

# The Sustainability of Disruptive Technology in Singapore's Supermarket Industry

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This paper aims to investigate disruptive technology in the supermarket industry and its' sustainability in Singapore. The extended Technology Acceptance Model 3 (TAM3) was used to test and analyse factors affecting consumer willingness to adopt the use of high-tech enabled (HTE) services in supermarkets. A sample of 50 survey respondents completed an online questionnaire. Pivot tables and multiple regression statistics were used to analyse survey responses. Perceived usefulness and Perceived ease of use are two determining factors that contributed to adoption attitudes. Other moderating factors like unique demographics, psychographics, relative convenience, and location accessibility also play big roles in adoption rates. While actual use of HTE services was found to be low, the intention to use was high.

**Key words:** *Disruptive technology, Technology acceptance, Supermarket, Smart retail technology.*

## Introduction

With the advent of a rapid technological overhaul in today's landscape, the usage of smart devices and applications has gained momentum in many sectors of the economy (Jiang, Du, & Jin, 2019). Disruptive technology coined and popularised by Clayton Christensen and Joseph Bower (Bower & Christensen, 1995, Christensen, 2003, Christensen & Bower, 1996) dramatically displaces many existing processes, products and value networks today.

Against this backdrop, disruptive innovation has also penetrated one of the world's most traditional retail business. The traditional supermarket business structure that has long been a perennial blueprint in the realm of retail is now changing with disruptive technological transformations, resulting in an unceasing disappearance of traditional markets (Matalamas & Ramos, 2009). In spite of the upheavals caused by such innovations, mobile applications are

here to stay as they continually provide users with high-quality services (Williams, 2012).

*Habitat by honestbee* is the only tech-enabled and multi-sensory supermarket in Singapore (honestbee, n.d.). In this paper, habitat by honestbee will be referred to as a high-tech supermarket. Adoption of smart retail in Singapore supermarkets is still in its infancy. Coupled with unique demographic and geological conditions, digitalisation and automation seem to be the future of supermarkets in Singapore. *Do supermarket businesses stand to benefit from the investment and deployment of such complex infrastructure and technology, and will this change the future of the most traditional of retail shopping experiences for customers?*

The primary objective of this paper is to determine the factors affecting the acceptance of high-tech supermarket technology derived from the Technological Acceptance Model (TAM3).

This paper seeks to understand Singaporeans' attitudes towards technology adoption through constructs identified in TAM literature, including other external moderating factors.

## Literature Review

The speed at which technology is evolving and penetrating the retail industry has left many customers confused, hence apprehensive due to their unfamiliarity using them (Kaushik & Rahman, 2015). As a result, supermarkets have developed a variety of ways to incorporate technology to serve existing consumer needs whilst revolutionising their businesses. Countries all over the world have been launching new **high-tech-enabled (HTE)** services in their local grocers. Amazon Go in the US and Alibaba's Hema in China are just two of the most progressive high-tech supermarkets worldwide that pioneered the transformation (Fannin, 2018).

Recent studies by Cho and Fiorito (2010) have introduced disruptive technology as a supermarket attribute that customers in supermarkets value today though only limited to self-scan devices and/or checkout counters. Some indispensable qualities of supermarkets as identified by Nilsson, Gärling, Marell and Nordvall (2015) and Sharma, Lowalekar and Jain (2013), were functional qualities such as store location, product pricing as well as psychological qualities such as store aesthetics, friendliness of staff. Other studies conducted by Uusitalo (2001) and Carpenter and Moore (2006) found that product supply and variety were the most important attributes when choosing a supermarket to patronise. These supermarket attributes provide the basis of supermarket visitorship, which will be useful for the study of including HTE services in supermarkets if these factors remain consistent.

