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An investigation of self-service technology usage during the COVID-19 pandemic: The changing perceptions of ‘self’ and technologies

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1. Introduction

Self-service technologies (SSTs) in shopping refer to technological interfaces that allow consumers to produce their own service experiences without any direct involvement of service personnel \cite{1,2}. For the service providers, implementation of SSTs often leads to operational cost-savings (e.g. reduced number of service staff, high level of transactional accuracy and extended operating hours); for consumers, human–technology interactions also create a sense of convenience, privacy and flexibility \cite{3–5}. With the mutual benefits, SSTs have long been introduced to replace interpersonal services in various service contexts, such as banking \cite{6,7}, retailing \cite{8,9} and more pertinent to the current research, e-commerce logistics \cite{10,11}.

Although SSTs are not new to modern consumers, the COVID-19 pandemic brings new motivations into SST usage \cite{12,13}. To illustrate, the prevailing social distancing practices have induced contactless consumption where the technology-facilitated self-services are adopted out of pure health concerns \cite{11,14}. Indeed, the pandemic has triggered a massive demand for SSTs. Meanwhile, consumers’ need for social interactions that were common in the traditional service setting becomes less important \cite{15,16}. Furthermore, the COVID-19 pandemic seems to reinforce the individualised lifestyle that has already emerged among modern communities \cite{17}. Individualist consumers increasingly value simplicity and self-sufficiency in their service encounters, and the ‘do-it-myself’ style is thus preferred \cite{15,18}. Some consumers accustomed to digital services may even feel inconvenient with face-to-face service offerings and demonstrate social avoidance under certain circumstances \cite{15}. To this end, along with the imposed social constraints associated with COVID-19, a phenomenon of social isolation can be observed in which consumers willingly exclude themselves from uncomfortable social activities. Hence, the impacts of the social distancing practices and the individualism trend are subtly intertwined to shape consumers’ service preferences, making SSTs a favoured choice by giving back the valued ‘self’ to consumers.

Besides the ‘self’ element, the ‘technology’ element also connotes new meanings concerning SST usage under the pandemic context. Although the existing SST literature emphasises consumers’ innovativeness as a general predisposition to technology acceptance \cite{1,19}, the consumers going through the pandemic may have attached deeper and more personalised meanings in their technology usage. In particular, unlike a normal service setting where the technological features are simply good-to-have, the contactless SSTs become essential tools that

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enable daily consumption activities during the pandemic. As such, consumers adapt to live with the pandemic constraints by using technological alternatives; in turn, technology usage reflects consumers’ capability to take control of their daily lives. In this connection, the identity research suggests that individuals treat technology usage as a means to express their identity, that is, ‘I would like to be identified as a technology user’ [20–22]. Herein, the technology-related self-identity becomes a silent declaration of consumers’ adaptive capability in response to the pandemic. Therefore, consumers’ self-identity (concerning technology usage) and their innovativeness collectively influence their SST usage during the pandemic.

Given the fresh ‘self’ and ‘technology’ elements elaborated earlier, this study aims to revisit consumers’ SST usage under the pandemic context. Of note, extensive studies have been conducted to examine consumers’ technology usage during the pandemic [16,23]. However, to the best of our knowledge, none of the existing studies acknowledges consumers’ accentuated ‘self’ and their deeper attachment to ‘technology’ in response to the pandemic. Thus, to fill the research void, we aim to conceptualise consumers’ motivations towards SST usage focusing on the two elements. Our key argument is that the changed perceptions on ‘self’ and ‘technologies’ give rise to new motivational factors to SST usage which were seldom considered significant before the pandemic context.

Firstly, the ‘self’ element concerns consumers’ perceptions of social interactions. As to be elaborated in the latter section, we capture the ‘self’ element using two theoretical constructs: 1) perceived prevalence of social distancing and 2) individualistic culture. The two constructs relate to the external social and cultural environment, thus serving as external motivators for consumers’ SST usage. Secondly, the ‘technology’ element addresses consumers’ perceptions regarding technology-related interactions, which are reflected by two theoretical constructs: 3) self-identity as a technology user and 4) personal innovativeness. These two constructs pertain to consumers’ innate characteristics, which are thus proposed as internal motivators.

To achieve the research aim, we adopt hierarchical regression to discern and validate the differentiated impacts of the internal and external drivers on consumers’ SST usage. By doing so, we provide answers to the following research question (RQ):

RQ1: What internal and external drivers motivate consumers’ usage of SST under the pandemic context? Are consumers more strongly motivated internally or externally (in terms of the explanatory power of the proposed drivers)?

Further, this study aims to unveil the motivational heterogeneity among the SST users. Accordingly, a latent class analysis is performed to identify the user segments, and the produced segmentation results are interpreted and rationalised under the pandemic context. With the segmentation profile of the SST users, the following research question is addressed:

RQ2: What are the major SST user segments in terms of their sizes, underlying motivators and other key characteristics?

The smart parcel locker is selected as the representative SST for this study. It is an automated locker technology introduced to facilitate contactless deliveries following e-commerce orders [11,24,25]. This study selects the case of the smart locker due to the pandemic’s impact on e-commerce adoption experienced worldwide and in the research region. Instead of focusing on consumers’ e-commerce usage (i.e., adoption of technological platforms), we turn to the post-shopping delivery stage, where consumers must make tangible efforts to perform the self-collection procedures via a technology interface [26]. Thus, the smart parcel locker is qualified as an SST application whose usage is likely to be induced by the pandemic. Although logistics scholars have examined consumers’ adoption of smart lockers as an SST [27,28], few studies have considered the pandemic context. In this regard, this study also aims to provide practical implications regarding e-consumers’ usage of smart parcel lockers in response to the pandemic. The practical implications answer the following research question:

RQ3: How are e-consumers from different market segments motivated to use smart parcel lockers?

The remainder of this manuscript is structured as follows. Section 2 reviews the extant SST literature focusing on two emerging research themes related to consumers’ changing perceptions of social interactions and technologies. Theoretical hypotheses are proposed by integrating insights from technology, culture and identity literature. Section 3 describes the data collection method and assesses the reliability and validity of the adopted measures. Section 4 presents the data analysis findings, starting with a hierarchical regression and then a latent class analysis. Finally, Section 5 presents the theoretical and practical implications and discusses some limitations of this research.

