. Besides, technology may also facilitate human service in another manner. As suggested by de Kervenoael et al. (2020) that through the assistance of social robots in handling repetitive, often monotonous tasks, service employees can have more time to spend with guests to understand and attend to guests' emotional needs and to cultivate unique and personalized experience with customers. Previous researchers also suggested that the importance of the interplay between non-technological and technological elements of innovation has gained increasing acknowledgment in both academia and industry (Gallouj 2002; Hipp and Grupp 2005). However, to our understanding, the moderating effect of TRSI has rarely been studied before. Therefore, we proposed the following hypotheses. The conceptual framework is depicted in Fig. 2.

Hypothesis 4a TRSI applications play a moderating role between HRSI and customer satisfaction.

Hypothesis 4b TRSI applications play a moderating role between HRSI and customer delight.

3 Method

We apply a partial least square (PLS) approach (Hair 2010; Hair et al. 2019) to analyze the data. PLS-SEM is commonly used for the estimation of causal relationships involving latent constructs that are measured indirectly by many indicators (Salameh et al. 2018) and is the preferred method when the research objective is theory development and explanation of variance (Taghizadeh et al. 2018). PLS-SEM has advantages of supporting predictions, and the assessment of the prediction-oriented result

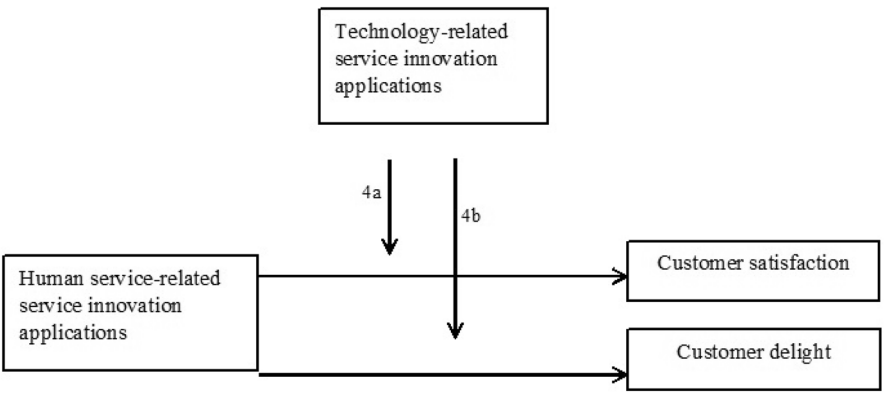

Fig. 2 Moderating effect of technology-related service innovation application

(Evermann and Tate 2016; Shmueli et al. 2016) and can be used if less rigid theoretical backgrounds are available (Hair et al. 2012; Henseler et al. 2014). Theoretical background on the relationships between TRSI and HRSI applications and customer satisfaction and delight is limited. Therefore, we found partial least square approach is suitable for our study.

3.1 Research sample

The questionnaire was distributed to hotel guests using the snowball sampling technique. Specifically, three researchers distributed the questionnaire to their colleagues, friends, and relatives who frequently stay in four and five-star hotels when they travel. These participants were then asked to introduce more candidates who have similar backgrounds and experiences. This study must recruit survey participants who have sufficient experience on both TRSI and HRSI during their hotel stays so that they can evaluate the relative importance of TRSI and HRSI on their satisfaction and delight. Snowball sampling technique enables the researchers to recruit a specific group of participants (experienced hotel dwellers) with specific experience (sufficient experiences on both TRSI and HRSI) and therefore it is regarded as an appropriate sampling technique for this study.

To ensure the recruitment of appropriate candidates, the foremost important criterion of survey participants that is having abundant experiences of staying in four and five-star hotels was carefully explained to those who were willing to help with the recruitment task. The second batch of survey participants was given a link to an online survey and the results of their answers were directly sent back to the researchers. Only the researchers have the authority to access the online survey and see the results. The whole process of data collection took about two months and a total of 479 valid questionnaires were collected. The majority of participants (97.3%) were Taiwanese citizens, while 2.7% of respondents were from the USA. Among these participants, slightly more were female responders, in a female to male ratio of 56.2% and 43.8%, respectively. The age breakdown of participants was: in their 30 s (18.0%); 40 s (33.8%); and 50 s (29.6%), and educationally divided into a bachelor (60.1%) and masters (30.3%) degrees. Most of them (48.6%) earned less than 1 million NT dollars per year with careers in the service industry (23.6%), manufacturing industry (13.2%), technology industry (10.2%), and finance & insurance industry (10.0%). A substantial number (70.6%) of responders are married and mostly travel for leisure purposes (88.1%) (Table 1).