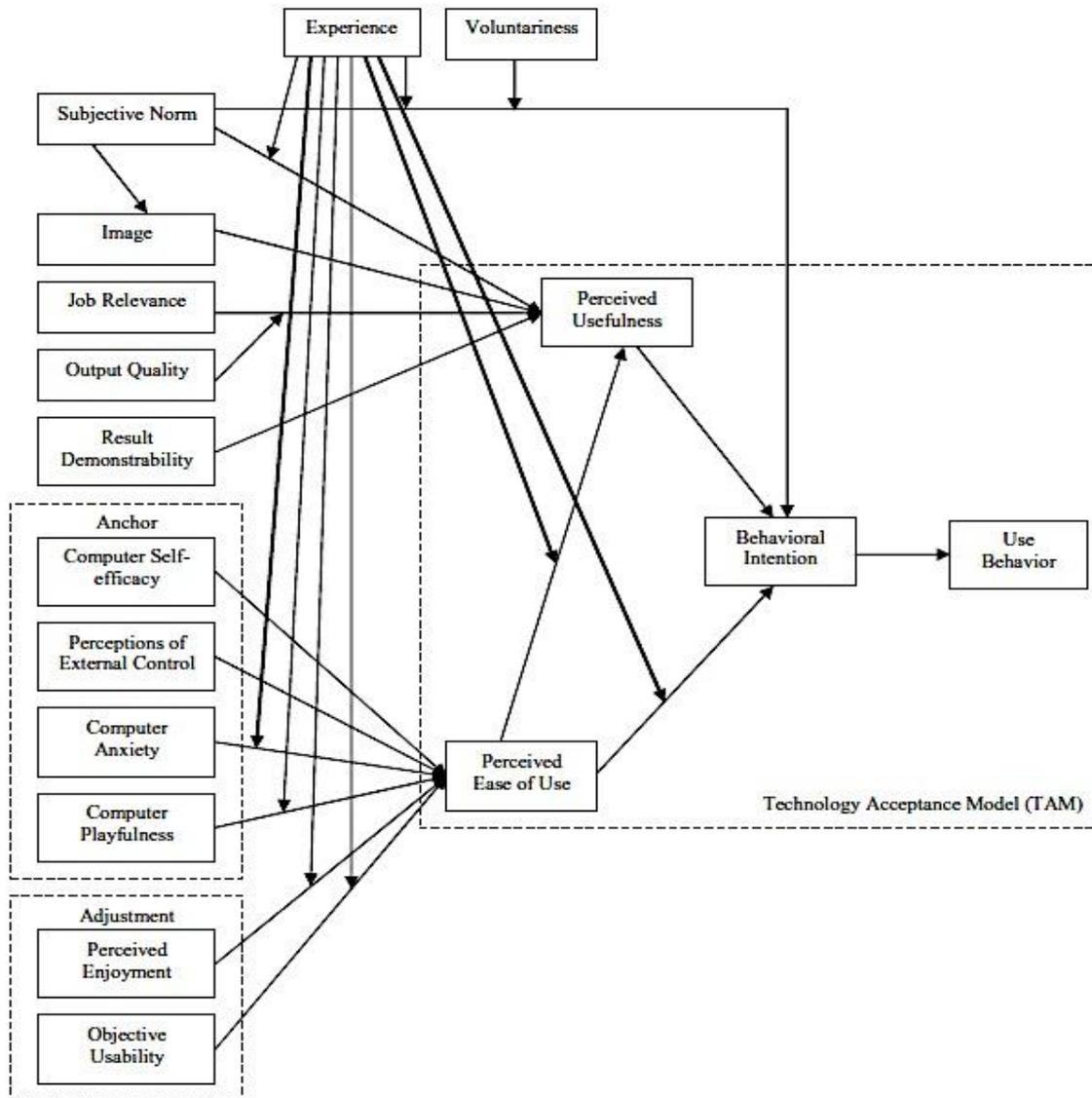
Supermarket shopping behaviour might also impact the adoption of HTE services in supermarkets. Nilsson et al. (2015) highlighted two main styles of customer shopping behaviours: major and fill-in shopping. Major shopping refers to when customers invest more time, effort and money while shopping (Kollat and Willett, 1967; Kahn and Schmittlein, 1992; Walters and Jamil, 2003) while fill-in shopping demands more visits but less time and effort (Kollat and Willet, 1967; Kahn and Schmittlein, 1992).

### ***Technology Acceptance Model (TAM)***

Many technology adoption models that have been used and studied upon in existing literature are, but not limited to, the Theory of Diffusion of Innovations (DIT), the Theory of Reasonable Action (TRA), Theory of Planned Behavior (TPB), Decomposed Theory of Planned Behaviour, the Technology Acceptance Model (TAM), Technology Acceptance Model 2 (TAM2), and Technology Acceptance Model 3 (TAM3) (Lai, 2017).

The TAM, in particular, has been developed to project individual adoption and use of new information technology (Venkatesh & Bala, 2008). It is shown to be highly accurate in its ability to conjecture technology adoption and use (Davis, Bagozzi, & Warshaw, 1989; Adams, Nelson, & Todd, 1992; Venkatesh & Davis, 2000; Venkatesh & Morris, 2000). The model asserts that *perceived usefulness (PU)* and *perceived ease of use (PEOU)* are constructs that govern an individual's intention to adopt any form of technology (Venkatesh & Bala, 2008). In the newest extension of the models, the TAM3 will present a holistic nomological network that includes three new theoretical extensions from TAM2, as well as the model of the determinants of PEOU (shown in Figure 1 below).

**Figure 1.** Technology Acceptance Model 3 (TAM3) (Venkatesh & Bala, 2008)



Considering the above, this study will adopt the TAM3 to understand customer attitudes and usage behaviour in relation to new retail technology used in high-tech supermarkets. Two hypotheses will be tested in this research based on the theories suggested by the TAM:

- H1:** PU affects the willingness of consumers to adopt smart retail technology (HTE services).
- H2:** PEOU affects the willingness of consumers to adopt smart retail technology (HTE services).