2. Literature review and hypothesis development

The research field of SST usage is considered highly established. A literature search with the keyword structure of (‘self-service technology’ OR ‘technology-based self-service’) generates 648 research documents in Elsevier’s SCOPUS database (as of October 2021, when this manuscript was written). Even adding a constraining keyword of ‘consumer*’ to the structure, the search generates over 200 results. In fact, with three decades of research endeavours, extensive insights have been created regarding consumers’ usage behaviours of SSSTs from various perspectives.

For example, focusing on the different stages of SST usages, previous researchers have examined consumers’ behaviours of initiation adoption [29,30], continued/repeated usage [9,31] and service failure responses [32,33]. Considering the SST applications’ contextual differences, comparative studies have also been conducted to unveil the distinct driving forces in different technology environments [30], different service settings (e.g. private versus public) [34] and different cultures [35]. Among these studies, theories or theoretical models, such as the technology acceptance model, innovation diffusion theory, theory of planned behaviour and unified theory of acceptance and use of technology, have been adapted and applied to the SST contexts [19,27,36]. Based on these theories, factors of perceived usefulness, ease of use, behavioural control, technology readiness, technology anxiety and need for interactions are among the most widely accepted antecedents influencing consumers’ SST usage [37–40].

2.1. Changing ‘self’ perceptions: SST and social interactions

Despite being a mature research field, some newly emerged themes can be identified. In particular, social interactions were assumed to be favourable even in technology-based service encounters within the traditional SST literature. Under such an assumption, consumers’ need for interactions was often considered a discouraging factor related to their SST usage [1,41]. However, consumers’ perceptions of social interactions have been changing along with the explosive development of technological applications in service settings. For modern consumers, social interactions may no longer be considered convenient or necessary; instead, an anxious and unpleasant feeling is often associated with social interactions, which become emotional burdens driving consumers towards technology-based service alternatives. To a certain extent, consumers choose to self-exclude from the burdensome social interactions and rely on technologies to complete service transactions independently. Examining the extant literature, besides a brief touch on social anxiety and avoidance [42–44], we determine that little research has been conducted to explore the trend of social exclusion by the modern consumers and the impacts on their SST usage. To the best of the
authors’ knowledge, no single study has focused on the pandemic-induced social exclusion and the promoted SST usage as a direct outcome.

2.1. Prevalence of social distancing as an external motivator

To overcome the research gap, we argue that the changing perceptions of social interactions are especially salient under the pandemic context [17]. During the COVID-19 pandemic, social distancing practices are implemented worldwide. Consumers are reminded to keep a distance from each other when shopping, dining, and so on. They are advised not to join mass gatherings simply due to health concerns [45]. Such practices have been gradually institutionalised as the new normal as the consumers adapt themselves to live with the pandemic [46,47]. In this regard, the prevalence of social distancing may reinforce consumers’ willingness to exclude from social interactions by signalling that such exclusion is safe and desirable. Authorities implement most social distancing practices, and thus, they convey an indirect message that avoiding social interactions is accepted by the society and promoted for distancing practices, and thus, they convey an indirect message that

As such, the social distancing practices create implications for consumers’ SST usage. On the one hand, SSTs, being contactless technological interfaces, are effective tools that consumers may use to comply with the social distancing practices. On the other hand, the practices’ prevalence also gives consumers psychological permission to exclude from social interactions. Under the specific context of smart lockers for self-collection, empirical evidence has been reported to support a promoting effect of the pandemic on consumers’ uptake of the self-collection service [11,16,45]. Therefore, we propose the following hypothesis:

**Hypothesis 1.** Perceived prevalence of social distancing is positively related to consumers’ intention to use the SST (smart parcel locker in this study).

2.1.2. Individualistic culture as an external motivator

The social distancing trend also coincides with the individualistic culture that collectively contributes to consumers’ changing perceptions of social interactions, though the latter being a rather subtle contributor. The individualistic culture refers to the shared subjective process that results in similar beliefs which value independence, achievement and self-enhancement [7,48]. SST scholars have confirmed the cultural impacts (independence vs. interdependence) on consumers’ responses to SSTs [19,49].

Under the pandemic context, being self-sufficient and empowered by various contactless technologies are even more important to the individualist consumers. To this end, the SSTs become a perfect match to the consumers’ aspiration for independence. In fact, the SST literature has always stressed the ‘self’ consideration that influences consumers’ usage behaviour. For example, Dabholkar and Bagozzi [37] recognised the self-consciousness in consumers’ interactions with SSTs. Subsequent studies also confirmed the importance of a sense of self-control, personal power or accomplishment that motivated consumers’ usage of SSTs [32,50,51]. More recently, drawing on the concept of ‘unact service’ (i.e. all technological applications that enable contactless consumption), researchers have suggested that technology-based service interactions are especially compatible with the individualists in the modern society (e.g. busy professionals and single-person householders) [15,18,52]. In the specific case of smart locker adoption, Wang, Wong, Teo, Yuen and Feng [4] also proposed a user segment of self-enhancers who responded strongly to the self-enhancement value in SST offerings. Given the fulfilment of self-centric needs by SSTs, we argue that consumers influenced by a strong, individualistic culture are more likely to use SSTs. Thus, the following hypothesis is proposed:

**Hypothesis 2.** Perceived influence of individualistic culture is positively related to consumers’ intention to use the SST.

2.2. Changing ‘technology’ perceptions: SST and technological interactions

The second emerging theme concerns consumers’ changing perceptions of technologies [53,54]. Consumers’ technology anxiety and innovativeness are the two somewhat paradoxical factors often examined in the SST literature [9,40,55,56]. To elaborate, we describe technology anxiety as consumers’ reactance to unfamiliar technological elements which creates a negative emotion leading to behavioural implications (e.g. unwilling to use SSTs). The technologies’ ease of use, trialability and observability, which may lower consumers’ technology anxiety, often enhance their usage intention [35,57]. Paradoxically, consumers’ innovativeness, especially concerning their novelty-seeking tendency of new technological elements, is also a validated antecedent to SST usage behaviours [37,58]. To this end, we may infer that two distinct segments of SST users simultaneously exist: one perceives the technological interactions as intimidating; the other perceives the interactions as favourable and empowering. Under the pandemic context, the second segment may be quickly enlarging, thus leading to consumers’ more receptive perceptions of and deeper connections with the technologies. Specifically, an accelerated digitalisation trend has been observed globally during the pandemic, and consumers turn to technological alternatives to fulfill essential consumption needs.

