Factors influencing the acceptance of self-checkout machines in the supermarket industry in Singapore.

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Abstract

The purpose of this paper is to study the factors influencing the acceptance of self-checkout kiosks in the supermarket industry in Singapore. In particular, it is to find out whether social pressure, self-efficacy, technology anxiety and differential waiting time affects the self-checkout kiosks' usage decision. A *simple random sample* of 72 usable respondents had been obtained to test the nine different hypotheses conceived. In conclusion, differential waiting times affect whether shoppers will use the self-checkout kiosks. Findings show that societal factors such as individualism and uncertainty avoidance, and demographic factors such as age and educational level plays a part in determining the levels of social pressure, self-efficacy and technology anxiety, which affect whether the shoppers will use the self-checkout kiosks.

Keywords:

Supermarkets

Singapore

Self-service technology

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1. Introduction.

Self-service technology (SST) are any facility that enables shoppers to 'produce services for themselves without assistance from firm employees' (Beatson, Lee and Coote, 2007). The implementation of SSTs is not entirely new since there are automatic teller machines (ATMs) and self-service payment kiosks which have been implemented much earlier. SSTs are indeed prevalent and play an important role in service delivery for companies. There broadly are two different approaches in implementing SSTs (Salomann et al 2007). The high-tech approach focuses on the technology benefits for the company while the high-touch approach tries to infuse personal touch into self-service understanding their customers' processes (Salomann et al., 2007). Thus, it is important to complement the high-tech self-service with high-touch elements in order for SSTs to be successful since ultimately, customers are the one who need to adopt the technology. To successfully implement high touch approach, the understanding of the consumer behaviour is essential. The understanding of the (demographic) factors influencing the usage of self-checkout terminals in supermarkets will be very useful for the supermarkets in planning the number of cashier check-out lanes; this is particularly where the supermarkets have a good understanding of the demographics of their shoppers. In Singapore, for example, most supermarkets have a 'senior citizen day' where senior citizens enjoy a discount on their purchases for that day. If *age* is found to be a significant factor in the usage of self check-out terminals, then more cashier check-out lanes need be provided for those days.

This paper hopes to shed some light on some factors influencing the usage decision in different cultural settings by looking at the supermarket self-checkout usage in Singapore and comparing the results with previous results from Germany and Russia.

2. Productivity and the use of SST in Singapore.

> *"If we are to reduce our dependency on foreign workers without sacrificing economic growth, we have no choice but to speed up the pace of automation and mechanisation"*

(Tony Tan, 1984 Annual Budget Statement; then Finance and Trade and Industry Minister, currently President of Singapore)

Though made three decades ago; the statement by Tony Tan is still very relevant today for Singapore; a small nation in land size. Ongoing land reclamation projects has increased land area from 581.5 km^2 in the 1960s to 719.1 km^2 in 2015 and projected to grow by another 100 km^2 by 2030.

Singapore has a low fertility rate of 1.4; which is lower than the population replacement rate of 2.1 to maintain the population level[2]. Without the inward migration the required population growth is not attainable. The resultant labour shortfall had traditionally been filled by transient foreign workers from domestic helpers (to free mothers into the labour market) to construction workers (to meet the huge demand for the continuous developments) to service staff to professionals. The immigration authorities had different work passes; *work permits* for the unskilled, *S pass* for semi-skilled and *employment pass* for the professionals, each with its' own set of regulations.

In January 2013, the Singapore government published a white paper on population with plans to increase the population from 4.5 to 6.9 million by 2030. The publishing of the white paper backfired and had political and social costs. The Singaporean public reacted with anti-foreigners sentiments[3]. This has put pressure on the authorities to reduce the dependency on foreign workers or at minimum to *appear* to do so. This led to more stringent requirements for hiring foreigners and higher minimum wages for hiring foreigners resulting in wage cost increases and accelerating business costs particularly for labour intensive business. We, therefore, need to be mindful that Singaporeans' acceptance of SSTs could *also* be motivated by their desire to 'reduce dependency on and the number of foreigner workers'. This possible motivating factor was not tested in our research and is recognised as a limitation.

