Research Article

Empowering Consumers Through Self-Service Technology: A Comparative Analysis

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Abstract

This study tests consumer evaluations of services with the adoption of self-service technology (SST) in the hospitality service context. We revised the conventional consumer evaluation model by incorporating the concept of consumer empowerment to capture the consumer experience with the technology. This model was tested in a two-stage process using data collected from the consumers of clubhouses in Singapore before and after the adoption of SST. We found that structural relationships among service quality, customer satisfaction, and customer loyalty were established with consistent pre- and post-adoption, and that consumer empowerment has positive effects on service quality, customer satisfaction, and loyalty. Moreover, the adoption of SST increased customer loyalty but did not increase service quality or customer satisfaction. The study's results suggest that the focus when adopting SST should be on empowering consumers, which should also be incorporated into managing customer satisfaction.

Keywords

self-service technology, consumer empowerment, service quality, customer satisfaction, customer loyalty

Introduction

The hospitality and tourism industry has increasingly relied on technology in service delivery and value creation between frontline staff and consumers (Fisher, 1998; Lu et al., 2022). Advanced technology generates various benefits to service providers, including better operational efficiency, lower production costs, and enhanced employee engagement in service design (Davis et al., 2011). Not only does technology help improve operational efficiency, but it also enriches consumer experience (Weijters et al., 2007).

With the adoption of technology, the service industry aims at increasing consumer involvement in service production for reasons other than cost concern. This is exemplified by so-called self-service technology (SST). In general, SST is an electronic or digital interface widely used in the service industry that enables consumers to be at the center of innovation by servicing themselves without the presence of service staff (Curran & Meuter, 2005; Weijters et al., 2007).

The implementation of SST can be manifested in a multitude of contexts. The earliest form and the most prevalent are automated teller machines (ATMs) and telephone and online transaction systems in banking (Curran & Meuter, 2005). In the tourism and hospitality industry, it is not uncommon for customers to use online ordering systems for food and beverages, and to use check-in and check-out systems for facilities in hotels through vending machines, kiosks, and web applications (Kim et al., 2012; Rosenbaum & Wong, 2015). Airline check-in systems at airports are perhaps the most common (Lee, 2016) and, during the pandemic, we saw them increase.

In all these cases, SST helps standardize services, reduce operational costs, and diversify service delivery (Curran & Meuter, 2005; Weijters et al., 2007). By using SST, firms can substitute consumers for service staff so that service encounters are transformed from employee-based "high-touch and low-tech" mode to consumer-based "low-touch and high-tech" mode (Wang et al., 2012). Hence, the overriding goal of SST is to transform consumers from passive receivers to

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active participants in service production and delivery, thereby empowering them in service consumption (Schrier et al., 2010).

Thus, whether and to what extent consumers can harness and control the technology (i.e., consumer empowerment) determines the success of its adoption and use (Schrier et al., 2010), which would otherwise relegate it to a cost-saving technique. Some studies have shown that employees in a technology-intensive work environment feel empowered, and hence are more committed to their work than in traditional work environments (Kuo et al., 2010). This is perhaps also true for consumers.

This is theoretically related to the concept of interaction orientation in marketing (Ramani & Kumar, 2008). The foundation is that when consumers are allowed to participate in service delivery, the sense of control increases and results in empowering customers (Auh et al., 2019). Such an environment is intrinsically linked to the concept of empowerment, which is a positive subjective state evoked by the perception of consumers in terms of their own abilities and a sense of control (Hunter & Garnefeld, 2008), but is naturally provided when consumers use SST (Harrison & Waite, 2015).

Previous studies have emphasized customer participation leading to greater consumer empowerment and satisfaction that eventually affects firm performance (Auh et al., 2019; Fuchs et al., 2010; Hunter & Garnefeld, 2008; Hunter et al., 2011). However, the research on the impact of empowerment on consumer behavior (e.g., willingness to pay, and personal satisfaction) is limited (Fuchs et al., 2010; Hunter & Garnefeld, 2008; Hunter et al., 2011) and, in the SST setting, it is still scarce.

Besides SST, the environment in which technology is used influences consumer experiences in several key dimensions, particularly customer satisfaction and repurchase intention (Boon-itt, 2015; Meuter et al., 2000; Orel & Kara, 2014; Shamdasani et al., 2008). The service environment will change before and after the technology's adoption, and so does the response of consumers. Hence, it is necessary to distinguish between pre- and post-adoption, thereby assessing how consumer behavior or experience changes. Such a comparison is desirable, even for assessing the impact of SST in general, yet many studies, for example Son and Han (2011), Yang and Park (2011), and Zhao and colleagues (2008), have focused on post-adoption. For the handful of studies that compared pre- and post-adoption, the focus was on the experience of employees (Marler et al., 2009). In fact, in many service industries, consumer experience overrides employee experience when it comes to using technology.

Based on the aforementioned research gaps, we developed two conceptual models to test customer evaluation of SST pre- and post-adoption. Pre-adoption, we tested a base model of service evaluation focusing on service quality, customer satisfaction, and customer loyalty. Post-adoption, we revised the base model by incorporating consumer empowerment to account for consumers' control of the technology. Due to the difficulty in adopting more sophisticated experiments, such as randomized controlled trials, we collected two separate data sets in a hospitality service setting equipped with SST to address our research objectives.

Literature Review

SST and the Consumer Experience

SST has become an indispensable part of service encounters in many industries (Meuter et al., 2000). Unlike technologies that function behind the scenes, SST creates consumer interfaces, thereby enabling consumers not only to be directly involved in service consumption but also to play a co-production role in service production (Meuter et al., 2000). According to Oliveira and colleagues (2021), the use of SST gained momentum during the Covid-19 pandemic because it has the advantage of providing safety, ease, and speed of service delivery. Given constant encounters between consumers and SST, current research has focused on consumers' use of SST, such as their experiences and willingness to accept the technology in their consumption (Lin & Hsieh, 2006).