To some extent, consumers have grown dependent on technologies, by choice or by circumstance, and technologies, in turn, become part of the consumer’s self-identity [45]. Although the changing perceptions of technologies have been acknowledged by some consumer studies in general [59-61], we notice that the SST literature is yet to respond to such a recent phenomenon. The impact of the technologies’ deeper embedment in consumers’ lifestyle on SST usage behaviours, as accidently triggered by the pandemic, remains to be explored [84].

2.2.1. Self-identity as a technology user as an internal motivator

To address the research gap, we propose investigating the theoretical construct of self-identity (as technology users) in consumers’ SST usage. Self-identity can be defined as individuals’ answers to ‘who am I’ [22]. To verify such an identity, individuals tend to perform identity-consistent behaviours. Hence, self-identity as a technology user refers to consumers’ identity as expressed by technology usage. Consumers who take pride in their identities as technology users involve more deeply in technological interactions [20,62,63].

Although the identity aspect has been rarely discussed in SST literature, some scholars have acknowledged consumers’ deeper connections with technologies and the associated consequences of SST usages. For example, Ahn and Seo [64] highlighted the ‘gadget-loving propensity’ among modern consumers. These consumers were intrinsically motivated to use edge-leading technologies and thus preferred SSTs over conventional services. Further, Newman, Wachtler and White [65] identified a sense of connection between SSTs and SST users, to the extent that the users integrate the technological elements to form their self-concept. In fact, the identity literature has long been suggesting that individuals’ identity-related considerations are as important as traditional factors (e.g. technology anxiety/readiness) in predicting technology usage [62]. Moreover, identity-related studies have also provided empirical evidence supporting the impact of self-identity on identity-reinforcing behaviours [20,22,62]. Recent researchers have further confirmed the importance of technology-related self-identity in shaping consumers’ behaviours in response to the pandemic [66]. Therefore, the following hypothesis is proposed:

**Hypothesis 3.** Consumers’ self-identity expressed as technology users is positively related to their intention to use the SST.

2.2.2. Personal innovativeness as an internal motivator

Apart from technology-related self-identity, consumers’ innovativeness remains a critical personal trait in the SST usage context.
Innovativeness refers to individuals’ general tendency to seek newness and unexpected features (related to technological services in this study) during service encounters. The technology-related self-identity is about consumers’ deep attachment to technologies, whereas the innovativeness trait is associated with a broad, favourable attitude towards technology-based experiences. The SST literature has validated the contributing effect of consumers’ innovativeness on their SST usage behaviours \([1,58,67]\). Under the specific context of COVID-19, we argue that the general trait of innovativeness complements the more identity-defining factor of self-identity, leading to consumers’ acceptance of SST. Hence, we propose that consumers’ innovativeness remains a significant contributor to SST usage during the pandemic.

**Hypothesis 4.** Consumers’ innovativeness is positively related to their intention to use the SST.

### 3. Research method

A survey questionnaire is designed to collect empirical data, and a professional research agency is engaged in survey administration. This section explains the survey design and administration processes. Confirmatory factor analysis is performed, and the common method bias is tested at the end of this section.

#### 3.1. Questionnaire design

The questionnaire is intended to understand consumers’ opinions about the proposed theoretical constructs using the operationalised measures. Firstly, on the cover page, some general descriptions of the pandemic development were provided, along with a few examples of social distancing practices implemented locally. The purpose was to help the survey respondents establish a sense of personal relatedness to the research context of the current study. The cover page also presented the statements on our research objective and confidentiality issues. The respondents were assured that all information collected in this survey was to be anonymised and used for academic purposes only. By doing so, we encouraged the respondents to answer the survey questions with their genuine opinions, thus minimising the self-serving bias in the data.

Secondly, a qualifying question was prompted to the respondents to indicate their online shopping experiences within the past two months. Only those who recently shopped online were directed to the survey’s main part, whereas those who did not were discontinued. We considered the recent online shopping experience an essential prerequisite to participate in this survey because the targeted SST in this study was used in delivery services following online purchases. Thus, it would be practically meaningless to study consumers’ usage intention of the delivery technology if they did not shop online.

Next, the qualified respondents were required to rate the measures of the key constructs in this study, which were perceived prevalence of social distancing (DIS), perceived individualistic culture (CUL), self-identity expressed as technology users (IDE), personal innovativeness (INO) and SST usage intention (INT). A nine-point Likert scale was used to capture the respondents’ opinions (‘1’ = *disagreement* and ‘9’ = *agreement*). This study designed four items to measure the prevalence level of social distancing, which reflected the government support of social distancing (DIS1) and the local implementation of social distancing (DIS2, DIS3 and DIS4) (Table 1). A three-step process was adopted for development these new measures, that is, internal brainstorming, external opinion gathering and finalising. The similar new-measure development process was also used by Refs. [66,71]. To illustrate, the author team formed a focus group which was led and moderated by the first author. With reference to the existing literature, the group members applied their domain knowledge to brainstorm a list of measures related to the prevalence perception of social distancing. Next, a group of external researchers was invited to comment on the measure list. Based on their comments, those ambiguous or less straightforward measures were dropped, and various amendments were made to improve the face validity of the retained measures. Finally, the author team applied some minor adjustments (e.g. length, wording) and the four finalised measures were obtained.

Moreover, two items adopted from Triandis and Gelfand [68] were used to measure the individualistic culture. It should be highlighted that our study was conducted in Singapore, known for its high level of cultural diversity. Thus, rather than adopting a cross-country perspective, our study emphasised the differentiated influences of the individualistic culture that individual consumers experienced within the same region.