The key determinants of both PU and PEOU from TAM3 will be used in this study, which are relevant to HTE services in supermarkets. The definitions of these determinants are as below:

Extracted determinants of Perceived Usefulness (PU) from TAM3.

Determinants	Definitions
Subjective Norm (SN)	The degree to which an individual perceived that most people who are important to him think he should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000).
Perceived Ease of Use (PEOU)	The degree to which a person believes that using IT will be free of effort (Davis et al., 1989).

Extracted determinants of Perceived Ease of Use (PEOU) from TAM3.

Determinants	Definitions
Computer Self-Efficacy (CSE)	The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer (Compeau & Higgins, 1995a, 1995b).
Computer Playfulness (CPLAY)	"...the degree of cognitive spontaneity in microcomputer interactions" (Webster & Martocchio, 1992, p. 204).
Computer Anxiety (CANX)	The degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers" (Venkatesh, 2000, p.349).
Perceived Enjoy (ENJ)	The extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000, p. 351).

## Methodology

An online self-completion questionnaire was administered to a representative sample group of 50 participants. This study targeted at Singapore residents who are involved in supermarket shopping responsibilities in a household. The questionnaire was disseminated via a generic survey link by Google Forms, a survey administration application. Survey respondents were able to access the survey through smart devices, i.e. smartphones, tablets, computers and so on. A web questionnaire method was chosen to expedite the data collection process and for the ease of data visualisation and analysis. The online survey algorithm ensured that all questions were attempted before respondents were allowed to advance to the next, lowering quality rejects.

The three sections in the survey questionnaire collate respondent demographic information, test TAM3 constructs in relation to high-tech enabled (HTE) supermarkets as well as understand respondent interaction with habitat at honestbee and other supermarkets respectively. TAM3 constructs in the questionnaire were adapted from Venkatesh and Bala (2008) and were measured using a 7-point Likert scale that ranges from 1 (Strongly Disagree) to 7 (Strongly Agree). A 7-point scale was used instead of a 5-point scale because it provides more varieties of options which eliminates the dilemma of choice, thus improving the internal validity of survey responses (Joshi, Kale, Chandel & Pal, 2015).

The survey will test if the factors influencing adoption of smart technology in supermarkets

align to that of the TAM3 model, considering other relevant factors such as convenience, accessibility, grocery variety and pricing as found in the existing literature. It will disclose participants' attitudes towards technology disruption and adoption using appropriate determinants. It will also reveal participants' interaction with honestbee's habitat supermarket, e.g. willingness to visit, opinions of HTE and so on. A pilot test was conducted with 5 participants, aged 23, 25, 34, 57 and 58, before the dissemination of the survey. Minor adjustments were made to questions that needed more clarification based on feedback received.

Multiple regression was used to test the determinants of the TAM3, which would yield the strength of relationships (correlation) between the independent and dependent variables. For example, the extent to which both PU and PEOU will influence the behavioural intention (dependent variable) of respondents, respectively.

Pivot tables were used to analyse the demographic segment of the survey results. Demographic information will allow the understanding of consumer behaviour relating to the willingness to accept HTE services. At the same time, it will aid in the formation of specific consumer profiles who behave in a similar fashion, for which businesses can target due to their heightened receptiveness of adopting HTE services in supermarkets.

## **Results and Discussion**

The demographics of survey respondents are summarised below. Of the 50 respondents, 32% were male, and 68% were females - all of which were generally spread out amongst the five age categories. The majority were Singapore citizens (92%) who had university or post-grad education levels (51%) and were married (66%). Majority of responses were valid for analyses purposes except in the categories "Age" and "Education Level", the numbers "48" and "49" in parentheses respectively represent the number of responses that were considered (out of 50) due to the omission of anomalies.

**Table 1:** Summary of Respondent Demographics

Questions	No. of Respondents	% of Respondents
Gender	Males: 16	32%
	Females: 34	68%
Age (48)	18-24 yrs: 11	23%
	25-34 yrs: 3	6%
	35-44 yrs: 9	19%
	45-54 yrs: 11	23%
	55-64 yrs: 14	29%
Citizenship	Singapore Citizen: 46	92%
	Permanent Resident: 4	8%
Education Level (49)	Secondary: 12	24%
	Pre-U/Junior College: 4	8%
	Polytechnic: 8	16%
	University/Post Grad: 25	51%
Marital Status	Single: 15	30%
	Married: 33	66%
	Divorced/Separated: 2	4%
No. of Members in Household	<4 members: 16	32%
	4 members: 17	34%
	5 members: 10	20%
	>6 members: 7	14%
Ave. Household Monthly Income	<\$2500: 8	16%
	\$2500 - \$7000: 14	28%
	\$7001 - \$10,000: 9	18%
	>\$10,000: 19	38%