Since the success of SST relies largely on consumers, a comprehensive understanding of consumers' perception of SST is important. Weijters and colleagues (2007) identified the antecedents and consequences of SST adoption by consumers. They found that consumers' attitudes toward SST are formed through their perceptions of its usefulness, ease of use, and reliability, as well as whether or not it is fun. More importantly, a positive attitude is one of the key predictors of consumers' actual use of the technology.

Several studies, such as Collier and Kimes (2013), Lin and Hsieh (2006), and Meuter and colleagues (2000), showed that the use of SST increases customer satisfaction, so it is crucial to understand where customer satisfaction or dissatisfaction with SST originates (Weijters et al., 2007). Meuter and colleagues (2000) argued that SST fulfills customers' intensified needs, and provides them with better alternatives, thereby making consumers more satisfied; dissatisfaction occurs due to poor design and malfunction of the technology, among other things. Collier and Kimes (2013) found that convenience can increase customer satisfaction and trust. Lin and Hsieh (2006) found that satisfied consumers are more likely to use SST which, in turn, decreases their contact with service staff.

Empowerment Shaping the Consumer Experience

The concept of empowerment is usually linked to employees because of its origin in the organizational behavior literature (Conger & Kanungo, 1988). In this context, empowerment emphasizes the role that employees' initiative and innovation play in the workplace. Such a role generates a sense of meaning at work, and boosts employees' inner work motivation, thereby increasing organizational performance (Chiang &

Jang, 2008). Hence, employee empowerment is a key catalyzer in the workplace to enhance service quality and job satisfaction (He et al., 2010).

By the same token, consumer empowerment is an authoritative state perceived by consumers, which is evoked by their sense of control in decision making (Hunter & Garnefeld, 2008). Consumers feel empowered because they are actively involved in service production (Wright et al., 2006), and hence have a sense of control over service performance, leading to higher customer satisfaction and enjoyment (Wright et al., 2006).

In an interactive business environment, consumer empowerment is manifested as proactive consumers being transformed into crucial partners of employees who can thus access resources and gain a sense of control in service production (Auh et al., 2019). Thus, the extent to which consumers are empowered depends on whether firms provide them with the opportunity to collaborate with service staff when service coproduction is needed (Ramani & Kumar, 2008). Such an opportunity rests largely on the use of information and communications technologies (ICT) in the service industry (Harrison & Waite, 2015), which is a precursor to SST. The use of ICT can delegate to consumers certain power that used to be held by service providers, whereby not only the firms' operational efficiency but the consumer experience can be boosted (Meuter et al., 2003; Pires et al., 2006).

A self-service setting equipped with technology can increase consumer empowerment (Harrison & Waite, 2015). Current studies have focused on business contexts that are embedded in technology interfaces, which enable consumers to be independent and empowered in the consumption and experience process (Schweitzer & Simon, 2021). Schweitzer and Simon (2021) pointed out a paradox of consumer empowerment in using SST. On the one hand, consumers' positive experience can increase their empowerment; on the other hand, consumer empowerment might diminish due to dehumanization, inequitable exchanges, and status demotions that are associated with the technology. However, the negative aspects of empowering consumers are more related to their perceptions at an aggregate level, not at an individual level.

Consumer Empowerment and SST

Consumer empowerment is a key intrinsic benefit of SST because SST helps consumers customize their experiences in service consumption (Schweitzer & Simon, 2021; Wei et al., 2017). For instance, Wei and colleagues (2017) summarized seven intrinsic attributes of SST: independence, accomplishment, empowerment, confidence, novelty, enjoyment, and engagement. By evaluating their impacts on consumer experiences with SST in the hotel and restaurant context, they found that the intrinsic capability of SST significantly affects overall satisfaction; however, the intensity of empowerment evoked through SST mechanisms was not tested in this domain.

However, research on consumer empowerment induced by the use of SST has been unappreciated. In addition, research on the impact of consumer empowerment on behavior, such as consumers' willingness to pay and their satisfaction with the service, is limited (Fuchs et al., 2010; Hunter & Garnefeld, 2008; Hunter et al., 2011). This line of research is rare in the SST setting.

Previous studies have emphasized customer participation leading to greater consumer empowerment and satisfaction, which eventually affects firm performance (Auh et al., 2019; Fuchs et al., 2010; Hunter & Garnefeld, 2008; Hunter et al., 2011). For example, Brennan and Ritters (2003) argued that consumer empowerment is associated with customer satisfaction which, in turn, increases firm profitability. Hunter and colleagues (2011) found that consumer empowerment enhances customer satisfaction and loyalty.

O'Cass and Ngo (2011) found a positive relationship between the capabilities of consumer empowerment and customer satisfaction. This relationship becomes more pronounced with the increasing use of advanced technologies in service-dominant environments for service coproduction (Prentice et al., 2016). This perhaps led Lawson-Body and Limayem (2004) to conclude that consumer empowerment is a form of customer relationship management (CRM) that increases customer loyalty. However, little research has been conducted to model consumer empowerment in the presence of SST, and to determine how it could affect consumers' evaluations of services.

Models and Hypotheses Development

A Comparative Analysis: Pre- and Post-Adoption

To evaluate the impact of SST on consumer evaluations of services, it is necessary to compare consumer experience with service provided before and after SST adoption. This two-stage modeling was adopted by Marler and colleagues (2009) to examine employees' experiences before and after SST adoption, and by Karahanna and colleagues (1999) in examining the differences in consumer beliefs and attitudes pre- and post-adoption. However, most studies, like Son and Han (2011), Yang and Park (2011), and Zhao and colleagues (2008), have focused on consumers' perceptions and behavior after the adoption of a technology.

We developed two structurally different, yet related, conceptual models to test customer evaluations of services pre- and post-adoption of SST. The base model was designed to test the relationships among service quality, customer satisfaction, and loyalty pre-adoption, that is, in the absence of SST (see Figure 1). It is worth noting that in the pre-adoption stage, the base model is relegated to the classic service quality, customer satisfaction, and loyalty model proposed by Oliver (1993) and Zeithaml and colleagues (1996), and has been widely used in various tourism and hospitality industry contexts.