| Table 1 | Constructs and measures. |
|---------|--------------------------|
| Construct | Measure | Source |
| Perceived prevalence of social distancing (DIS) | DIS1: I think social distancing is encouraged by the government DIS2: Social distancing is practised in our local community DIS3: I can see signage of social distancing practices everywhere DIS4: Strict observance of social distancing is required in our neighbourhood | Designed for the current study |
| Perceived individualistic culture (CUL) | CUL1: In my culture, I am expected to depend on myself than others CUL2: It is important to rely on myself most of the time in my culture | Triandis and Gelfand [68] |
| Self-identity expressed as technology user (IDE) | IDE1: I use technologies to express my values IDE2: I use technologies to express who I want to be IDE3: Using technologies is part of how I express my personality | Thorbjørnsen, Pedersen and Nysveen [22] |
| Innovativeness (INO) | INO1: I am among the first in my circle to use an innovative technology when it appears INO2: If I heard a new technology was available, I would be interested enough to try it INO3: In general, I am the first in my friend circle to know the nature of innovative technologies INO4: I often know about innovative technologies before other people do | Goldsmith and Hofacker [69] |
| SST usage intention (INT) | INT1: I intend to use smart parcel lockers for my next e-commerce purchase INT2: My intention to use smart parcel lockers for my next e-commerce purchase is high INT3: I would recommend others to use smart parcel lockers for e-commerce delivery INT4: I would say good things about smart parcel lockers INT5: Using smart parcel lockers is natural to me | Pavliou and Kyrgiou [70] and Wang, Wong and Yuen [11] |
| User categorisation | Current behaviour: I have been using smart parcel lockers during the pandemic (Y/N) Future intention: I will continue to use smart parcel lockers even when the pandemic ends (Y/N) | Designed for the current study |
Consumers’ technology-related self-identity was measured using three items adapted from Thorbjørnsen, Pedersen and Nysveen [22]: value (IDE1), personal aspiration (IDE2) and personality (IDE1). Meanwhile, consumers’ innovativeness was measured by four items adapted from Goldsmith and Hofacker [69]. Note that the measures of self-identity and innovativeness were related only to consumers’ opinion/experience of technologies in general, not to any specific SSTs. The difference here should be noted as it affects the subsequent interpretations of our empirical findings.

Five items were used to measure consumers’ SST usage intention. These items were adapted from Pavlou and Fygenson [70] and Wang, Wong and Yuen [11]: the former is a study concerning e-commerce adoption, and the latter is about adoption of smart lockers. The five items reflected consumers’ usage intention in general (INT1 and INT2), recommendation tendency (INT3 and INT4) and usage habit (INT5), all of which were directly related to the usage of smart parcel lockers.

Finally, the last part of the questionnaire collected the respondents’ sociodemographic information, including their gender, age, and household income level. In addition, two more questions were added to understand the respondents’ current usage behaviour during the pandemic (Yes or No) and future usage intention after the pandemic (Yes or No). The respondents were categorised as adopters (if they were current users and indicated a positive future usage intention, i.e., Y/Y), copers (Y/N), wait-and-see (N/Y) and not-interested (N/N). This categorisation was used as a co-variant in the latent class analysis (in Section 4.2).

3.2. Survey administration

Two fellow researchers were invited to assess the face validity of the measures and the overall clarity of the questionnaire. Minor adjustments were made based on the researchers’ feedback, and the questionnaire was finalised accordingly. The finalised questionnaire was sent to a professional research agency employed for data collection for this study.

More specifically, the questionnaire was programmed into an online survey and the survey link was mass sent to the agency’s panellists located in Singapore. The panellists then participated in the survey by accepting the invitation link voluntarily. To ensure the data quality of the online survey, we incorporated three attention-checkers into the questionnaire. The respondents were asked to select only a specified answer (e.g. please select ‘9’ for this question) to the attention-checker question, failing to do so resulted in immediate termination of the survey. The attention-checker/termination mechanism ensured that only quality data from the respondents who paid sufficient attention to the questions were captured.

It should be acknowledged that data collection by engaging research agencies may be associated with some controversies in terms of response rate and ‘professional survey respondents’ [72]. However, due to the social constraints of the pandemic, it was perhaps the most feasible and efficient method of data collection. The data credibility was upheld given the inbuilt attention-checkers in the questionnaire and our rigorous check on the research agency’s reputation and past records [72].

During the two-week survey launch period, a total of 519 valid responses were collected. A pre-agreed amount of service fee was paid to the survey agency which covered all the costs including the completion rewards for the qualified respondents. The rewards varied in terms of amounts and forms (e.g. monetary or non-monetary) depending on the agreement between the panellists and the agency. Nonetheless, the survey agency did not disclose the amount/forms of rewards as the information might be commercially sensitive.

The sample statistics are shown in Table 2. The sample had an even breakdown of gender, age (from the mean age of 40 years old) and household income (from the median monthly income around $8000 Singapore dollars). Among the surveyed sample, about two-thirds of consumers were current users of smart parcel lockers; however, only about half indicated a positive future usage intention when the pandemic ends. The data revealed a strong pattern of SST usage during the pandemic, yet the future usage intention weakened after the pandemic. The initial statistics seem to suggest the pandemic as an effective stimulus that motivates consumers’ SST usage. However, although a considerable proportion of consumers were motivated to use the SST, the stability of the motivations varied. To this end, not only must the proposed motivators be validated using a regression analysis, but also the motivational heterogeneities among different consumer segments must be unveiled via a latent class analysis. Thus, both analyses are conducted to achieve the purposes, which are elaborated in Section 4.

3.3. Measure assessment

Before proceeding with further analysis, we must first assess the reliability and validity of the measures. To this end, a confirmatory factor analysis (CFA) was performed. The results were analysed following a few steps.

We first evaluated the overall fit of the measurement model based on the generated fit indices. As shown in Table 3, the comparative fit indices, such as CFI = 0.96, TLI = 0.95 and IFI = 0.96, were all above the recommended value of 0.95; the absolute fit statistics, such as SRMR = 0.06 and RMSEA = 0.07, were below the upper threshold of 0.08. Thus, the measures demonstrated a good fit with the data overall. Next, the

| Table 2 | Sample statistics. |
|---------|--------------------|
| Gender  | Frequency | Percentage |
| Female  | 244       | 47%        |
| Male    | 275       | 53%        |
| Age     |           |            |
| Mean age (years) | 40       | N/A        |
| Younger than 40 years old | 253     | 49%        |
| 40 years old and above    | 266     | 51%        |
| Household income (SGD/month) |         |            |
| <8000  | 245       | 47%        |
| >8000  | 274       | 53%        |
| Current usage behaviour   |           |            |
| Users   | 328       | 63%        |
| Non-users | 191     | 37%        |
| Future usage intention    |           |            |
| Positive | 239       | 46%        |
| Negative | 280       | 54%        |

| Table 3 | Confirmation factor analysis results. |
|---------|-------------------------------------|
| Construct | Measure | Standardised estimate | t-value | AVE | CR  |
| DIS      | DIS1    | 0.68                  | 11.36*** | 0.51 | 0.80 |
|          | DIS2    | 0.69                  | 11.37*** |     |     |
|          | DIS3    | 0.73                  |         |     |     |
|          | DIS4    | 0.74                  | 12.80*** |     |     |
| CUL      | CUL1    | 0.83                  |         | 0.78 | 0.87 |
|          | CUL2    | 0.93                  | 9.77***  |     |     |
|          | IDE1    | 0.90                  | 35.14**  | 0.85 | 0.94 |
|          | IDE2    | 0.92                  | 36.89**  |     |     |
|          | IDE3    | 0.94                  |         |     |     |
| INO      | INO1    | 0.89                  | 33.54**  | 0.78 | 0.93 |
|          | INO2    | 0.77                  | 24.02**  |     |     |
|          | INO3    | 0.94                  |         |     |     |
|          | INO4    | 0.92                  | 37.10**  |     |     |
| INT      | INT1    | 0.91                  |         | 0.74 | 0.94 |
|          | INT2    | 0.90                  | 32.18**  |     |     |
|          | INT3    | 0.83                  | 26.89**  |     |     |
|          | INT4    | 0.81                  | 25.20**  |     |     |
|          | INT5    | 0.85                  | 28.31**  |     |     |