3.2 Research procedure and measurements

This study was a questionnaire survey conducted in two phases. The first phase survey was designed to discover service innovation applications (both technology-related and human-related service) currently implemented in four and five-star hotels in Taiwan. The aim was to obtain this information in highly ranked hotels in Taiwan and to lay the foundation for the second phase of the questionnaire design. The researchers firstly conducted a comprehensive literature review to design a

Table 1 Demographic information of survey participants

	Number	Percentage
Gender		
Male	210	43.8
Female	269	56.2
Age		
20–29 years old	45	9.4
30–39 years old	86	18.0
40–49 years old	162	33.8
50–59 years old	142	29.6
60–69 years old	31	6.5
Above 70 years old	13	2.7
Education		
High school/vocational school	31	6.5
Bachelor	288	60.1
Master	145	30.3
PhD	15	3.1
Yearly salary (in NTD)		
400,000 ~ 690,000/year	139	29.0
700,000 ~ 990,000/year	94	19.6
1,000,000 ~ 1,290,000/year	73	15.2
1,300,000 ~ 1,590,000/year	53	11.1
1,600,000 ~ 2,000,000/year	37	7.7
Above 2,000,000/year	72	15.0
Missing	11	2.3
Occupational field		
Service industry	113	23.6
Manufacture industry	49	13.2
Technology industry	63	10.2
Finance & Insurance industry	48	10.0
Others (include construction, retail, transportation, catering, education, mass communication, medical, entertainment industry)	160	33.3
Marital status		
Married	138	70.6
Single	141	29.4
Travel purpose		
Business	57	11.9
Leisure	422	88.1

list of questions involving a variety of technology-related and human-related service innovation applications. We then invited high-ranking managers (i.e., director, supervisor, and general manager) from eighteen four- and five-star hotels in Taiwan to answer whether these applications were implemented in their hotels and to

include any applications that had been omitted from the survey questions. Participants were also asked to indicate other service innovation applications they planned to employ in the future. The results of the first phase survey identified six current TRSI applications, three future TRSI applications, and eight HRSI applications.

The second questionnaire was then designed with seven sections of questions. The first section contained questions about TRSI applications currently implemented in the hotels; the second section focused on HRSI applications. These two sections of questions were designed based on the results from the first survey. The third section contains three questions from Finn's study (2005) to accessed customer satisfaction. The fourth section adopting 4 questions from Finn's (2005, 2012) and Wang's study (2011) evaluated customer delight, and four questions from the researches of Chitturi et al. (2008) and Oliver (2010) were applied to examine customer loyalty. The last section of questions was designed to collect participants' demographic information.

Upon the completion of the questionnaire design, a double translation process was undertaken. We firstly translated all questions into Mandarin Chinese. This process was done by three researchers of the current study, who are bilingual and were educated in the United States, England, and Switzerland. Several discussions were performed by three researchers to ensure that the precise meaning was conveyed. Then one researcher's relative who has lived in the United States for more than 40 years was invited to perform back translation to ensure the precision of the language. The questionnaire was then distributed to 30 subjects who have abundant experiences of staying in upscale hotels for pre-testing. Several questions (i.e., RFID key card, facial recognition key card system, room service ordering through in-room television) were deleted due to the unavailability in most hotels. Some wordings were further modified to increase the precision of the questions.

3.3 Data analysis

SmartPLS 3.8 software is used to estimate the proposed model. The PLS-SEM method runs two-step approaches for data analyses, involving measurement model testing and structural model testing.

3.4 Measurement model testing

To assess the measurement model, we examined the reliability and validity (convergent validity and discriminant validity) of the constructs. Item reliability examines whether the manifest indicators measure only a particular construct by checking their item loadings on the corresponding construct (Lok 2015). It is determined through factor loading, composite reliability (CR), and Cronbach's α. Two items (participate in online travel metasearch engine and equipped with Washlet) in the section of TRSI elements are excluded because the factor loadings did not exceed 0.50 (Hair et al. 2012). CR values of each construct range from 0.812 to 0.942 which exceed the threshold value of 0.7 (Hair et al. 1998). Cronbach's α of each construct

is from 0.693 to 0.909 surpassing the threshold value of 0.6 (Hair et al. 2006). These results indicate the high internal reliability of the proposed constructs.