In the post-adoption stage, we evaluated the impact of consumer empowerment induced by the use of SST, as well as the above relationships post-adoption (i.e., in the presence of SST). Post-adoption, the base model is a theoretical

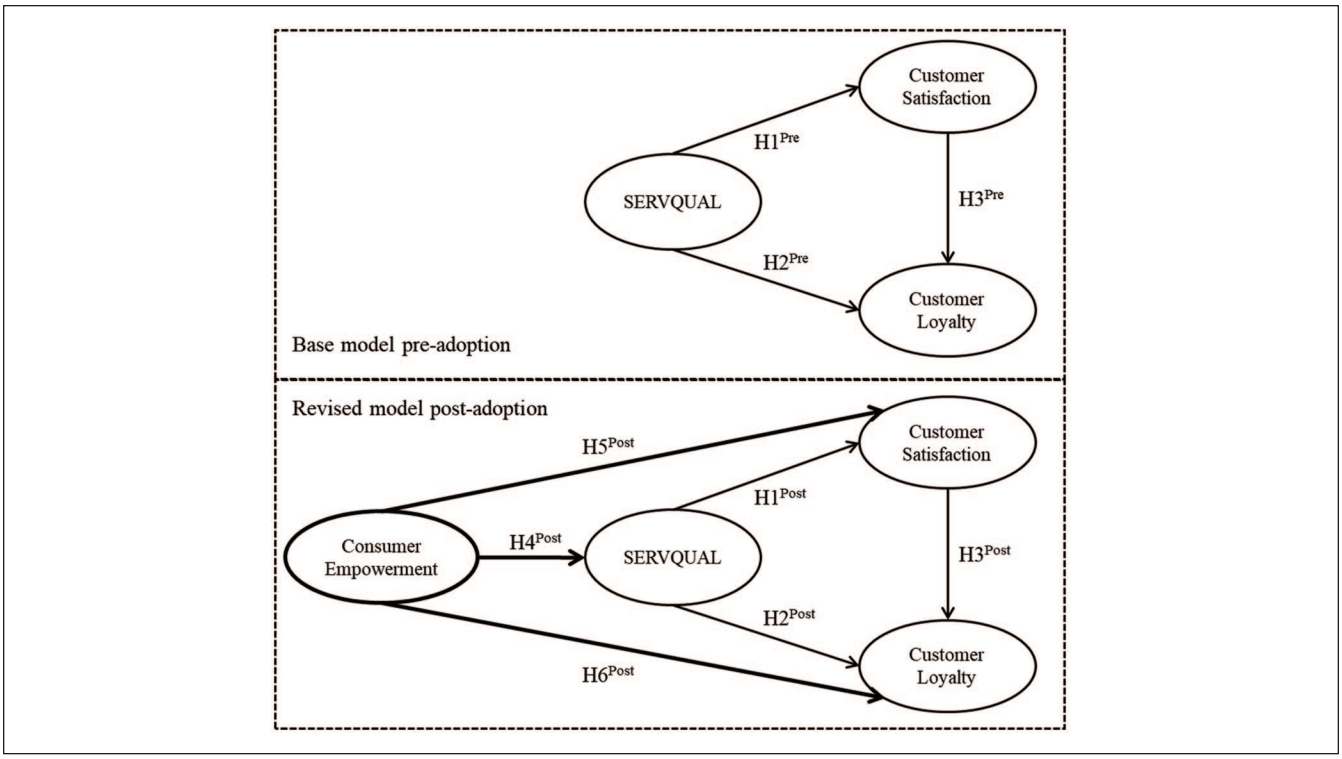

Figure 1. Study Models of SST Pre- and Post-Adoption.

benchmark against which the extended model that incorporates consumer empowerment is constructed. Incorporating consumer empowerment allows us to account for consumers' control of the technology. It is also worth noting that only in the SST setting will consumer empowerment matter in shaping consumer experience. In this regard, the base model can be seen as a degenerate version of the extended one.

To construct the extended post-adoption model, we adopted what Brady and colleagues (2005) called a comprehensive service evaluation model, and we revised the model by highlighting in service evaluation the role of consumer empowerment induced by the use of SST. In the extended model, we are interested in how service quality, customer satisfaction, and loyalty are affected by consumer empowerment in the presence of SST. We used this model to assess consumer experiences pre- and post-adoption. The revised model allowed us to examine the impact of SST on consumer evaluations by focusing on consumer empowerment.

Hypotheses Formulation

The formulation of the hypotheses in the base model is straightforward. The causal relationships among service quality, customer satisfaction, and loyalty have been tested. In particular, Cronin and Taylor (1992) proved that service quality is a key antecedent of both customer satisfaction and customer loyalty. Additionally, customer satisfaction has a stronger impact on loyalty than service quality. In other words, customer loyalty is significantly affected by both factors. In addition, a few studies found that service quality associated with SST increases customer satisfaction and loyalty (Orel & Kara, 2014) and reconfirmed that SST performance measured by service quality is an important antecedent of customer satisfaction, which may lead to customer loyalty (Boon-itt, 2015). However, it is still unclear how service quality from adopting SST affects customer loyalty.

Moreover, Zhao and colleagues (2008) found that self-efficacy facilitates consumers' use of SST and increases their satisfaction with it. Because technology anxiety is reduced through employee assistance, consumers are more willing to use SST in the future. Yang and Park (2011) described a process of SST adoption from technological, organizational, and environmental aspects. They concluded that SST, through an effective adoption procedure, enhances the post-adoption value of SST to the company.

Hypothesis $1^{Pre,\ Post}$: Service quality has a positive effect on customer satisfaction.
Hypothesis $2^{Pre,\ Post}$: Service quality has a positive effect on customer loyalty.
Hypothesis $3^{Pre,\ Post}$: Customer satisfaction has a positive effect on customer loyalty.