Model fit statistics: $\chi^2 = 408.48$, df = 124, $\chi^2/\text{df} = 3.29$, CFI = 0.96, TLI = 0.95, IFI = 0.96, SRMR = 0.06, RMSEA = 0.07, $**p < 0.001$, AVE, average variance extracted; CR, composite reliability.
standardised estimates and the values of composite reliability (CR) were assessed to determine the reliability of the measures. For example, all the standardised estimates were found to be larger than 0.50, and CRs for all constructs were above 0.70. Thus, the measures’ reliability was supported. Finally, the convergent and discriminant validity was evaluated by analysing the average variance extracted (AVE). We found that the AVEs of the five proposed constructs were above 0.50, which confirmed the convergent validity. Regarding discriminant validity, the squared correlation between every two constructs were calculated, and compared with the AVEs. The comparison is presented in Table 4. Results reveal that AVEs were greater than the squared correlations. As such, the discriminant validity was also supported.

In addition, Harman’s single factor method was adopted to assess the extent of common-method bias associated with the survey instrument used in this study. The method involved a simple but effective test by loading all measurement items onto a common factor. Subsequently, the produced fit indices from the one-factor model were compared with our original measurement model. The one-factor model led to a considerable worse model performance, with the following fit indices: \( \chi^2 = 63,738.58, \text{df} = 134, \chi^2/\text{df} = 27.90, \text{CFI} = 0.51, \text{TLI} = 0.44, \text{IFI} = 0.51, \) SRMR = 0.18, RMSEA = 0.23. Therefore, we may safely conclude that the common method bias was not a serious issue in our study.

4. Findings and discussion

This section presents the findings of the hierarchical regression analysis (Section 4.1) and the latent class analysis (Section 4.2). The key motivators that drive consumers’ SST usage intention are discussed, and the major consumer segments that are driven by different SST usage motivations are identified.

4.1. Hierarchical regression analysis

We performed a hierarchical regression with consumers’ SST usage intention held as the dependent variable and the four proposed motivators as the independent predictors. To discern the explanatory power of the external and internal motivators, we regressed the predictors onto consumers’ usage intention in a sequential manner. The analysis results are shown in Table 5.

Model 1 assesses the explanatory power of the external motivators. The model demonstrated a good fit with the data overall (\( F = 44.80^{***} \)) and explained approximately 15% of the variance in the usage intention. Regarding the standardised regression coefficients (denoted as \( b \)), both coefficients were statistically significant at a 95% confidence level. The results suggested that the perceived prevalence of social distancing (\( b = 0.31^{***} \)) and the influence of individualistic culture (\( b = 0.17^{***} \)) contributed to consumers’ intention of SST usage. Thus, hypotheses 1 and 2 are accepted. Comparing these two predictors, we determined that consumers are more strongly influenced by the social distancing practices than the individualistic culture. This is understandable as the social distancing practices directly promote contactless consumption and hence SST usage, whereas the cultural impact is often subtle and gradual. Notwithstanding the difference in the predictive strength, both the context-specific consideration on social distancing and the background influence of individualism culture turned out to be significant factors that motivated consumers’ SST usage.

Model 2 extended the previous model by adding the two internal motivators into the regression analysis. Based on the model fit statistics, Model 2 was considered a significantly better model overall (\( \Delta F = 66.76^{***} \)) with a considerably higher explanatory power (\( \Delta R = 17\% \)) than Model 1. Thus, Model 2 may be accepted as a better-performing model, suggesting that the internal motivators complemented the external motivators to explain consumers’ SST usage. More specifically, consumers’ self-identity as technology users (\( b = 0.27^{***} \)) and their innovativeness (\( b = 0.21^{***} \)) were positively associated with their usage intention of SST, supporting hypotheses 3 and 4. In terms of the coefficients’ magnitude, consumers’ identity attachment to technology was a slightly stronger predictor than the general trait of being innovative. The aggregated explanatory strength of consumers’ self-identity and innovativeness (measured by \( \Delta R \)) was comparable with those of the internal motivators. It may be inferred that consumers take a balanced consideration of internal and external factors when deciding whether to use SSTs.

In addition, although not hypothesised, consumers’ technology usage behaviour may be influenced by some sociodemographic factors. Accordingly, Model 3 was constructed by adding four sociodemographic factors: age, household income, education and online shopping frequency. Of note, these factors were categorical coded as ordinal variables. Consumers who were older, earned a higher level of income, received a higher level of education and shopped more frequently online were assigned to a larger code. Comparing Models 3 and 2, we deemed that Model 3 is a better model, as suggested by the fit statistics (\( \Delta F = 6.56^{**} \)). However, the model’s explanatory strength increment was marginal (\( \Delta R = 3\% \)). To this end, Model 3 may be accepted over Model 2; however, the sociodemographic factors were much weaker predictors than the proposed internal and external motivators. Among the four sociodemographic factors, only age and online shopping frequency were found to be significant predictors of consumers’ SST usage intention, whereas consumers’ income and education levels did not demonstrate any significant impact. Younger consumers and more frequent online shoppers were associated with a stronger intention of SST usage, whereas the intention did not vary significantly among consumers with different income and education levels.

Finally, focusing on the six significant predictors (two external/internal motivators and two sociodemographic factors), Model 4 was constructed as the finalised model. The model resulted in \( R^2 \) of 35% with background.
the perceived prevalence of social distancing (b = 0.29\(^{**}\)) as the strongest predictor, followed by self-identity as technology users (b = 0.25\(^{***}\)), innovativeness (b = 0.16\(^{***}\)) and individualistic culture (b = 0.12\(^{**}\)), and the two sociodemographic factors being the weakest. Noteworthily, a multicollinearity test was also performed and the variance inflation factor (VIF) for each independent variable was obtained. The result showed that the VIF values ranged from 1.05 to 1.73, indicating no major multicollinearity issues.