To check for validity, average variance extracted (AVE) is used to test convergent validity, while the Fornell–Larcker ratio (Fornell and Larcker 1981) is run to examine the discriminant validity. Convergent validity examines whether the AVE of each construct is larger than its correlation with other constructs. Discriminant validity examines the degree to which items differentiate among constructs by comparing the correlations between constructs and the square root of the average variance extracted for that construct (Taghizadeh et al. 2018). AVE of each construct is between 0.521 and 0.843 which exceed the threshold value of 0.5 (Fornell and Larcker 1981) and the square roots of the AVEs (the values on the diagonals) are greater than the construct correlations indicating a satisfactory convergent and discriminant validity of the proposed measures. The results of the reliability and validity test are presented in Tables 2 and 3 below.

Regarding the goodness-of-fit of the model, according to Hair et al. (2019, p. 7), "while CB-SEM strongly relies on the concept of model fit, this is much less the case with PLS-SEM." Scholars explained that the algorithm PLS-SEM applies is not based on minimizing the deviance between observed and estimated covariance matrices, instead, PLS-SEM mainly focuses on prediction and theory testing and results should be justified accordingly (Hair et al. 2019; Shmueli 2010). Three criteria were proposed to exam the model fit with the PLS model including significant path coefficients, reasonably high R^2, and construct reliability above 0.7 for each construct (Barclay et al. 1995; Lok 2015). The results of the three criteria of this study, which were presented in the next section, meet the suggested standards and therefore the goodness-of-fit of the proposed model should be fairly ascertained.

3.5 Structural model testing

To evaluate the structural model, a bootstrapping procedure with a resample of 5,000 (Henseler and Chin 2010; Hair et al. 2016) was applied to estimate the significance of the paths in the model (the t-value) and to measure the explained variance or predictive power (the R^2 value). Figure 3 and Table 4 highlight the results of path coefficients, significance levels, and R^2 values. Barclays et al. (1995) suggested that R^2 is a measure used for assessing the predictive power of the model for the endogenous constructs. In other words, the R^2 of examined variables indicates how well the examined variables measure their underlying latent constructs (Ahmad 2015). Therefore, we look into the R^2 value to examine the predictive power of technology and human-related service constructs on customer satisfaction, delight, and loyalty. We apply the critical values suggested by Cohen (1988) of $R^2 > 0.67$(strong predictive power), R^2 around 0.33 (moderate predictive power), and R^2 around 0.19 (weak predictive power). In this study, R^2 values of satisfaction, delight, and loyalty are 0.402, 0.648, and 0.642 respectively indicating that the proposed variables (TRSI and HRSI elements) have moderate to strong predictive power on customer satisfaction, delight, and loyalty.

Table 2 Reliabilities and validities results

Construct	Items	Factor loadings	CR	AVE	Cronbach's α
Current technology	Mobile payment system	.614	.812	.521	.693
	Customer feedback system	.735			
	Customer service system	.799			
	Hotel online reservation system	.704			
Service delivery styles of service personnel	One-stop service	.712	.917	.580	.896
	Sensitive and observant	.792			
	Create a sense of familiarity	.763			
	Extra friendly and enthusiastic	.747			
	Make customers feel special	.678			
	Stand in customer's shoes (be empathetic)	.839			
	Ability to think elaborately	.756			
	Serve beyond duties	.794			
Satisfaction	Feel satisfied	.933	.942	.843	.906
	Feel happy	.946			
	The experience is as expected	.874			
Delight	Feel pleasant	.899	.931	.770	.901
	Feel touched	.865			
	Feel excited	.866			
	Have an unforgettable experience	.880			
Loyalty	Maintain a long-term relationship	.876	.936	.785	.909
	Return to the hotel	.905			
	Have a strong emotional connection	.864			
	Recommend the hotel	.898			

Table 3 Discriminant validity analysis and correlations between constructs

	Current technology	Delight	Service styles of service personnel	Loyalty	Satisfaction
Current technology	.722				
Delight	.472	.878			
Service styles of service personnel	.310	.533	.762		
Loyalty	.457	.791	.441	.886	
Satisfaction	.509	.788	.516	.702	.918