Table 1 summarises the behaviour, potential intentions and interaction that survey respondents have with habitat by honestbee. Only a small percentage (26%) have patronised. However, the majority of the same group were willing to patronise habitat by honestbee only. This was telling of their willingness and preference for using HTE services during supermarket shopping. Respondents were also generally receptive to adopting HTE if their routine supermarkets started using them. A resounding 88% were willing to use them instead of looking for another traditional supermarket. From these statistics alone, it seems that respondents were willing to adopt new HTE services in supermarkets but were lacking the opportunity.

**Table 2:** Respondent's Supermarket Shopping Preferences/Behavioural Intentions

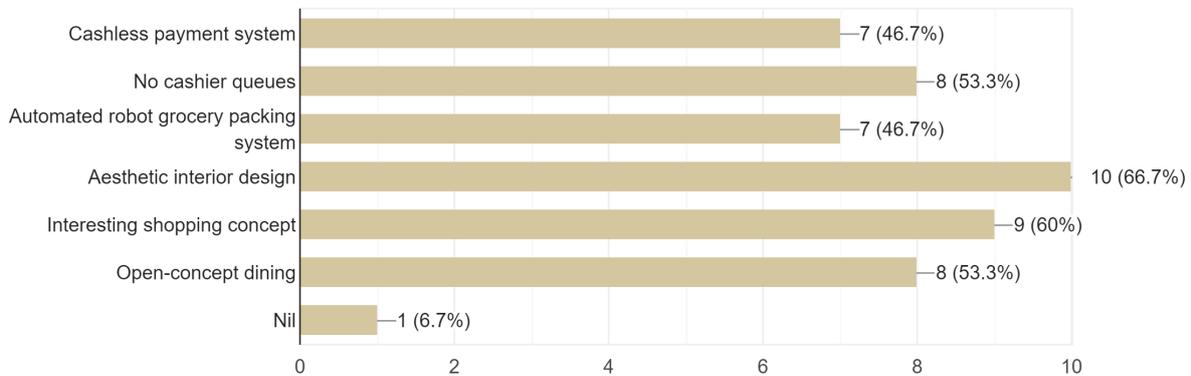
Questions	No. of Respondents	% of Respondents
Patronised habitat by honestbee	Yes: 13	26.0%
	No: 37	74.0%
Intention to patronise habitat by honestbee ONLY	Yes: 13	26.0%
	No: 37	74.0%
Patronise routine supermarkets if it changes entirely to HTE (instead of switching to other traditional supermarkets)	Yes: 44	88.0%
	No: 6	12.0%

From the qualitative responses gathered, the majority (52%) of the respondents elaborated that habitat by honestbee “is too far”, “inconvenient”, “inaccessible location”, hence were not willing to travel further than their routine supermarket's location to habitat by honestbee. Other top reasons related to the familiarity with traditional/conventional supermarkets, habitat's higher price items and lack of variety and promotions. This further corroborates why very few have patronised habitat by honestbee but do have intentions to visit and explore HTE supermarket services. Inconvenience and inaccessibility issues aside, the 88% of respondents who were fond of adopting HTE services cited that the convenience the cashless system provides, the efficiency, the novelty of a new shopping concept interested them.

Of the 13 respondents who have patronised habitat by honestbee, most favoured its interior aesthetics, followed closely by its interesting shopping concept, no cashier queues, cashless payment system and the automated robot grocery-packing system (see Figure 2). These were unique features that were typically not found in traditional supermarkets.

**Figure 2.** Summary of respondents' favourite features in habitat by honestbee

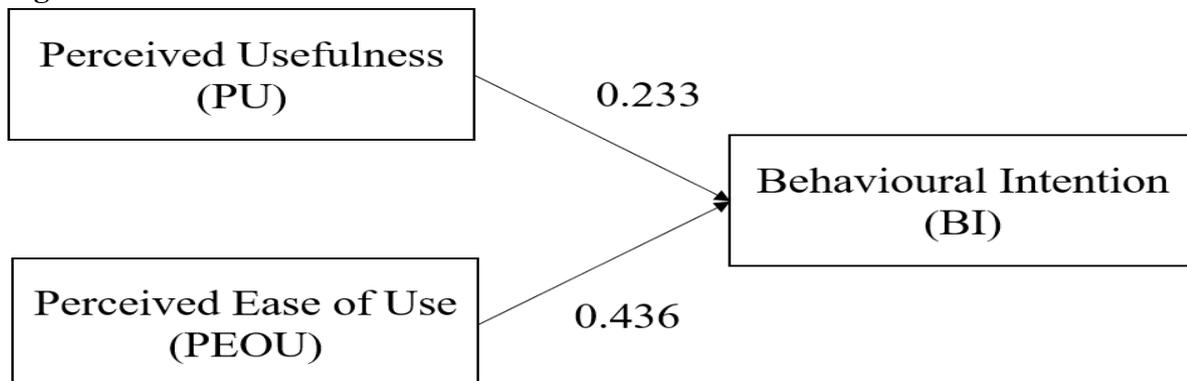
4b. If yes, what did you like about habitat by honestbee? You may select more than one option.  
15 responses