Furthermore, consumer empowerment has long been undervalued in technology adoption and use (Schrier et al., 2010). There is also little understanding of the relationship between

consumer empowerment and consumer evaluations of services in the SST setting. To better understand consumers' experiences with SST and their evaluations of services, we need to incorporate consumer empowerment in a conventional consumer evaluation model, namely, the quality-satisfaction-loyalty framework (Oliver, 1993; Zeithaml et al., 1996), which was developed in a technology-deficient service context. Based on the evidence, we hypothesize three further relationships post-adoption:

Hypothesis 4^{Post}: Consumer empowerment induced by the use of SST has a positive effect on service quality.
Hypothesis 5^{Post}: Consumer empowerment induced by the use of SST has a positive effect on customer satisfaction.
Hypothesis 6^{Post}: Consumer empowerment induced by the use of SST has a positive effect on customer loyalty.

Methods

Research Settings

We carried out two rounds of data collection with support from a state-owned service firm called HomeTeamNS in Singapore. As a non-profit organization, HomeTeamNS manages leisure and recreational facilities and provides hospitality services to members. Membership is only available to certain groups of nationals, such as the Singapore Police Force (SPF) and the Singapore Civil Defense Force (SCDF), which are two organizations that contribute to safety and security in Singapore. We targeted HomeTeamNS recreational clubhouses that offer members a wide range of indoor and outdoor experiential facilities and events, including sports courts, gyms, swimming pools, function rooms, and BBQ sites, as well as adventure climbing. As a result, there are enough opportunities for consumers to interact with service staff on various occasions.

To contain the spread of Covid-19 during the pandemic, stringent circuit breaker lockdowns were implemented from May to July 2020 to restrict the movement of Singaporean residents. During this time, the operational systems of five clubhouses in the city were fully digitalized as part of a renovation initiated by the government. The clubhouses were Balestier, Bukit Batok, Chinatown, Tampines, and the smart Khatib clubhouse that opened in August 2020, all of which were fully equipped with digital tools, including self-help kiosks, a real-time visitor tracking system, mobile applications, and so on. This allowed us to examine consumers' actual experiences with the SST on site.

We collected two sets of data: before and after the adoption of SST. In fact, this was a response to previous research that only conducted one-shot studies to examine consumer experiences post-adoption, and hence had no comparisons before and after adoption. We obtained support and permission from the five clubhouses to survey their members. We approached members in various ways to ascertain their perceptions of SST pre-adoption and their experiences with the technology post-adoption.

Data Collection

Prior to the main data collection, one senior manager and 45 employees were invited to participate in interviews regarding their perceptions of the digital transformation and the SST-installed environments. Interviewees were encouraged to provide feedback on the suitability of measurement items included in the questionnaire. Their feedback and opinions were collated to complement data collection. In doing so, we could ensure that survey questions were unambiguous and reliable, and hence could be used in the two stages. In the first stage, 57 out of 60 responses were obtained in May 2020, which were used to check the questionnaire. In the second stage, 45 employees who had been trained to support and use the technologies were invited to review the post-stage questionnaire in December 2020. Based on their feedback, the consumer survey questionnaire was revised and finalized.

Primary data were collected via both on-site interview and online survey tools such as Google Forms, which respondents could complete if they were not present at the time of the interview. The study population consisted entirely of active members of the five clubhouses, which totaled 30,000 people to whom a survey link was sent. To test the base model pre-adoption, we collected data to evaluate consumer experiences prior to SST adoption, and 393 out of 486 responses were collected between May and June 2020. For digital transformations in operations, SST was set up in only four of the clubhouses because one was temporarily closed during the survey period.

To test the revised model post-adoption, a second survey was administered from December 2020 to May 2021 to collect data on consumer experiences. Like the first survey, we sent a hyperlink to all members; to increase the response rate, two research assistants and two researchers also collected data at the clubhouses. Out of 477 completed questionnaires, 288 responses were checked for validity before being accepted for further analysis.

In terms of sample size, there is no consensus on a rule of thumb, but five to 10 participants per parameter is considered adequate (Bentler & Chou, 1987). In addition, a critical sample size should be greater than 200 for statistical power, including reliability of parameter estimates and model fit (Barrett, 2007). Finally, we were able to interpret the results and compare consumer experience with SST before and after its adoption.

Measurement

The consumer questionnaire consisted of screening questions to check membership status and the main questions about service performance and consumer experience. Pre-adoption,

the main questions included measures of service quality, customer satisfaction, and customer loyalty; post-adoption, questions about consumer empowerment were added, and questions about consumer experiences with SST were asked. In addition, we included non-identifiable demographic profile questions.

We used the SERVQUAL scale with 19 items to measure consumer perceptions of service quality and how service was manifested and experienced (Parasuraman et al., 1988). Four items of consumer empowerment were drawn from Hunter and Garnefeld (2008), three customer satisfaction items were drawn from Lin and Hsieh (2006), and four customer loyalty items were drawn from Hung and Petrick (2011). All the items were measured on a 7-point Likert scale indicating level of agreement (see the Appendix).

Results and Discussion

Profiles of Respondents

Table 1 shows the respondents' sociodemographic information. In the pre-adoption survey, 90% of the 393 respondents were male and aged between 30 and 60. This exactly matches characteristics based on membership eligibility (e.g., serving in the SPF and SCDF). Nearly 40% of the respondents earned a monthly income of SG$3000 (around US$2245) or less, and around 30% earned between SG$3,001 and SG$5,000 (around US$2246 and US$3740). More than 50% of the respondents had been members of a clubhouse for more than 9 years, with the two most popular, in terms of the number of entries, being Bukit Batok Clubhouse (50%) and Balestier Clubhouse (28%). In the post-adoption survey, over 90% of the 288 respondents were male, aged between 20 and 50. Their monthly incomes were comparable to respondents surveyed pre-adoption. More than 30% had held a membership for 9 years. The most popular clubhouse was again Bukit Batok, but Khatib was second.