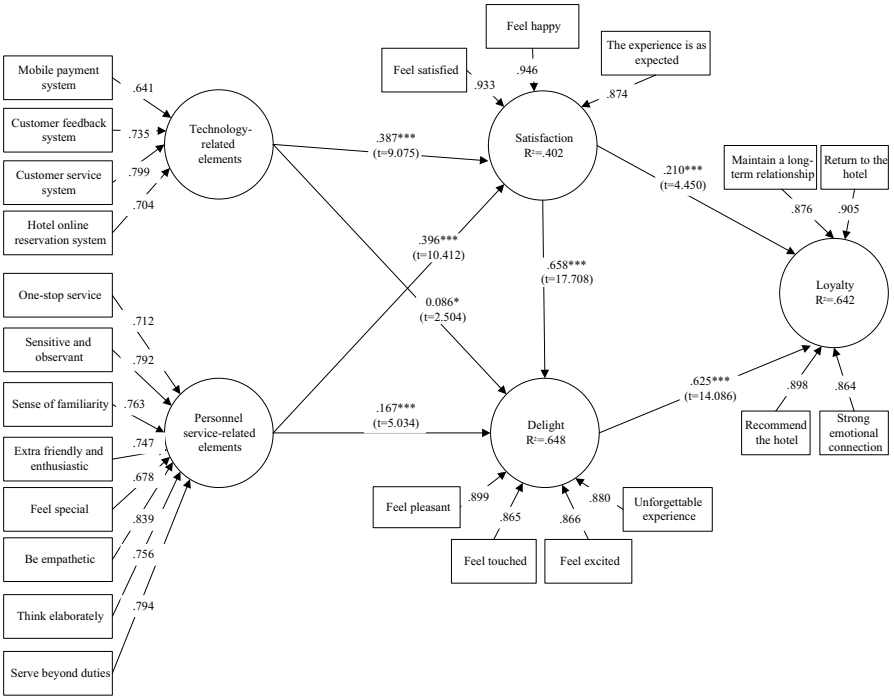

Fig. 3 Research model result

In the PLS-SEM model, the path coefficient value (β) represents the causal relationships between proposed constructs, and the t-value is used to examine the significant level of the causal relationship between constructs. The critical values suggested by Hair et al. (2006) of 1.96 (significance level = 5 percent), 2.58 (significance level = 1 percent), and 3.29 (significance level = 0.1 percent) are applied. The causal relationships between constructs are presented in Table 4 below.

Table 4 Hypotheses testing

Hypotheses	Relationships	β	t-value	Results
H1a	Technology → satisfaction	0.387***	9.075	Support
H1b	Technology → delight	0.086*	2.504	Support
H2a	Personnel service → satisfaction	0.396***	10.412	Support
H2b	Personnel service → delight	0.167***	5.034	Support
H2c	Human service innovations have stronger effect on satisfaction than technology-related innovations do	0.396 > 0.387		Support
H2d	Human service innovations have stronger effect on delight than technology-related innovations do	0.167 > 0.086		Support
H3	Delight has stronger effect on loyalty than satisfaction does	0.625 > 0.210		Support
H4a	Technology × personnel service → satisfaction	0.127	1.600	Not support
H4b	Technology × personnel service → delight	0.195**	2.701	Support

Note: *p < 0.05, **p < 0.01, ***p < 0.001

The results of direct effects show that all the proposed relationships are significant. Both TRSI ($\beta = 0.378$, $p < 0.001$) and HRSI ($\beta = 0.396$, $p < 0.001$) elements have significant relationship with satisfaction. The relationships between TRSI ($\beta = 0.086$, $p < 0.05$) and HRSI ($\beta = 0.167$, $p < 0.001$) applications and customer delight are also significant. Therefore, H1a, H1b, H2a, and H2b are all supported.