[2] Straits Times (The Main Daily Newspaper), Feb 14, 2016, "Tackling Singapore's baby shortage".
[3] See *Yahoo News* January 30th, 2013, " Fury over 6.9 million population target for Singapore"

3. Prior literature.

The adoption of technological products in general and the acceptance of self-service technologies in particular are often explained by the Technology Acceptance Model (TAM) (Davis, 1989). The Technology Acceptance Model shows how users accept and use a new technology. The Technology Acceptance Model may help us understand how consumers evaluate users' technology acceptance and to predict the determinants of individual behaviour toward a given system (Agarwal/Prasad, 1997). The Technology Acceptance Model (TAM) in Fig 1 is an information system theory which helps maximise the success of the implementation of an information system (Pearlson and Saunders, 2013). There are four determinants: *individual differences, system characteristics, social influence and facilitating conditions* which will affect the perceived usefulness and ease of use. Thus, the Technology Acceptance Model (TAM) can be linked with this research since the individual differences refer to self-efficacy and technology anxiety while social influence refers to social pressure. The perceived usefulness refers to whether shoppers feel that self-checkout kiosks will help them to reduce their waiting time and improve their overall shopping experience while the ease of use refers to how easy it is to use the self-checkout kiosks, which will affect whether they are willing to use the self-checkout kiosks, which is the behavioural intention and use behaviour in the TAM.

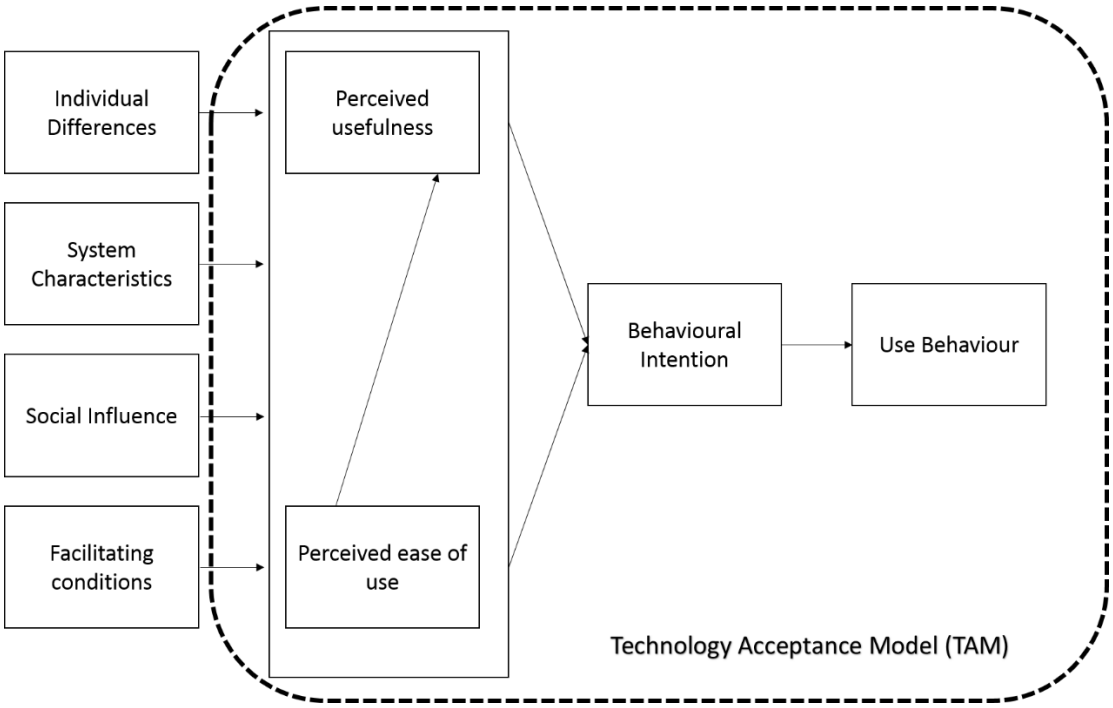

Figure 1. Technology Acceptance Model. Pearlson and Saunders, 2013

One research field in technology acceptance considers the impact of the personal characteristics (e.g. self-efficacy, perceived control, demographics) of the user (Eastin, 2002; Meuter et al., 2003; Meuter et al., 2005; Nysveen et al., 2005). It is important to identify the characteristics of the customers influencing the acceptance (Anselmsson, 2001) because customers vary in their intention to use innovative self-service technologies. Unfortunately, the contribution of the demographic characteristics is not particularly satisfactory, so additional factors were investigated, like psychological constructs. Psychological factors facilitating technology acceptance are social pressure, self-efficacy and technology anxiety (Eastin, 2002; Meuter et al., 2003; Meuter et al., 2005; Nysveen et al., 2005, Schliewe and Pezoldt 2010).