Measurement Invariance

To test whether the three key constructs (service quality, customer satisfaction, and customer loyalty) were measured consistently before and after SST adoption, we performed multi-group confirmatory factor analysis (CFA). This analysis establishes measurement invariance whereby we can examine whether constructs in the measurement models and the structural relationships differ before and after SST adoption. Tables 2 and 3 show the configural invariant model of each construct, in which no constraints were imposed across the two groups other than model identification. The other three invariant measurement models were nested models of the configural invariant model. By definition, in metric invariant models we constrained factor loadings, and in scalar invariant models we further constrained factor means to zero; finally, in residual invariant models we constrained the residual variances to be identical in the two groups.

Since configural invariant models allowed all parameters to be freely estimated, they were expected to have the best model fit compared to the other three invariant models. Thus, we expected the three invariant models to be no worse than the configural invariant models in order to establish measurement invariance. This means we hoped to reject the null hypothesis that the three nested models are different from the configural invariant models. Table 2 shows the chi-square difference testing of the four models. CFA of the three constructs achieved metric invariance, suggesting that service quality, customer satisfaction, and customer loyalty were measured consistently between the two groups. There is no concern that factor loadings of the three constructs are statistically different across the two groups. Also, scalar invariance of the measurement for customer loyalty was established, which further allowed us to compare the values of customer loyalty in the two groups.

CFA of the three constructs achieved metric invariance, suggesting that service quality, customer satisfaction, and customer loyalty were measured consistently across the two groups. Again, there is no concern that the factor loadings of the three constructs were statistically different across the two groups. Also, the scalar invariance of the measurement for customer loyalty was established, which further allowed us to compare the values of customer loyalty in the two groups.

Table 4 shows the standardized factor loadings of the three constructs in the four measurement invariant models. Note that all factor loadings are standardized, and thus factor loadings differed between the two groups for measurements of metric invariance, scalar invariance, and residual invariance. All factor loadings are greater than the cutoff value of 0.05 and are statistically significant at 0.001. Since customer loyalty achieved scalar invariance, the result shows that customer loyalty post-adoption was 0.362 units higher than pre-adoption. This suggests that the adoption of SST increases customer loyalty. However, there was no evidence that the adoption of SST also increased service quality and customer satisfaction, because scalar invariance for these two constructs was rejected, as shown in Table 2.

Structural Relationships With Measurement Invariance

We analyzed the structural relationships based on the metric invariant models. Table 5 shows that all three hypotheses were supported in both groups. There are positive structural relationships between service quality, customer satisfaction, and customer loyalty. In particular, the effect of service quality on customer satisfaction was the strongest in both groups. This relationship is robust, and does not seem to be affected by SST adoption. Customer satisfaction also had a strong effect on customer loyalty, and this relationship was slightly stronger pre-adoption. Service quality had a relatively weak effect on customer loyalty

Table 1. Respondent Profiles.

Category	Pre-Adoption ($N = 393$)	Post-Adoption ($N = 288$)	Category	Pre-Adoption ($N = 393$)	Post-Adoption ($N = 288$)
Gender			*Membership Length*		
Male	379 (96.4%)	261 (90.6%)	3 to 5 years	66 (16.8%)	43 (14.6%)
Female	14 (3.6%)	27 (9.4%)	5 to 7 years	34 (8.7%)	24 (8.3%)
Age			7 to 9 years	28 (7.1%)	19 (6.6%)
19 and under	0	5 (1.7%)	More than 9 years	203 (51.7%)	90 (31.3%)
20–29	17 (4.3%)	54 (18.8%)	Unknown	0	38 (13.2%)
30–39	75 (19.1%)	73 (25.3%)	*Clubhouse*		
40–49	105 (26.7%)	62 (21.5%)	Balestier	111 (28.2%)	60 (14.9%)
50–59	82 (20.9%)	49 (17.0%)	Bukit Batok	196 (49.9%)	142 (35.2%)
60–69	90 (22.9%)	38 (13.2%)	Chinatown	17 (4.3%)	16 (4.0%)
70 and over	24 (6.1%)	7 (2.4%)	Tampines	38 (9.7%)	31 (7.7%)
Monthly Income			Khatib	0	129 (32.0%)
Under SG $3,000	149 (37.9%)	107 (37.2%)	Sembawang	28 (7.1%)	0
SG $3,001–5,000	105 (26.7%)	84 (29.2%)	Not specified	3 (0.8%)	25 (6.2%)
SG $5,001–7,000	71 (18.1%)	50 (17.4%)	*Monthly visits*		
SG $7,001–9,000	30 (7.6%)	19 (6.6%)	Once	170 (43.3%)	
SG $9,001–11,000	13 (3.3%)	10 (3.5%)	2 times	68 (17.3%)	
SG $11,001–13,000	9 (2.3%)	4 (1.4%)	3 times	41 (10.4%)	
Over SG $13,000	16 (4.1%)	14 (4.9%)	4 times	28 (7.1%)	
Membership Length			More than 5 times	29 (7.4%)	
Less than 1 year	9 (2.3%)	20 (6.9%)	Sometimes	38 (9.7%)	
1 to 3 years	53 (13.5%)	54 (18.8%)	Rarely	4.8%)	

Table 2. Summary of Measurement Invariant Models.

	Service Quality		Customer Satisfaction		Customer Loyalty	
Models	Chi-Square	Pr (> Chi-Square)	Chi-sq	Pr (> Chi-Square)	Chi-Square	Pr (> Chi-Square)
Configural	1203.9		0.0000		40.989	
Metric	1215.4	0.4899	2.5175	0.284003	44.956	0.2651
Scalar	1308.6	1.172e-14***	11.3322	0.012188*	46.808	0.6036
Residual	1356.2	7.588e-06***	24.9432	0.003485**	76.095	6.836E-06***

Note. Pr = probability, Significance level: *0.05, **0.01, ***0.001.

in both groups, because the effect was mediated by customer satisfaction. If we take into account the indirect effect, we can conclude that the effect of service quality on customer loyalty was strong and robust, which is consistent with many studies.