### *Role of Members in a Household*

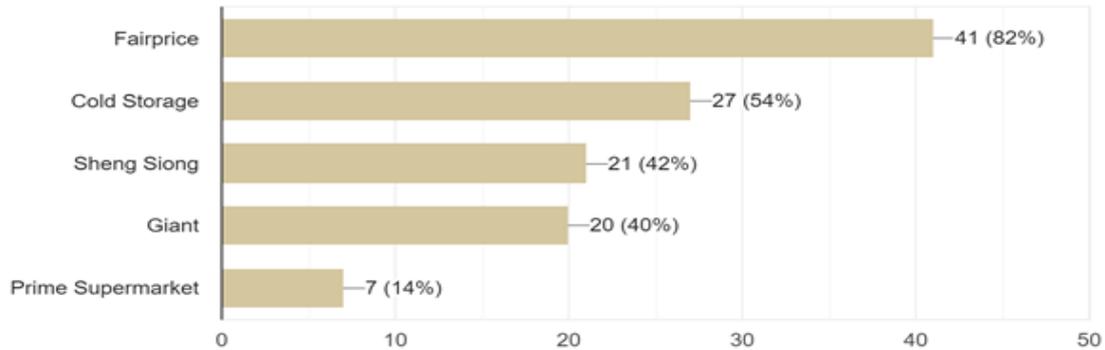
As can be seen in Figure 4, 66% of respondents found to be responsible for supermarket shopping in their households (see Figure 4). Of this group, a vast majority (74%) indicated their interest to adopt HTE services. Similarly, those who were not supermarket shoppers of their household also indicated their willingness to adopt HTE services in supermarkets (89%). It can be concluded that most members of the household are generally inclined to use HTE services, although intra-family influencing determinants like SN (subjective norm) has on an individual, i.e. motivating or discouraging members of their family who are responsible for supermarket shopping to adopt or reject the usage of HTE supermarket services.

**Figure 3.** PU and PEOU's influence on BI



**Figure 4.** Supermarket patronage amongst survey respondents

3. Which supermarkets do you usually visit? You may select more than one option.  
50 responses



**Table 3:** Respondents' Supermarket Shopping Habits

Questions	No. of Respondents	% of Respondents
Supermarket Shopper of Household	Yes: 33	66.0%
	No: 17	34.0%
Frequency of Supermarket Shopping	Everyday: 1	2.0%
	Several times a week: 12	24.0%
	Once a week: 28	56.0%
	Once every two weeks: 3	6.0%
	Once a month: 6	12.0%

### *Testing TAM3 Determinants Using Multiple Regression*

Multiple regression was used to predict the adoption of HTE services. Two main hypotheses were formed at the beginning of the research:

**H1:** PU affects the willingness of consumers to adopt smart retail technology (HTE services).

**H2:** PEOU affects the willingness of consumers to adopt smart retail technology (HTE services).

In testing the willingness of consumers to adopt HTE services, the determinant Behavioural Intention (BI) that is derived from the TAM3 model was used as the indicator of willingness to adopt (dependent variable). Since BI refers to an individual's subjective probability to perform a certain task, it will equate to the willingness of an individual to adopt HTE services. To test BI, both PU and PEOU functioned as independent variables. The primary

determinants, i.e. SN, PEOU, and CSE, CPLAY, CANX, ENJ, were also tested to uncover their relative influence on both PU and PEOU, respectively.

**H1:** PU affects the willingness of consumers to adopt smart retail technology (HTE services).

Perceived usefulness (PU) was identified to be influenced by both SN and PEOU. Table 4 presents the regression statistics relating to this test. Both determinants were found to have the following relationship with PU:

**Table 4:** Summary of regression statistics of SN and PEOU on PU

<i>Regression Statistics</i>	
Multiple R	0.73907362
R Square	0.54622981
Adjusted R Square	0.52692044
Standard Error	0.93876495
Observations	50

$$PU = 0.63333 + (0.25254 * SN) + (0.68835 * PEOU)$$

PEOU's larger coefficient of 0.688 compared to SN's 0.252 indicates that it has a greater effect on PU. Generally, its multiple R-value of 0.739 (see Table 2) illustrates a good positive linear relationship between the variables, indicating that both of these determinants do correlate well with PU. In sum, given the context of utilising HTE services during supermarket shopping, consumers will more likely be affected by subjective norms than perceived ease of use, e.g. opinions of their friends or family members that will either increase or decrease perception of HTE services' usefulness. This will rely heavily on people's sentiments of high technology usage in retail contexts which will activate a herd effect amongst individuals of the same ingroup. For example, parents' perceived usefulness of HTE services is high because they were influenced by their child's positive opinion of it. Such implications should benefit the sales and marketing strategies of businesses. Though the adjusted R-Square of 0.526 indicates a mediocre fit, these determinants still demonstrate a correlation to perceived usefulness just as Venkatesh and Bala (2008) had empirically deduced.