The effects of self-efficacy, social pressure and technology anxiety on the usage of supermarkets self-scan check out usage was examined by Schliewe and Pezoldt (2010) and compared for Russia and Germany. The data was collected from students in two universities in Germany and Russia. Schliewe

and Pezoldt (2010) found that the German participants had lower level of social pressure and technology anxiety whereas the Russian participants had lower level of self-efficacy.

Social pressure (SP) is defined as the individual's perception that people who are important to her/him, think that s/he should or should not behave in a particular way, like using self-service technologies (Schliewe and Pezoldt, 2010). Thus, social influence could serve as a positive reinforcement for customers to use self-service technologies (Kinard, Capella and Kinard, 2009).

Self-efficacy (SE) refers to the individual's assessment of his/her abilities to deal with a specific situation and this is one of the key factors for usage of SSTs (Meuter et al, 2005). Customers who believe that they are capable of using the SSTs will be more likely to do so. Compeau and Higgins (1995) also shows that self-efficacy is strongly influenced by social pressure (SP) and technology anxiety (TA).

Technology anxiety (TA) refers to the level of anxiety experienced by an individual confronted with the decision to use a new technology (Meuter et al 2003). The intention to use SSTs is negatively affected by TA, thus people with higher TA use fewer SSTs. Meuter et al, (2003) also showed that technology anxiety is a better predictor of SST usage than demographic variables.

The psyche is influenced by the culture (Mueller/Gielbigh 2004). It has been shown that cultural aspects play an important role in determining technology acceptance (Van Everdingen/Waarts, 2003; Nilsson, 2007). Hofstede's (2001) cultural framework consists of four dimensions: individualism, power distance, uncertainty avoidance and masculinity. Prior studies have shown that individualism and uncertainty avoidance are the two variables that are important to consumers' acceptance of innovations in different cultures (van Everdingen/Waarts, 2003; Lim et al., 2004).

People in individualistic cultures see themselves as more independent persons than people in collectivistic cultures, who feel they belong to a group and are responsible for each other

(Yeniyurt/Townsend, 2003). According to Steenkamp et al. (1999), consumer innovativeness is valued positively in cultures with a high level of individualism and negatively in cultures with a low level of individualism. People in cultures with a high level of individualism are more willing to adopt innovations than people in countries with a low level (Steenkamp et al., 1999; van Everdingen/Waarts, 2003).

People in cultures with a high level of uncertainty avoidance have a low level of willingness to change their established patterns (Steenkamp et al., 1999). Using new technologies is risky and uncertain. Cultures with a higher level of uncertainty avoidance are less likely to be early users of new products and technologies (Park/Jun, 2003).

Schliewe and Pezoldt, (2010) writes that Germany and Russia exhibit different levels of uncertainty avoidance and individualism. The Germans are characterized as having a high level of uncertainty avoidance (index: 65) and individualism (index: 67) (Hofstede, 2001). In comparison, Russians are characterized as possessing a higher level of uncertainty avoidance (index: 75) and as having a lower level of individualism (index: 47). Because of the higher level of uncertainty avoidance and the lower level of individualism in Russia, Russian consumers would not be expected to be as eager as German consumers to use self-service technologies. Singapore has a score of 20 and is a collectivistic society (Hofstede, 2001). When there is a high level of individualism, shoppers are more willing to adopt innovations than those with a low level (Schliewe and Pezoldt, 2010).

Uncertainty avoidance is the extent to which members may feel threatened by unknown situations and will try to avoid (Hofstede, 2001). Singapore has a score of 8 which is very low (Hofstede, 2001). When there is a high level of uncertainty avoidance, they are less likely to adopt new products and technologies (Schliewe and Pezoldt, 2010).