### 4.2 Latent class analysis

Upon validating the proposed internal and external motivators of consumers’ SST usage, we further examine the heterogeneities in their motivations. To this end, a latent class analysis was performed using the software of LatentGOLD version 5.1. Upon validating the proposed internal and external motivators of consumers’ SST usage, we further examine the heterogeneities in their motivations. To this end, a latent class analysis was performed using the software of LatentGOLD version 5.1 [4,7,3,74]. The software is a powerful yet ease-to-use tool for latent class identification. It handles classification errors in categorical and numerical variables. It also allows for covariates to be directly added to the model for improved cluster description. In line with the past studies, survey data were applied for the analysis [4,7,4,75]. Based on the analysis results, each cluster is given a label that best describes its defining features [76-79].

#### 4.2.1 Indicators and co-variant

Regarding Table 6, the four motivators were held as the key indicators to form the latent classes. The indicators were categorically coded using their respective mean scores as the split references. For example, based on the mean score of the perceived prevalence of social distancing, the sample was split into two subsamples: a ‘low’ subsample (n = 237)/a ‘high’ subsample (n = 283) consisting of consumers who perceived the prevalence of social distancing to be of a lower/higher level than the mean score. The purpose was to split the sample into relatively balanced subsamples which may facilitate the formation of clearer latent classes that can be interpreted with ease. Subsequently, the indicators of individualistic culture, self-identity and innovativeness were also coded in the same manner.

Furthermore, we identified four categories of SST users based on their current usage behaviour (during the pandemic) and future usage intention (when pandemic ends). Consumers who identified themselves as current users and indicated a positive future usage intention were categorised as adopters. Those current users who expressed no further intentions to use the SST after the pandemic were categorised as pure copers, suggesting that they only used the SST to cope with the pandemic situation. Non-users were categorised as ‘wait-and-see’ or ‘not-interested’ if they indicated positive or negative intentions towards future usage after the pandemic. Applying such a categorisation rule, we found that 39% of the surveyed consumers were adopters, 30% were the not-interest consumers, 24% were pure copers, and 7% decided to wait and see after the pandemic. To consider the different usage patterns, we deemed the user category as a co-variant in the latent class analysis.

#### 4.2.2 Results of latent class analysis

To determine the optimal number of clusters, we performed an initial run of one to six clusters (Table 7). The clustering results were analysed following a few steps. Firstly, the models that resulted in a p-value less than 0.05 were excluded as these models failed to support the structural invariance, indicating an inadequate model fit. Consequently, the 1-, 2- and 3-cluster models were discarded. Next, the remaining models were assessed on their parsimony and classification strength. In this regard, the 4-cluster model was the most parsimonious one with the lowest number of parameters involved (Npar = 28) and the smallest Bayesian Information Criterion generated (BIC = 2694.88). However, the 5- and 6-cluster models, being more complex, resulted in smaller classification errors.

The L\(^2\) difference test was often performed to address the trade-off between the model parsimony and classification strength. The test was to determine whether the improvement on the model’s classification strength was significant so that the loss of model parsimony was justifiable. Thus, the 4-cluster model was compared against the 5- and 6-cluster models based on the significance of the L\(^2\) differences. The test results suggested that no significant differences could be detected between the 4- and 5-cluster models, or the 4- and 6-cluster models. As such, despite the enhanced classification strength of the 5- and 6-cluster models, their losses of model parsimony were not justifiable with statistical significance. Thus, the 4-cluster model was considered the optimal clustering result. In addition, the bivariate residuals associated with the 4-cluster model were calculated, and none exceeded the recommended upper threshold of two (Table 8). Therefore, we may safely accept the 4-cluster model as the final clustering structure, suggesting that four latent segments of SST users exist among the surveyed consumers.

The latent class analysis results are shown in Table 9. All the four indicators and the co-variant of user category were significant contributors to the formation of the four-cluster structure. In terms of the contributing effect (measured by R\(^2\)), consumers’ self-identity as technology users was the strongest contributor (R\(^2\) = 72\%), followed by consumers’ innovativeness (R\(^2\) = 49\%), perceived prevalence of social distancing (R\(^2\) = 34\%), and individualistic culture (R\(^2\) = 16\%). A relatively balanced four-cluster structure emerged, with the largest cluster consisting of 29% of the surveyed consumers and the smallest 23%. Detailed interpretations of the four emerged latent classes are provided in Section 4.2.3.

#### 4.2.3 Interpretation of the latent classes

To facilitate the interpretation of the consumer segments, we labelled each segment based on its key characteristics. Accordingly, the four consumer segments were analysed and labelled as follows: technology lovers, social excluders, self-service embracers, and insensitive pandemic-responders.

Technology lovers: The first segment is labelled as technology lovers because a large majority of consumers from this segment are under a high influence of IDE (99%) and INO (83%). In contrast, only a small proportion of these consumers are strongly influenced by DIS (23%) and CUL (35%). Taking the statistics together, we may interpret this segment as the consumer group that is relatively insensitive to the external pandemic stimulus, but primarily motivated internally. To these consumers, an expression of self-identity and innovativeness via technology usage is important regardless of the social distancing practices and the cultural trend.

Concerning the user category, we note that 34% of consumers in this segment are adopters of the SST, whereas about the same size of consumers (37%) are categorised as pure copers. The statistics suggest that a considerable proportion of the current SST users use the technological service as a compromised alternative to cope with the pandemic. This is probably due to the nature of the SST being studied (i.e. smart lockers),

| Indicator/Co-variant | Subsample | Frequency | Percentage (%) |
|----------------------|-----------|-----------|----------------|
| DIS                  | Low       | 237       | 46             |
|                      | High      | 282       | 54             |
| CUL                  | Low       | 259       | 50             |
|                      | High      | 260       | 50             |
| IDE                  | Low       | 229       | 44             |
|                      | High      | 290       | 56             |
| INO                  | Low       | 254       | 49             |
|                      | High      | 265       | 51             |
| User category        | Adoptor   | 205       | 39             |
|                      | Non-interested | 157     | 30             |
|                      | Pure coper | 123       | 24             |
|                      | Wait-and-see | 34       | 7              |
which utilises the commonplace locker technology and lacks the innovative features preferred by true technology lovers. In fact, this segment also contains 23% of consumers who are non-users of the SST and indicate no future usage intentions (i.e. the not-interested consumers).