In addition, the path coefficient values also verify the strength of the effect of TRSI and HRSI elements on satisfaction and delight. The path coefficient values (β) of HRSI applications on customer satisfaction ($\beta = 0.396$) and delight ($\beta = 0.167$) are greater than the values of TRSI applications on satisfaction ($\beta = 0.387$) and delight ($\beta = 0.086$). This result suggests that HRSI applications have stronger effects on customer satisfaction and delight than TRSI applications. Furthermore, the relationship between delight ($\beta = 0.625$) and loyalty is also stronger than the one between satisfaction ($\beta = 0.210$) and loyalty, which supports previous researchers' results indicting that delight has a stronger effect on customer loyalty (Crotts and Magnini 2011; Kumar et al. 2001; Torres and Kline 2006, 2013). Therefore, H2c, H2d, and H3 are supported.

In addition to the direct relationships between proposed constructs, we suspect that TRSI applications may also moderate the effect of HRSI applications on customer satisfaction and delight. That is, with the help of TRSI applications, service personnel may operate their job more efficiently and be able to provide better services, which increases customer satisfaction and delight. Therefore, we examine the moderating effect of TRSI mechanisms. To evaluate the moderating effect, the interaction effect model (with the moderating effects) is used to compare with the original model (without the moderating effects). The interaction effect model is calculated by multiplying the moderator indicators (TRSI) with the predictor indicators (HRSI) (Lok 2015). The results show that TRSI

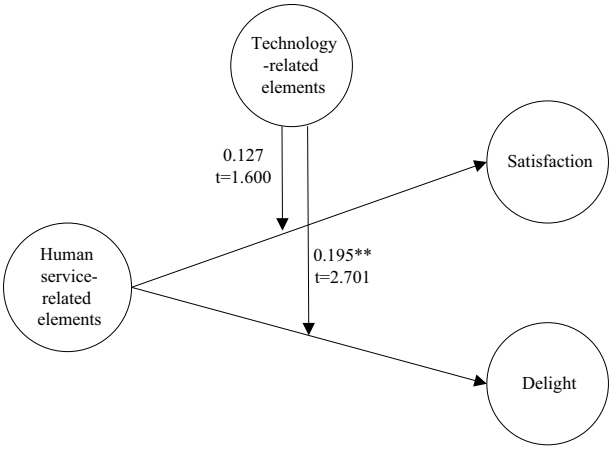

Fig. 4 Research model with moderating effect

mechanisms only moderate the effects of HRSI applications on delight, but not on satisfaction. Therefore, H4b is supported but H4a is not supported. The result of the moderating effect is presented in Table 4 and Fig. 4.

4 Discussion

This research applied the PLS-SEM approach to study the causal relationships between TRSI mechanisms versus HRSI applications and customer satisfaction, delight, and loyalty. Several interesting findings are discovered. First, both TRSI and HRSI elements have positive and significant relationships with satisfaction and delight, which is in line with previous scholars' research results (Bilgihan et al. 2011; Luo et al. 2019; Piccoli et al. 2017; Sorensen et al. 2013). This result supports the hotels' efforts in introducing new technologies or enhancing service personnel's service performance. These efforts can deliver a positive message that the hotel has the customers' best interests in mind and constantly strives to improve its service quality. Consequently, this can increase customers' satisfaction and delight with the hotel. Therefore, hotel practitioners are encouraged to improve their service quality continuously through introducing new technologies, as well as enhancing human service performance to sustain customers' satisfaction and delight.

We investigated further to compare which service innovation mechanism (TRSI vs. HRSI) had greater effects on customer satisfaction and delight. The statistical results showed that HRSI applications outperform TRSI elements for both customer satisfaction and delight. We believe that the hospitality industry is a human-centric industry where intense human interactions are required and valued. Exceptionally positive human interactions can directly elicit the most powerful emotions of customers, and thus enrich customers' experiences. Further, customers' emotions, hidden and higher-order needs (i.e., self-esteem) can only be identified and satisfied through direct human interactions. Technology is most criticized for its inability to

feel and perform real-time interactions during service encounters. However, customers can only experience the service as personal, unique, and memorable when their emotional state is acknowledged, and their hidden and higher-order needs are satisfied. Customers can thus have a long-lasting impression of the hotel which is the stronger indicator of customer loyalty. TRSI mechanisms may communicate a sense of novelty and convenience to customers, but this feeling may soon fade if new technologies are not constantly introduced to maintain the sense of novelty. Therefore, even though introducing and implementing new technology service mechanisms is an inevitable and important trend in the hospitality industry, for hotel practitioners we reiterate that human service remains the most effective and pivotal element in delivering exceptional service experiences that are valued most highly by customers. As Lee and Lee (2020) also suggested that while untact service is desired and increasingly adopted by customers with "individualist" tendencies, staff assistance and interpersonal interaction is still required by certain types of services (i.e., the service involving a skilled specialist or personal attention) and desired by customers who want to receive the full extent of the service. This result provided solid evidence to facilitate our understanding of the relative importance of human service versus technology application in the service industry. This aspect of information is rarely studied previously in academic research and it provided valuable and useful guidance to managers on how to plan and utilize human service and technology application to reach their best effectiveness.