Of the entire sample, 80% of respondents had a >4-point rating (out of 7 on the Likert scale) of the perceived usefulness of HTE services. This is indicative of a strong positive attitude towards HTE services. PU and BI share the following correlation:

$$BI = 2.51 + (0.522 * PU)$$

The multiple R-value of 0.612 in Table 5 indicates a moderate positive linear relationship. The low R Squared value of 0.375, however, implies a weak correlation between PU and BI. Nonetheless, survey results also show that 80% of respondents had a >4-point rating of BI, indicating a high likelihood and intention to use HTE services. This means that both PU and BI received equally high positive ratings but had a low correlation. This could be due to the interference of other moderating factors such as the lack of access, convenience, unfamiliarity, as found in existing literature as well as in primary survey research. To elaborate, one could have a positive perception of usefulness of HTE services and a corresponding positive behavioural intention but do not act on it due to the inconvenient location of the high-tech supermarket. However, the hypothesis that PU affects the willingness of consumers to adopt HTE services still holds true, but with limited effect due to the presence of external moderating factors.

**Table 5:** Summary of regression statistics of PU on BI

<i>Regression Statistics</i>	
Multiple R	0.6124
R Square	0.37504
Adjusted R Square	0.36202
Standard Error	0.92966
Observations	50

**H2:** PEOU affects the willingness of consumers to adopt smart retail technology (HTE services).

PEOU's determining factors include CSE, CPLAY, CANX and ENJ. Table 8 presents the regression statistics of these variables on PEOU (dependent variable). These determinants were found to have the following relationship with PEOU:

$$PEOU = 1.0163 + (0.38171 * CSE) + (0.37743 * CPLAY) + (-0.078527 * CANX) + (0.12618 * ENJ)$$

The coefficients of the determinants indicate that none of the variables alone affects PEOU significantly though all of which have a positive relationship with PEOU. The negative CANX coefficient is reflective of the negatively phrased survey questions, i.e. items where disagreement (values 1, 2 and 3 on a 7-point Likert scale) is considered a good answer. However, the multiple R-value of 0.834 (see Table 6) reflects a strong positive linear relationship, indicating that the variables correlate strongly to PEOU in totality to a large extent. Adjusted R Square of 0.70 also implies a moderate fit. Therefore, these determinants largely influence PEOU that is consistent with findings from the TAM3 model. Out of the 4

determinants, computer self-efficacy (CSE) seems to influence PEOU the most given that it possesses the highest coefficient. It is followed closely behind by computer playfulness (CPLAY) that is only marked a 0.01 difference. In response to these findings, managerial decision-making should take into account the role of CSE and CPLAY to in order to raise the perceived ease of use of HTE services amongst targeted audiences. For instance, CSE can be boosted through informational support that allows consumers to clearly understand the workings of a specific technology so that they are more confident of their ability to complete a task. Similarly, CPLAY can be encouraged through the conception of creative and fun technology with which consumers can interact. This can also be supported by marketing efforts that will showcase the entertainment value of said technology.

**Table 6:** Summary of regression statistics of CSE, CPLAY, CANX and ENJ on PEOU.

<i>Regression Statistics</i>	
Multiple R	0.834782336
R Square	0.696861548
Adjusted R Square	0.669915908
Standard Error	0.735217323
Observations	50

The result shows that 74% of respondents had >4-point rating of PEOU. This means that the majority perceive HTE services to be easy to use. It is also just as high as BI that had 80% of respondents exceeding the >4-point rating. The following equation summarises the relationship between PEOU and BI:

$$BI=2.14 + (0.611*PEOU)$$

The multiple R-value of 0.672 from Table 7 implies a moderate positive linear relationship between the two variables. The low R Squared value appears to be similar to that of PU's. Similarly, the identical reason involving the interference of external moderating factors would entail. Majority of the respondents who gave high ratings for both PEOU and BI would have been affected by inaccessibility or inconvenience of the supermarket location, which could account for the low correspondence. For example, one could perceive HTE services to be easy to use, as well as possess a strong intention to use, but are unmotivated because a traditional supermarket nearby is much more accessible. Though, this does not void the correlation between PEOU and BI. The positive relationship represented by the multiple R-value indicates clear causation that was also as exemplified in the TAM3. Hence, the hypothesis that PEOU affects the willingness of consumers to adopt HTE is not rejected but accepted with the conclusion that external factors moderate the impact of PEOU on the intention to adopt HTE services in supermarkets.