The implication is two-fold. First, the structural relationships among service quality, customer satisfaction, and customer loyalty were robust. There were no noticeable differences in the strengths of the structural relationships between the two groups. The difference is insufficient for us to conclude that SST adoption would have changed consumer behavior which, in turn, would have altered the structural relationships in the two groups. This shows that the three constructs have tremendous explanatory power in assessing consumers' evaluations of services. Second, the three constructs cannot account for possible structural differences due to the intervention of SST, perhaps also because the structural model is explanatorily inadequate in the first place. Thus, we incorporated consumer empowerment in the model, and revised the conventional service quality model. Consumer empowerment can best capture the consumer experience when confronting SST, which is a dimension of consumer experience that studies have yet to explore.

Effects of Consumer Empowerment

Since the model with consumer empowerment is configurally different, we needed to estimate, in isolation, the revised model post-adoption. There were two reasons for such treatment. First, configural variance exists between the two groups, so we needed a different data set that included consumer empowerment; second, consumer empowerment was assessed only after consumers experienced the SST. We

Table 3. Model Fit of Measurement Invariant Models.

	Service Quality			Customer Satisfaction			Customer Loyalty		
Models	CFI	TLI	RMSEA	CFI	TLI	RMSEA	CFI	TLI	RMSEA
Configural	0.836	0.803	0.156	1	1	0	0.988	0.964	0.165
Metric	0.836	0.820	0.149	1	0.999	0.028	0.988	0.979	0.126
Scalar	0.824	0.821	0.148	0.995	0.992	0.073	0.988	0.986	0.104
Residual	0.818	0.830	0.145	0.988	0.989	0.087	0.988	0.983	0.114

Table 4. Confirmatory Factor Analysis.

	Configural		Metric		Scalar		Residual	
Constructs	G1	G2	G1	G2	G1	G2	G1	G2
Service Quality	0.000	0.000	0.000	0.000	0.000	0.367	0.000	0.359
SQ1	0.690	0.692	0.690	0.693	0.697	0.698	0.697	0.698
SQ2	0.737	0.740	0.719	0.762	0.727	0.763	0.741	0.743
SQ3	0.756	0.749	0.743	0.764	0.745	0.765	0.754	0.756
SQ4	0.710	0.747	0.700	0.759	0.707	0.762	0.729	0.731
SQ5	0.801	0.751	0.803	0.744	0.799	0.737	0.771	0.773
SQ6	0.773	0.784	0.782	0.768	0.777	0.762	0.772	0.774
SQ7	0.822	0.795	0.811	0.808	0.809	0.805	0.808	0.809
SQ8	0.867	0.839	0.868	0.839	0.864	0.833	0.848	0.849
SQ9	0.796	0.772	0.793	0.776	0.792	0.773	0.782	0.784
SQ14	0.672	0.629	0.683	0.605	0.677	0.597	0.644	0.645
SQ15	0.709	0.695	0.721	0.670	0.718	0.664	0.697	0.698
SQ16	0.743	0.721	0.745	0.717	0.746	0.716	0.732	0.734
SQ17	0.721	0.745	0.740	0.712	0.739	0.708	0.728	0.729
Customer Satisfaction	0.000	0.000	0.000	0.000	0.000	0.299	0.000	0.302
CS1	0.872	0.906	0.870	0.908	0.868	0.906	0.878	0.895
CS2	0.878	0.942	0.888	0.936	0.888	0.936	0.901	0.915
CS3	0.840	0.873	0.827	0.881	0.829	0.882	0.845	0.866
Customer Loyalty	0.000	0.000	0.000	0.000	0.000	0.360	0.000	0.362
CL1	0.853	0.872	0.860	0.864	0.860	0.865	0.865	0.856
CL2	0.835	0.776	0.829	0.788	0.830	0.789	0.816	0.806
CL3	0.978	0.986	0.976	0.988	0.976	0.987	0.981	0.980
CL4	0.947	0.968	0.949	0.966	0.950	0.967	0.957	0.954

Note. G1 = pre-adoption ($N = 393$), G2 = post-adoption ($N = 288$). All factor loadings are standardized. All statistics are significant at 0.001. Please refer to the appendix for information on each construct's items.

Table 5. Structural Relationships With metric Invariance.

	Pre-Adoption ($N = 393$)		Post-Adoption ($N = 288$)	
Relationship	Estimate	Std.all	Estimate	Std.all
Customer satisfaction ←				
Service quality	1.090	0.863***	1.197	0.853***
Customer loyalty ←				
Service quality	0.296	0.230**	0.323	0.258**
Customer satisfaction	0.637	0.625***	0.510	0.570***

Note. Std.all = standardized factor loadings.
Significance level: *0.05, **0.01, ***0.001.

Table 6. Measurement Model With Consumer Empowerment.

Constructs	Estimate	Std.Err	Std.lv	Std.all
Service Quality				
SQ1	1.000		0.560	0.696
SQ2	1.039	0.087	0.582	0.738
SQ3	0.988	0.082	0.553	0.746
SQ4	1.009	0.083	0.565	0.748
SQ5	1.229	0.100	0.688	0.763
SQ6	1.223	0.097	0.685	0.782
SQ7	1.096	0.086	0.614	0.792
SQ8	1.233	0.091	0.691	0.839
SQ9	1.100	0.089	0.616	0.766
SQ14	1.086	0.106	0.608	0.629
SQ15	1.115	0.098	0.624	0.698
SQ16	0.988	0.085	0.553	0.719
SQ17	1.127	0.094	0.631	0.742
Customer Satisfaction				
CS1	1.000		0.792	0.906
CS2	1.000	0.041	0.876	0.942
CS3	1.036	0.046	0.820	0.873
Customer Loyalty				
CL1	1.000		0.721	0.880
CL2	0.848	0.049	0.611	0.778
CL3	1.155	0.040	0.833	0.982
CL4	1.167	0.041	0.841	0.970
Consumer Empowerment				
CE1	1.000		0.742	0.890
CE2	1.083	0.050	0.804	0.951
CE3	0.834	0.058	0.619	0.702

Note. Std.Err = standard error, Std.lv = standardized factor loadings; Std.all = standardized total effects or standardized coefficients for the respective variables in the model. All factor loadings are statistically significant at .001. Please refer to the Appendix for information on each construct's items.

aimed to evaluate the role that consumer empowerment plays in affecting service quality, customer satisfaction, and customer loyalty.