Another possibility is that technology and human service do not compete against each other, but rather collaborate. Hence, we examined the moderating effect of TRSI mechanisms on HRSI applications and satisfaction and delight. The results indicate that TRSI mechanisms only moderate the effect of HRSI applications on delight, but not on satisfaction. Previous studies suggest that technology can assist in increasing customer satisfaction by providing the appropriate signifiers, while customizing services, to match their personal needs and facilitating the presentation and disambiguation of a large number of options, thereby aiding users to formulate and record their preferences. (Bitner et al. 2000; Overby 2008; Piccoli et al. 2017). A plausible reason for the different outcome is that, unlike previous studies that mainly focused on the effect of technology, we examined the collaborative effect of both technology and human service. Technologies that facilitate the recoding of customers' preferences and habits provide more information to assist service personnel in discerning the customers' hidden needs, leading to more personalized and attentive services, even before customers request them. Besides, with the assistance of technology performing the routine and repetitive tasks, service personnel can have more time with customers to exchange meaningful conversations, to take notice of customers' subtle emotional needs, and to provide more attentive and customized services. This level of service is beyond customers' expectations and evokes strong feelings of pleasure. Therefore, it exceeds satisfaction and leads directly to customer delight. As delight is suggested to have better effects than satisfaction to achieve customer loyalty (Crotts and Magnini 2011; Torres and Kline 2006, 2013), this result is especially valuable to service managers. It provides useful guidance for managers to design a more effective collaborative mechanism by utilizing technology as a supporting tool to collect and manage customer information and effectively

and efficiently provide useful information to assist the delivery of exceptional service and personalized interaction by frontline service employees. As indicated by Reis et al. (2020) that there are two distinct types of tasks in hospitality; one is tasks of low analytical-cognitive complexity and others of high emotional complexity. Frontline roles and duties, which require highly empathetic interactions, will have to be mainly delivered by humans or be performed in collaboration and not assigned to fully automated environments. In addition, while unmanned technology services are expected to become more prevalently available in the future, the manned encounter can be differentiated as a premium service rather than a free service (Lee and Lee 2020) to attract top-notch customers who desire supreme treatments. Thereby, through the right collaboration of technology application and human service, a long-term loyal customer relationship can be expected through delighting customers in every service encounter.

5 Conclusions and implications

The role of service innovation is becoming increasingly critical in the contemporary hospitality industry as the competition intensifies. When service offerings among competitors are undifferentiated, customers seek better and more innovative alternatives. In today's business environment, companies must take action leading to innovation. The prevalence of change requires innovation to sustain customer loyalty and maintain a competitive advantage in the industry. From the topics of previous academic research on service innovation (e.g., technology adoption processes, technology acceptance behaviors, and technology readiness), we can assert that technology innovation is central to academic research on service innovation. However, scholars are voicing the importance of human services, and especially in hospitality, as a service industry. This industry is commonly acknowledged as a human-centric industry that is viewed by customers as a platform for social experiences (Curran and Meuter 2005; Zeithaml and Gilly 1987), where human interactions are highly valued. We believe that customers' consumption experiences consist of cognitive and hedonic needs. Technology applications may fulfill customers' cognitive needs by offering efficient, accurate, and stable services. Human interaction, however, is often required to identify, respond to, and resolve their hedonic or affective needs. Technology has a limited capability to communicate respect and empathy, which would boost self-esteem and creating a sense of appreciation, trust, and loyalty in customers. Researchers also advocate that a further investigation and discussion of the role of human service as innovation is required.