**Table 7:** Summary of regression statistics of PEOU on BI

<i>Regression Statistics</i>	
<b>Multiple R</b>	<b>0.6724</b>
<b>R Square</b>	<b>0.45212</b>
<b>Adjusted R Square</b>	<b>0.4407</b>
<b>Standard Error</b>	<b>0.87045</b>
<b>Observations</b>	<b>50</b>

To further corroborate that external factors were indeed influencing the willingness to adopt HTE services, the correlation between behavioural intention (BI) and actual use (USE) was calculated. A low R Squared value of 0.161, implying a poor fit was telling of the poor correlation. In addition, the average scores of BI was a 6-point rating while USE was a 4-point rating. The difference of 2 points was clearly indicative of external influences that could explain the discrepancy. The respondents cited “inconvenience” and “too far” as top reasons for not actually using HTE services despite their strong intentions to.

Finally, the effect of both PU and PEOU on behavioural intention (BI) is summarised in the equation:

$$BI = 1.81 + (0.233 * PU) + (0.436 * PEOU)$$

PEOU has a slightly greater influence on BI as compared to PU as variable coefficient values only differ by 0.203. Both PU and PEOU do indeed influence the willingness to adopt HTE services in supermarkets, that is synonymous with conclusions established by the TAM3 model. The roles PU and PEOU play in the managerial decision is huge - both during pre-implementation and post-implementation. These determinants can aid in the creative designing process of HTE products during the initiation, adoption and adaptation phases, as well as serve as guidelines for the acceptance, routinisation and infusion phases (Cooper & Zmud, 1990). This also implies that the successful implementation and uptake of HTE services in supermarkets also depends on how sustainable it is. Results from this research prove that the willingness of adoption rates are largely positive, but only if changes were made to the current state of HTE services in retail outlets and supermarkets. Since BI scores were 80% positive, implying a strong inclination to use HTE services, managerial implications should primarily focus on the conceptualisation and development of HTE services that can be made accessible to the majority of the general public. PU and PEOU factors should also be considered to achieve sustainability, given their roles as significant catalysts in influencing the intention to use HTE services.

## Target Market Analysis

Table 8 below shows the demographic groups and their respective behavioural intention (BI) probabilities of adopting HTE services. Similar to the above analyses, the sample population was filtered using only respondents who had a >4-point rating (out of a 7-point Likert scale) of behavioural intention (BI). This was so because a >4-point rating indicates an agreeable attitude hence willingness to adopt HTE services. 80% of the respondents fall in this category.

**Table 8:** Summary of demographic information and BI probability

<b>Demographics</b>	<b>BI Probability</b>
<b>Total population with &gt;4 ratings: 40/50</b>	
<b>Gender</b>	
M: 14	0.765
F: 26	0.875
<b>Age</b>	
18-24 yrs: 11	0.636
25-34 yrs: 3	1.000
35-44 yrs: 9	0.667
45-54 yrs: 11	0.909
55-64 yrs: 14	1.000
<b>Marital status</b>	
Single: 15	0.667
Married: 33	0.848
Divorced/Separated: 2	1.000
<b>Average h/h monthly income</b>	
<\$2500: 8	0.750
\$2500 - \$7000: 14	0.786
\$7001 - \$10,000: 9	0.889
>\$10,000: 19	0.789
<b>Education level</b>	
Secondary: 12	1.000
Pre-U/Junior College: 4	1.000
Polytechnic: 8	0.750
University/Post Grad: 25	0.720
<b>No. of occupants in h/h</b>	
<4 members: 16	1.000
4 members: 17	0.765
5 members: 10	0.700
>6 members: 7	0.571
<b>Have children</b>	
0 children: 13	0.722
1 child: 12	1.000
2 children: 9	0.750
≥3 children: 6	0.750

The results in Table 8 show that both genders were generally inclined to adopt HTE, given the very high probability scores. The various age groups had moderate to high probabilities, in particular, the 25-34 and 55-64 age groups stood out with a 1.00 probability, and the 45-54 age group followed closely at a 0.909 probability. A large proportion of respondents in these age groups are indeed found to be responsible for supermarket shopping in their household - which explains their high involvement in the intention to use. The married and divorced/separated groups both have high probabilities of 0.848 and 1.00 respectively, which could be indicative of their responsibility to go supermarket shopping for their households. All household income groups received high positive outcomes of  $\geq 0.750$  probabilities throughout. The secondary and pre-U/junior college groups revealed the highest receptivity, evidenced by a 1.00 probability. Diploma and university graduates also presented good BI probabilities of  $\geq 0.720$ . Generally, all demographic groups yielded high BI probabilities, which could be telling of the influences of subjective norm on their willingness to adopt HTE services. Besides that, there could be existing HTE products performing well in the market that favoured these responses. Of these results, certain consumer profiles stood out, which could be desirable target markets for (potential) businesses delving into the utilisation of HTE services in Singapore supermarkets. The two main groups are:

i. Individuals

Individuals (Singles) above the age of 25, irrespective of household income and education levels.

ii. Families

Families preferably with children, with households consisting of 2 to 5 occupants, irrespective of household income and education levels.