Table 6 shows the measurement statistics of the model that incorporated consumer empowerment as an exogenous latent variable. All factor loadings are greater than the cutoff value of 0.05 and are statistically significant at 0.001. The factor loadings of service quality, customer satisfaction, and customer loyalty are comparable to those obtained in previous analyses. Despite consumer empowerment being added to the model, the measurement model demonstrated a high degree of consistency.

Table 7 shows the structural relationships tested with the post-adoption data. All six structural relationships are statistically significant with the expected signs. Consumer empowerment had a pronounced effect on service quality. The direct effects of consumer empowerment on customer satisfaction and customer loyalty were relatively weak. However, after taking into account the indirect effects through the mediation of service quality, we found that consumer empowerment was highly

Table 7. Structural Relationships With Consumer Empowerment.

Structural Relationships	Estimate	Std.Err	Std.lv	Std.all
Service quality ←				
Consumer empowerment	0.360	0.049	0.477	0.477***
Customer satisfaction ←				
Consumer empowerment	0.157	0.045	0.147	0.147**
Service quality	1.108	0.094	0.783	0.783***
Customer loyalty ←				
Consumer empowerment	0.168	0.044	0.173	0.173***
Service quality	0.313	0.108	0.243	0.243**
Customer satisfaction	0.450	0.080	0.494	0.494***

Note. Std.Err = standard error, Std.lv = standardized factor loadings; Std.all = standardized total effects or standardized coefficients for the respective variables in the model.
Significance levels: *0.05, **0.01, ***0.001.

associated with both customer satisfaction and customer loyalty. As we hypothesized, service quality is a crucial mediator between consumer empowerment and customer satisfaction, and between consumer empowerment and customer loyalty. So, consumer empowerment through SST increased consumers' involvement in service production which, in turn, boosted their satisfaction and loyalty.

We found that the effect of service quality on customer satisfaction was also strong, although slightly smaller than the effect in the base model. The difference is not substantial though. The effect of service quality on customer loyalty was slightly stronger than it was in the base model, but the effect of customer satisfaction on customer loyalty was slightly less. The results show that incorporation of consumer empowerment in examining the consumer experience and its evaluation is not only theoretically congruent, but also empirically valid. This is perhaps because SST not only provides a tool with which consumers can engage in the coproduction of services but also unleashes the power of consumers in creating their own experience as freely as they wish.

Conclusion

Theoretical Implications

This study adds theoretical value to the relevant knowledge body in the field of studies on consumer evaluations and SST. First and foremost, this study revised conventional consumer evaluation models by incorporating the concept of consumer empowerment in a technology-intensive service context. Conventional consumer evaluation models such as those by Fornell and colleagues (1996), Oliver (1993), Parasuraman and colleagues (1988), Song and colleagues (2012), and Zeithaml and colleagues (1996) were developed in contexts where services entailed tremendous human contact, that is, services were produced and delivered by frontline employees. Since there is a chasm between consumers as service receivers and employees as service producers, the focus of these models was to close

the gap, thereby increasing customer satisfaction. However, the service context in which firms operate today is markedly different from the conventional context. Indeed, many services that used to be provided by employees are not only automated but actively involve consumers.

The technology penetrating the hospitality industry is SST. It not only changes the way consumers engage in service coproduction but also changes the service environment. Therefore, it is different from the use of technology in industries like manufacturing or finance, where technology and automation are more or less insulated from the consumer's experience with goods or services. Once employees are absent in service-intensive industries, consumers equipped even with sophisticated technologies could feel helpless and anxious, which decreases their satisfaction. By extension, consumer empowerment via SST plays a central role in creating the consumer experience by delegating the power of production to consumers.

Previous studies mainly focused on employees empowered in a technology-intensive work environment (Kuo et al., 2010). However, this study is grounded on the theoretical concept of interaction orientation from the marketing perspective (Ramani & Kumar, 2008). On that foundation, we argue that when consumers participate in the service process, they are empowered and have a sense of control (Auh et al., 2019). Our study proved that the ultimate goal of SST transforms consumers to empower them in the service production and delivery process. This is supported by the findings in previous studies by Auh and colleagues (2019), Fuchs and colleagues (2010), Hunter and colleagues (2011), and Hunter and Garnefeld (2008). Consumer empowerment was a key concept based on interaction orientation, which is related to consumers' abilities and a sense of control. These are significant in the technology-intensive service environment in particular.

In addition, our study showed that SST adoption increases customer loyalty, which confirms the role of empowerment in explaining consumer evaluations. The adoption of SST actually constructs a new service environment that shapes the consumer experience. To provide insights into service environment changes, we designed our study focusing on pre- and post-adoption disparity, thereby investigating how consumer behavior or experience empirically changes. This aspect distinguishes it from studies that investigated the key role of technology in consumer experiences such as customer satisfaction and repurchase intention (Boon-itt, 2015; Meuter et al., 2000; Orel & Kara, 2014; Shamdasani et al., 2008).

A comparative analysis was conducted to test customer evaluations of SST pre- and post-adoption. Adopting the analysis, we empirically established the base service-evaluation model by confirming robust relations among service quality, customer satisfaction, and customer loyalty. On the ground, we tested an extended service evaluation model that incorporated consumer empowerment to account for consumers' control of the technology. We found no conspicuous alterations. However, the analysis process stage was needed to provide more precise parameter estimates than those obtained from two separate single-group analyses (Arbuckle, 2007) because consumers' attitudes or perceptions may be differently formed before and after implementation of technology (Marler et al., 2009).