In summary, the technology-lover segment demonstrates an internal drive of technology usage, yet such a driving force does not necessarily lead to a willing adoption of SSTs, leading to differentiated SST usage behaviours.

**Social excluders**: This segment displays some reverse characteristics from the previous segment. Most consumers from this segment rate their technology-related identity and innovativeness to be lower than the sample average, indicating that most consumers in this segment do respond to the pandemic-induced restrictions. Meanwhile, the individualistic culture does not seem to contribute to the formation of this segment as about equal sizes of consumers are under the stronger/weaker cultural influences. Thus, treating consumers’ perception of social distancing practices as the deterministic characteristic, this segment is labelled as social excluders.

Concerning the user category, about half of social excluders are SST adopters, and the proportion is even higher than that of the technology lovers. The proportion of pure copers among the social excluders (20%) is lower than that among the technology-lover segment (37%). Herein, we may infer that the imposed social constraints are more effective than consumers’ internal attachment to technologies in promoting the SST adoption. Such an inference is contrary to the common understanding that the internal motivations lead to willing adoptions whereas the imposed external constraints lead to forced/coping behaviours. The contradiction may again be explained by the simple technological features of the SST which are not sufficiently identity-defining to attract the technology lovers. Yet, such simple features are ideal for the less innovative social excluders once they are forced to try out the SST in response to the imposed pandemic constraints. Consequently, a large proportion of the technology lovers become the copers, and the social excluders become the adopters of the SST.

**SST embracers**: Consumers from this segment demonstrate consistent characteristics of being enthusiastic SST supporters, who are thus labelled as the SST embracers. For example, more than 80% of these consumers belong to the subsamples of high DIS, high CUL, high IDE and high INO, which means that most of them are highly motivated externally and internally to use the SST.

As such, unsurprisingly, about 75% of these consumers are categorised as adopters and only 6% are the not-interested consumers. This segment may be interpreted as a somewhat homogeneous group which favours the individualist style and the technological elements during service encounters, making it an ideal customer base for SSTs.

**Indifferent pandemic-responders**: This segment does not seem to respond to internal or external motivators. It may be considered a reverse segment of the SST-embracer segment. Most consumers are under a low level of influences from DIS (66%), CUL (70%), IDE (91%) and INO (89%). They remain indifferent to the ongoing pandemic situations and the technological alternatives that may help them go through the pandemic. Considering these characteristics, we label this segment as the indifferent pandemic-responders.

To a certain extent, this segment may be the most challenging segment for any technological innovations to penetrate. Examining the user category, we note that 78% of these consumers belong to the not-interested category, which is in line with the general segment characteristics as illustrated above.

| Model          | LL       | BIC(LL)  | Npar | L²   | df | p-value | Class.Err. | R²  | p-value (L² diff) |
|----------------|----------|----------|------|------|----|---------|------------|-----|------------------|
| 1-cluster      | -1433.31 | 2891.63  | 4    | 380.70 | 56 | <0.05   | 0%         | 100% |                  |
| 2-cluster      | -1302.96 | 2680.94  | 12   | 120.00 | 48 | <0.05   | 7%         | 73%  |                  |
| 3-cluster      | -1271.16 | 2667.37  | 20   | 56.41  | 40 | <0.05   | 11%        | 71%  |                  |
| 4-cluster      | -1259.91 | 2694.88  | 28   | 33.91  | 32 | 0.38    | 19%        | 69%  |                  |
| 5-cluster      | -1254.84 | 2734.74  | 36   | 23.76  | 24 | 0.48    | 14%        | 73%  | <0.05            |
| 6-cluster      | -1251.07 | 2777.42  | 44   | 16.22  | 16 | 0.44    | 16%        | 72%  | <0.05            |

Table 8
Bivariate residuals.

| Indicators/variant | DIS | CUL | IDE | INO |
|--------------------|-----|-----|-----|-----|
| DIS                | 0.07| 0.00|     |     |
| CUL                | 0.12| 0.23| 0.00|     |
| IDE                | 0.03| 0.29|     |     |
| INO                | 0.27| 0.21| 0.02| 0.12|

Table 9
Results of latent class analysis (4-cluster model).

| Technology lover (29%) | Social excluder (25%) | SST embracer (23%) |Insensitive pandemic-responder (23%) | Wald | p-value | R² |
|------------------------|-----------------------|--------------------|-------------------------------------|------|---------|----|
| DIS                    | 0.23                  | 0.72               | 0.95                                | 0.34 | 19.15   | ***|34%  |
| Low                    | 0.77                  | 0.28               | 0.05                                | 0.66 |          |    |      |
| CUL                    | 0.35                  | 0.58               | 0.81                                | 0.30 | 22.89   | ***|16%  |
| High                   | 0.66                  | 0.42               | 0.19                                | 0.70 |          |    |      |
| IDE                    | 0.99                  | 0.15               | 0.92                                | 0.09 | 28.36   | ***|72%  |
| Low                    | 0.01                  | 0.85               | 0.08                                | 0.91 |          |    |      |
| INO                    | 0.83                  | 0.18               | 0.86                                | 0.11 | 76.14   | ***|49%  |
| High                   | 0.17                  | 0.82               | 0.14                                | 0.89 |          |    |      |
| User category          |                       |                    |                                     |      |         |    |      |
| Adopter                | 0.34                  | 0.46               | 0.75                                | 0.04 | 50.52   | ***|N/A  |
| Not-interested         | 0.23                  | 0.17               | 0.06                                | 0.78 |          |    |      |
| Pure coper             | 0.37                  | 0.20               | 0.18                                | 0.17 |          |    |      |
| Wait-and-see           | 0.07                  | 0.17               | 0.01                                | 0.00 |          |    |      |
5. Conclusion

This study recognises consumers’ accentuated self and deeper attachment to technologies and revisits consumers’ SST usage behaviour (as measured by intention) under the pandemic context. The hierarchical regression analysis suggests that the social distancing practices and individualistic culture provide consumers with new extrinsic motivations to use SSTs. Intrinsically, the pandemic drives consumers to deeper dependence on technologies where technology-related self-identity and personal innovativeness motivate consumers’ SST usage behaviour. Furthermore, the latent class analysis reveals the motivational heterogeneities in consumers’ SST usages and four distinct consumer segments are identified, which are labelled as technology lovers, social excluders, SST embracers, and indifferent pandemic-responders. With the findings, this study makes several contributions.