We conclude that while both types of service innovation mechanisms have positive and significant relationships with satisfaction and delight, HRSI applications exercise a stronger influence on both satisfaction and delight. In contrast, TRSI mechanisms play a moderating role in this relationship. Our research contributes academically by provides valuable new information accentuating the significance of HRSI applications on increasing customer satisfaction and eliciting customer delight while redefining the role that TRSI mechanisms play in hospitality service encounters.

The results of this study also provide several important managerial insights. First, this study reconfirms the positive effects of TRSI and HRSI applications on increasing customer satisfaction and delight. Hotel practitioners are encouraged to continuously introduce new technologies and improve service personnel's performance by training more advanced service skills (e.g., observation skills, empathy, elaborative thinking ability, and proactive and quick response ability) to sustain customers' loyalty to hospitality service providers. Based on our survey results, several innovative technologies for example mobile keycard system, AI voice butler, and self-service order and checkout system may be considered popular among customers and hoteliers in the future. Hoteliers are thus recommended to consider implementing these advanced technologies to provide novel experiences to hotel guests and to improve hotel brand image. In addition, HRSI applications exert stronger effects on satisfaction and delight than TRSI mechanisms. Additionally, customer delight is found to be a better indicator of customer loyalty. This result provides a valuable guideline for managers to better allocate company resources, to carefully and creatively define high value-added tasks (De Kervenoael, et al. 2020), and to dedicate high value-added tasks to the more effective applications (i.e., HRSI). Thereby the possibility of successfully eliciting customers' positive responses of delight and fostering customer loyalty may be higher.

Finally, the result of this study suggests that TRSI applications moderate the relationship between HRSI applications and customer delight. Hotel managers should therefore have a better understanding of the roles TRSI and HRSI applications play (i.e., HRSI as the dominant actor and TRSI as the supporting actor), and design a better modality of cooperation. That is managers should recognize the role of technology as an enabler (Kandampully et al. 2016) or a facilitator using technology as a data collecting, information presenting, and service assisting tool and design a better user-friendly interface to increase customers' intention of use. Service personnel, on the other hand, should play the forefront and the main role of cultivating trust and emotional engagement with customers. Through the personal information collected by technology, service personnel can understand each customer more and better match customers' preferences with service options. As suggested by de Kervenoael et al. (2020), technology can be mobilized by service personnel to strengthen services through liberating service employees from repetitive and routine jobs to devote more time to understand and attend to customers' emotions and focus on guests' experience. Therefore, it will be easier to establish more personal conversation, which may interest customers more, to provide personalized service that tailors to customers' needs and preferences, and to deliver service in a way that shows respect and understanding. By doing so, customers' loyalty constructed upon the intense pleasurable affective delight can be more profound and sustainable. In addition, hotel operators can also deploy technology applications based on customers' technology proficiency (Jeon et al. 2020). That is, for customers with better technology adoption, hotels can assign them to the room equipped with more advanced technologies or introduce them to use self-service technology devices to increase service efficiency. On the other hand, for customers who are not familiar with or not feeling comfortable with operating technological devices, or for elite customers who desire to feel special and being royally pampered, service staff or manned service

should be deployed as premium services. As Lee and Lee (2020, p.14) suggested, "As untact service has become widely available, the manned encounter can be differentiated as premium service rather than free service. This strategy will allow a firm to improve its competitive advantage by securing the customers who prefer the premium manned encounter and also attract those who desire untact service." In this way, personalized service can be delivered to stimulate desirable emotions (wow feeling to tech-savvy customers, warm and privileged interpersonal interaction to non-tech-savvy customers and elite customers) and to enrich customers' hotel-stay experience.

5.1 Limitations and future research

This study has some limitations. First, the list of TRSI applications may not have been fully inclusive, as we were unable to include a list of technology applications that were planned for future implementation. Future research could include a comprehensive list of more advanced technologies. Additionally, the results of this study may not be able to generalize to other nations as there were few foreign participants and the majority of survey respondents were Taiwanese. People who live in different countries may have different levels of technology readiness and acceptance and therefore including more diverse survey participants may result in different results. Future research can replicate this study in other countries to establish whether these findings are applicable and generalizable when using participants from other countries. Finally, people from different cultures may value technology and human service differently. For example, people from Western society, as being at the forefront of the technology revolution, may value technology more favorably than people from Eastern cultures who value interpersonal interaction highly. Future researchers can include participants from different cultures to investigate whether culture plays a role in affecting consumers' preferences toward technology or human services.

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