### ***Implications on Habitat by Honestbee***

At this point of the research, Singapore's only HTE supermarket, habitat by honestbee was forced to close given the devastating effects of the COVID-19 pandemic. Habitat by honestbee had already been plagued by financial issues in recent years. The company had approximately S\$313 million in debt (Yap, 2020).

Honestbee CEO admits that the one-outlet-only supermarket business was a “recipe for disaster” given strong competition posed by other established local supermarket chains (Salim, 2020) As such, the tech supermarket's inability to reach out to the masses by means of convenience and accessibility was one of the firm's biggest failures. The tech components of the business model were not faulted, evidenced by its receptivity by local customers as well as from positive consumer sentiments found in this research. For example, restructuring efforts could take the form of partnerships with local supermarket chains that could primarily

expand the reach of habitat by honestbee's HTE services.

### **Conclusions and Recommendations**

HTE services do seem to have a promising future in Singapore's supermarket retail scene. Consumers were highly interested in the adoption and future of HTE services which further affirms the potential sustainability of disruptive technology in supermarkets. Although still in its infancy, HTE services are generally well-received by both users and potential users. The willingness to accept and adopt novel technology not only intrigues but also motivates some to stay ahead of the times. Though IT might seem to get increasingly complex and expensive to acquire, retail businesses should embrace the benefits it will reap in the long term. It is imperative to grasp the workings of technology adoption by understanding the determinants posited by Venkatesh & Bala (2008) in the TAM3 model to ensure the relevancy of IT used while advancing towards a more effective and efficient future. The more prominent players in the supermarket industry are traditional ones that have been serving households in many neighbourhoods for decades while habitat by honestbee is but a new entrant that relies heavily on unconventional shopping technology, located in an inaccessible location for many. Its failure should educate (future) retail business owners venturing into HTE services about the flaws of its business model that has limited to no effect on the willingness of consumers to adopt new retail technology.

The findings from this study can support managerial decision making in several ways. First, businesses are able to identify and target consumers that are most likely to adopt and sustain usage of HTE services in supermarkets or relevant retail fields. Next, businesses are able to develop and explore the novelty and utility of the different types of HTE services consumers prefer to use during shopping. Ideally, the understanding of family psychographics will also help businesses target the different segments more accurately depending on their desired audiences. Ultimately, businesses looking to develop their own HTE service will greatly value the importance of the determinants of PU and PEOU. This will help with prioritising of the generation, implementation and execution of their new service. For example, the comparison of both average scores of CSE (computer self-efficacy) and ENJ (perceived enjoyment), that are both determinants of PEOU, can help to expedite managerial decision-making. The higher average CSE score of 5.25 (out of seven) as compared to ENJ's 4.74 will mean that CSE assumes higher importance to consumers than ENJ. Hence, any new HTE service implemented will have to serve its utility in a simple and easy-to-understand fashion than it should possess features of fun and novelty. Though there may be more determinants involved in the understanding of technology adoption that could be culturally and/or geographically specific, the current TAM3 model was more than comprehensive to bolster the breadth and depth of this study.

## Limitations

There could be other factors affecting willingness to adopt unconventional HTE services in retail businesses between other close substitutes, i.e. other HTE supermarkets. This could have produced more discussions about the competition between substitutes, i.e. loyalty programmes, variety of groceries, price competition, delivery channels and so on, which would directly impact sustainability and feasibility of HTE services in the supermarket industry in Singapore. It is inadequate in providing recommendations for managerial decision-making relating to external competition between businesses that operate on very similar grounds. Suggested further research should cover these scopes where applicable. Additionally, the number of survey respondents (though  $n > 30$ ) should be increased to generate more representative results. Logistic and probit regression models can also be explored for data analysis in future studies to achieve more accurate findings.

$$PU = 0.63333 + (0.25254 * SN) + (0.68835 * PEOU)$$

$$BI = 2.51 + (0.522 * PU)$$

$$PEOU = 1.0163 + (0.38171 * CSE) + (0.37743 * CPLAY) + (-0.078527 * CANX) + (0.12618 * ENJ)$$

$$BI = 2.14 + (0.611 * PEOU)$$



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