5.1. Theoretical contribution

One unprecedented context: This study incorporates the COVID-19 pandemic as an unprecedented research context and strongly argues for its saliency in relation to consumers’ SST usage behaviour. Our findings suggest that the pandemic simultaneously gives rise to the external environment of social exclusion and individuals’ internal aspiration for independence (as empowered by technologies), leading to behavioural consequences. Our empirical evidence also confirms the similar explanatory powers of extrinsic and intrinsic factors that lead to consumers’ SST usage behaviour. In this regard, our study contributes to the research fields of both SST and pandemic-induced consumer behaviours by confirming the dual effects of the pandemic that change both SST consumption environments and SST users’ self-perceptions[80,81].

Two emerging themes: This study identifies two emerging themes of SST research (i.e. changing perceptions of social interactions and technologies) which become particularly salient under the pandemic context. Importantly, while the ‘technology’ aspect has been frequently assessed by the SST literature, our study also highlights the less-noticed ‘self’ perspective. The importance of the ‘self’ perspective is also indirectly supported by the presence of the ‘social excluder’ segment which is of a comparable size of the ‘technology lover’ segment. To this end, our study enriches the SST literature by emphasising the pandemic-induced effects on consumers’ SST usage behaviour due to the changing perceptions of both ‘self’ and technologies[11,59,82].

Four motivational factors: By integrating the theoretical insights from the culture and identity literature into SST usage behaviour, we propose and validate four antecedent factors (i.e. prevalence of social distancing, individualistic culture, self-identity expressed as technology users, and innovativeness) that lead to consumers’ usage of SSTs during the pandemic. Besides the three established factors by the prior literature, this study also designs and operationalises a new factor concerning individual perceived prevalence of social distancing. To the best of the authors’ knowledge, our study is the pioneer research that confirms the motivational effect of social distancing to consumers’ SST usage. Respectively, these four factors address a context-specific social practice, a general cultural influence, an identity-defining characteristic, and a general personal trait that collectively shape consumer-technology interactions. As such, our study also represents a novel attempt that integrates social, cultural, personal factors with pandemic-specific considerations into the SST literature.

5.2. Practical implications

Practically, the generated segments of SST users provide rich implications.

Technology lovers versus social excluders: Interesting differences can be observed when comparing the technology-lover and social-excluder segments. Although the technology-lover segment contains both adopters and copers of similar sizes, the social-excluder segment is dominated by SST adopters. The finding suggests that the SST suits well with the social excluders, yet many technology lovers (i.e. the copers) are not truly satisfied with the SST. When interpreting the finding in the specific context of smart locker self-collection, we may suggest that the social excluders are a key market for the self-collection service, whereas more distinctive technological elements need to be incorporated into the smart locker design to meet the expectation of the technology-lover segment. To this end, the logistics operators may consider implementing the self-collection service in communities where social distancing practices are prevalent. For the technology-lover segment, advanced technological features, such as virtual collection assistant and anthropomorphised self-service interface, may be added to the locker system in order to create a feeling of personal connection with the technology[52,83].

SST embracers versus indifferent pandemic-responders: Besides the segment of SST embracers who are mostly SST adopters, a similar-sized segment of indifferent pandemic-responders is largely uninterested in the SST. These two segments may fall onto the two extreme ends of the pandemic-induced SST users, with the SST embracers being the most sensitive responders to the pandemic stimuli, and the indifferent pandemic-responders being the least sensitive. Given the substantial heterogeneities among consumer groups, the SST operators should be aware of the danger (e.g. completely losing one of the segments) if the consumers are managed as a homogenous group. In the specific context of smart lockers, the self-service logistics operators should take the pandemic as an opportunity to expand their user base. More self-collection facilities may be implemented to meet the needs of SST embracers. Meanwhile, the logistics operators should also take care of the considerable number of the indifferent responders, who are likely to prefer the traditional delivery services. In this regard, although the self-collection service may be offered as a default option, the traditional delivery services should be made available at all times.

5.3. Limitations and future research

Some limitations of this study should be acknowledged. Firstly, the survey data were collection in Singapore in the late 2020. This was a period when the pandemic situation was under greater control and is less of a concern to the public in the research region. As such, readers should note the research background of this study when interpreting our findings. Next, this study explores the cultural impact on consumers’ SST usage in a single-country setting. Although the research country is culturally diversified, richer insights may be generated by adopting a cross-country design. Further, this study proposes a new theoretical construct of the perceived prevalence of social distancing and four measures are designed to operationalise the construct. The measures demonstrate a sufficient level of reliability and validity, yet they could be further modified/refined to enhance the performance. Thus, we invite future researchers to adapt the designed measures to different research contexts and make necessary adjustments when needed. In addition, this study selectively focuses on four motivational factors to consumers’ SST usage which are salient under the pandemic context. While it is not our intent to propose a comprehensive model, it should be acknowledged that many other factors exist which influence consumers’ SST usage. Among these, we encourage future researchers to explore factors such as technology anxiety and technology trust. An interesting topic would be whether the pandemic enhances (reduces) individuals’ technology trust (anxiety) as the technology-based alternatives become more viable or sometimes the only choice during the pandemic.

Finally, we would like to acknowledge that our data were collected during the pandemic period and our research focused on the pandemic-induced SST usage behaviours. While we foresee that the proposed factors continue to influence consumers’ SST usage in the post-pandemic era, the strength/momentum of the influence remains to be further explored. For example, our study suggests that the prevalence...
perception of social distancing is an important behavioural determinant, yet its impact under the post-pandemic era may be weakened. Moreover, instead of social distancing as an impose practice, it may be perceived as a social norm that continues to shape consumers’ interactions with technologies. Thus, future researchers may extend our study by incorporating the changing perception on social distancing and explore its continued impact on SST usage in the post-pandemic era.

The post-pandemic context may also lead to changed perceptions on all contributing factors proposed in this study, creating a new market landscape of SST users that is different from our study. To this end, we foresee there will be dynamic changes in the four SST user segments, with some segments (e.g. technology lover) expanding while others shrinking (e.g. social excluder) when the pandemic becomes less of a concern. Therefore, the uncertainties in consumers’ perceptual changes in the post-pandemic context create venues for future research. Future researchers may collect longitudinal data at different stages of the pandemic and profile the SST segments in a dynamic manner. The dynamic profiling would provide more accurate forecasting on consumers’ behavioural pattern, which is essential in preparing the retail operators for the post-pandemic market.

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Declaration of competing interest
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