Therefore, Singapore is a low uncertainty avoidance (8)-collectivist (20) country. Germany is a high uncertainty avoidance (65)-individualism (67) country while Russia is a higher uncertainty avoidance (75)-lower individualism (47) country. Research by Lim et al., 2004 shows that for countries with low uncertainty avoidance, individualist cultures are more likely to use SSTs than collectivism cultures. Due to the lower uncertainty avoidance and lower level of individualism in Singapore, it is expected that Singapore shoppers would not be as eager to use self-service technologies compared to Germany and Russian shoppers.

Based on these cultural differences, we conceive the following hypotheses:

H1) Singapore shoppers have a lower level of social pressure than German shoppers

H2) Singapore shoppers have a lower level of social pressure than Russian shoppers

H3) Singapore shoppers have a lower level of self-efficacy than German shoppers

H4) Singapore shoppers have a lower level of self-efficacy than Russian shoppers

H5) Singapore shoppers have a higher level of technology anxiety than German shoppers

H6) Singapore shoppers have a higher level of technology anxiety than Russian shoppers

As seen in Fig 2 below, research by Simon and Usunier, 2007 had shown that preference for self-service technologies is affected by permanent factors such as rational engagement, experiential style, age, perceived service complexity and also situational factors such as differential waiting times.

Differential waiting times can be measured via three situations: no wait at both cashiers and self-checkout kiosks, longer wait at self-checkout kiosks and longer wait at cashiers, to see whether respondents will choose to go to the cashiers or use the self-checkout kiosks (Simon and Usunier, 2007). The same questions for the differential waiting times from the above research will be used in order to find out whether differential waiting times influence the usage of self-checkout kiosks decision. Thus, the following hypotheses for differential waiting times are:

H7) When there is no queue at the cashiers and self-checkout kiosks, shoppers will choose to go to the cashiers.

H8) When there is longer queue at the self-checkout kiosks, shoppers will choose to go to the cashiers.

H9) When there is a longer queue at the cashiers, shoppers will choose to go to the self-checkout kiosks.