However, this implies that, in reality, SST is not the major determinant that dramatically improves post-service encounter elements such as service quality, satisfaction, and customer loyalty. It is the key motivator that enhances consumer empowerment whereby consumers' control of the technology is enhanced. This is supported by Marler and colleagues' (2009) study. Employees' work performances before and after SST adoption were unchanged by the use of the technology. However, it is worth noting that SST is a sort of supplementary service that supports the core service product delivery process and adds value to consumers' experiences in general.

This environment provides consumers with a great deal of sovereignty and freedom to engage in service production. It also invokes the feeling of control in consumers when it comes to service production. For this reason, conventional consumer evaluation models do not adequately accommodate the use of technology or the service environment. It is in this sense that consumer empowerment in the revised model can better explain consumer evaluations.

Practical Implications

Since self-service technology pervades almost all corners of the service industry, especially hospitality, our study suggests that firms need to shift the focus on the adoption of technology if they are going to empower consumers to coproduce services. The model we constructed showed that consumer empowerment strongly impacts service quality, customer satisfaction, and customer loyalty. In particular, our model showed that post-adoption customer loyalty increased significantly. To empower consumers, firms need to develop a wide range of strategies that not only suit the SST that is used but also suit the service context in which the SST is used. The general principle would be to provide freedom of choice and control for consumers.

For example, service firms can design a customer-oriented culture and environment embedded with self-service technology for participatory service activities. Not only self-service kiosks or other machines for simple check-in or registration, but also advanced SST for participatory activities can be the solution to make consumers feel that they are a part of the service organization. Also, user-friendly systems and tools in SST could be adopted. When the technology is perceived as difficult to use, consumers would not feel in control or that SST is beneficial to them. By providing a user-friendly technology system across operational service environments, consumers' perceptions of SST in operations such as the clubhouses in this study would, in turn, be more optimistic, and they would feel confident using the service in an SST setting.

Our study also showed that consumer empowerment, service quality, customer satisfaction, and loyalty are theoretically

consistent, and hence can be modeled to form a new theorization of consumer evaluation. Accordingly, when it comes to managing customer satisfaction, firms need to take into account consumer empowerment, especially in technology-intensive contexts. Overlooking consumer empowerment is likely to cause customer dissatisfaction, because SST provides an extra dimension to service production where failure can occur. SST is therefore a double-edged sword. On one hand, it provides an opportunity to further increase customer satisfaction from empowering consumers. On the other hand, failure to address consumer empowerment can lead to customer dissatisfaction.

Limitations and Future Research

This study incorporated consumer empowerment to test consumer evaluations with the SST adoption. The theoretical attempt is warranted, but concerns may exist when generalizing the results. First, our target respondents were certain groups of Singaporean nationals who are exclusively civil servants and clubhouse members. The majority had been affiliated with these clubhouses for more than 3 years, and all of them were repeat customers. As a result, the respondents cannot be treated as representative consumers in a generic service context. The structural relationships in our study are likely to be stronger than those in general consumers. Second, the comparison pre- and post-adoption was inadequate, because we were not able to approach exactly the same respondents in both stages. Third, we only tested the model in one hospitality setting (i.e., clubhouses), but SST and its environments are different in other hospitality settings. This difference is likely to affect the results, so future research needs to expand the empirical scope.

Appendix. Measurement Development.

Construct	References
Service Quality (SQ)	Parasuraman et al. (1988)
The clubhouse has up-to-date equipment.	SQ1
The clubhouse's physical facilities are visually appealing.	SQ2
The clubhouse employees are well dressed and appear neat.	SQ3
The appearance of the physical facilities of the clubhouse is in keeping with the type of service/recreation facility provided.	SQ4
When the clubhouse promises to do something by a certain time, it does so.	SQ5
When you have problems, clubhouse employees are sympathetic and reassuring.	SQ6
The clubhouse is dependable.	SQ7
The clubhouse provides its services at the time it promises to do so.	SQ8
The clubhouse keeps records accurately.	SQ9
The clubhouse does not tell customers exactly when services will be performed.	SQ10
You do not receive prompt service from clubhouse employees.	SQ11
Employees of the clubhouse are not always willing to help customers.	SQ12
Employees of the clubhouse are too busy to respond to customer requests promptly.	SQ13
You can trust employees of the clubhouse.	SQ14
You feel safe in your transactions with clubhouse employees.	SQ15
Employees of the clubhouse are polite.	SQ16
Employees get adequate support from HomeTeamNS (HTNS) to do their jobs well.	SQ17
The clubhouse does not give you individual attention.	SQ18
Employees of the clubhouse do not give personal attention.	SQ19
Employees of the clubhouse do not know what your needs are.	SQ20
The clubhouse employees do not have your best interests at heart.	SQ21
The clubhouse does not have operating hours convenient to all customers/members.	SQ22
Customer Satisfaction (CS)	Lin and Hsieh (2006)
I feel satisfied with the clubhouse's overall performance.	CS1
Clubhouse performance met my expectations.	CS2
Satisfaction with the clubhouse is quite close to my ideal service facility.	CS3
Customer Loyalty (CL)	Hung and Petrick (2011)
I will say positive things to other people about the clubhouse.	CL1
I intend to revisit the clubhouse in the future.	CL2
I will recommend the clubhouse to others.	CL3
I will encourage friends and relatives to visit the clubhouse.	CL4
Consumer Empowerment (CE)	Hunter and Garnefeld (2008)
In using self-service technologies/apps provided by HTNS, I feel I am in control.	CE1
The ability to influence the facilities and services of HTNS is beneficial to me.	CE2
I feel good because of my ability to influence the choices offered to me by HTNS.	CE3
My influence over service outcomes has increased relative to the past.	CE4

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