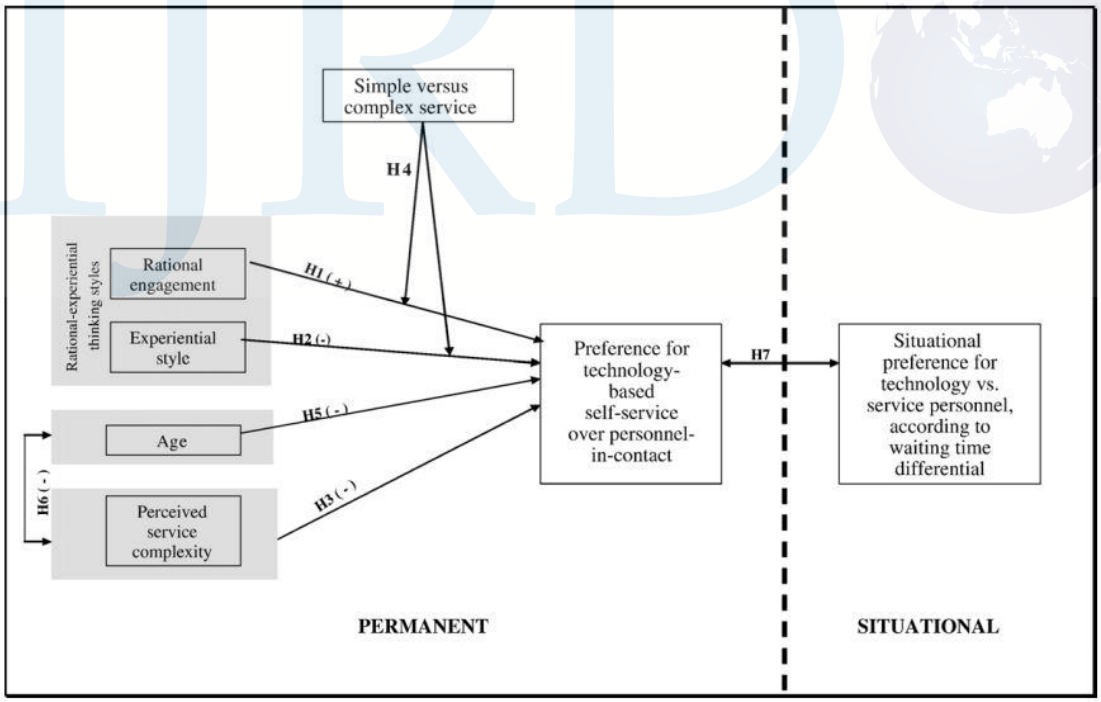

Fig 2. A model for the preference for technology-based self-service. F. Simon, J.-C. Usunier / Intern. J. of Research in Marketing 24 (2007) 163–173.

4. Methodology

To enable us to compare our findings with Schliewe and Pezoldt, (2010), we adopted the same survey instrument and tested the same constructs. In Schliewe and Pezoldt, (2010) social pressure was measured using the adapted scale from Bhattacherjee (2000). The respondents were asked to rate their level of persuasibility by people who are important to them. Self-efficacy was measured using a scale adapted from Compeau and Higgins (1995) and Pedersen (2005). The measures asked the subjects to express their level of confidence in their own abilities to perform a specific behaviour. Technology anxiety was measured with items adopted from Igbaria and Parasuraman (1989). The respondents were asked to express their level of anxiety and technological skills related to using technology. Our survey questionnaire also included situational questions adapted from Simon and Usunier (2007) and demographics.

For each of the three psychological constructs: social pressure, self-efficacy and technology anxiety, there are several questions under each construct. All questions will have a 5-point Likert scale ranging from “strongly disagree” to “strongly agree” and the scale reliabilities are high, with Cronbach’s alphas of 0.862, 0.786, 0.828 for social pressure, self-efficacy and technology anxiety, respectively. This shows that the several questions under each of the three psychological constructs have high internal consistencies and are reliable measures for this survey. For the situational factors, it is to find out whether waiting time will affect customers’ choice on using SSTs in 3 different scenarios: no wait at both cashiers and self-checkouts, longer wait at self-checkouts and longer wait at cashiers (Simon and Usunier, 2007).

A pilot test was conducted for the survey questions and some of the questions were rephrased for better clarity before the survey was finalized. The survey was conducted online using Google Forms.

5. Discussion of Results

The demographics of the total usable 72 respondents are summarised in Table 1 below.

Gender	Frequency
Male	26
Female	46
Citizenship	**Frequency**
Singapore Citizen	72
Singapore Permanent Resident	0
Non-resident	0
Marital status	**Frequency**
Single	38
Married	33
Divorced/Separated	1
Any children	**Frequency**
Yes	44
No	28
Age	**Frequency**
Below 25 years old	6
25 - 34 years old	35
35 - 44 years old	8
45 - 54 years old	8
55 - 64 years old	12
65 years old & above	3
Educational level	**Frequency**
No formal education	0
Primary	0
Secondly/ITE	19
Pre-uni/JC	4
Polytechnic diploma	19
University/Post-grad	30
Gross monthly income	**Frequency**
$0 - $2,000	7
$2,001 - $3,500	36
$3,501 - $5,500	18
More than $5,500	5
Don't want to answer	6

Table 1: Summary of demographic characteristics of respondents

As per the research done by Schliewe and Pezoldt, 2010, the mean ratings for the measurement items for social pressure, self-efficacy and technology anxiety are compared between Germany and Singapore ($Mean_1$), Russia and Singapore ($Mean_2$).

The Welch t-test is used to see if the difference in means is significant while P_{Mean1} and P_{Mean2} shows the corresponding P-values. As part of hypothesis testing, we will state the null and alternative hypotheses for social pressure, self-efficacy and technology anxiety.

For social pressure and self-efficacy, the alternative hypotheses state that Singapore shoppers have a lower level of social pressure and self-efficacy than compared to Germany and Russian shoppers, thus we are performing a left-tailed test. For technology anxiety, since our hypotheses state that Singapore shoppers have a higher level of technology anxiety than compared to Germany and Russian shoppers, we are performing a right-tailed test.

The 0.05 significance level was chosen for all the Welch t-tests and the decision rule is that if $p < 0.05$, we reject null hypothesis and accept alternate hypothesis. The analysis of the three different constructs: social pressure, self-efficacy and technology anxiety shows that there are significant differences in the mean values for German, Russia and Singapore, with significance levels of 0.0001, 0.0001, 0.0019 for German and Singapore and significance levels of 0.0001, 0.0001, 0.6846 for Russia and Singapore.

Table 2 below shows the measures for all the items. For German and Singapore shoppers, there is significant mean value differences for 14 items (SP1-5, SE1-2, SE4-6, TA1, TA4, TA7-8) while for Russia and Singapore shoppers, there is significant mean value differences for 12 items (SP1-5, SE1-6, TA4). Thus, the corresponding hypotheses H1, H2, H3 and H4 is being supported. Since TA1-8 varies, by comparing the overall area for technology anxiety, we can conclude that hypothesis H5 is being supported but the reverse is true for Hypothesis H6, in which Singapore shoppers have a lower level of technology anxiety than Russian shoppers.

Item	Mean (Ge)	Mean (Ru)	Mean (Spore)	P_{Mean1} [Mean (Ge) vs Mean (Spore)	P_{Mean2} [Mean (Ru) vs Mean (Spore)
SP1: The people who are important to me would think I should use the self-checkout kiosks.	3.66	3.72	3	**0.0001**	**0.0001**
SP2: It is expected that people like me would use self-checkout kiosks.	4.58	4.65	3.38	**0.0001**	**0.0001**
SP3: People I look up to would expect me to use self-checkout kiosks.	3.39	3.98	2.96	**0.0001**	**0.0001**
SP4: Most people who are important to me would approve of using self-checkout kiosks.	3.6	4.45	3.36	**0.0119**	**0.0001**
SP5: The people who are important to me would agree that using self-checkout kiosks is a good thing.	3.76	4.24	3.32	**0.0001**	**0.0001**
SP Overall	3.8	4.21	3.19	**0.0001**	**0.0001**
SE1: I could use self-checkout kiosks without the help of others.	5.99	5.26	3.74	**0.0001**	**0.0001**
SE2: I could use self-checkout kiosks if I had never used them before.	5.3	4.76	3.71	**0.0001**	**0.0001**
SE3: I could use self-checkout kiosks if I could ask someone for help if I got stuck.	3.39	4.71	3.67	0.9807	**0.0001**
SE4: I could use self-checkout kiosks if no one showed me how to do it first.	5.06	4.96	3.69	**0.0001**	**0.0001**
SE5: I could use self-checkout kiosks on my own.	6.03	5.23	4.03	**0.0001**	**0.0001**
SE6: I could use self-checkout kiosks if I had seen someone else using them before.	5.23	4.8	3.43	**0.0001**	**0.0001**
SE Overall	5.17	4.95	3.71	**0.0001**	**0.0001**
TA1: I am unconfident that I can learn technology-related skills.	1.48	2.1	2.07	**0.0001**	0.6158
TA2: I have difficulty understanding most technological matters.	2.18	2.32	2.18	0.498	0.894
TA3: When given the opportunity to use technology, I fear I might damage it in some way.	2.27	2.38	2.24	0.6323	0.923
TA4: I feel apprehensive about using technology.	2.15	2.21	2.71	**0.0001**	**0.0002**
TA5: Technological terminology sounds like confusing jargon to me.	2.31	2.46	2.36	0.3407	0.7861
TA6: I hesitate to use technology for fear of making mistakes I cannot correct.	2.36	2.45	2.54	0.0727	0.2301
TA7: I have avoided technology because it is unfamiliar to me.	1.71	2.23	2.11	**0.0002**	0.8597
TA8: I am not able to keep up with important technological advances.	1.74	2.62	2.24	**0.0001**	0.9982
TA Overall	2.03	2.35	2.31	**0.0019**	0.6846

Table 2: Overview of the mean values for Mean (Germany), Mean (Russia) and Mean (Singapore) and also the significance of differences between Germany, Russia and Singapore which is indicated by P(Mean1) & P(Mean2). Significant differences are marked in bold.

Next, we compare the mean values of each of the items.

For *social pressure*, we can see that for all the items, Singapore shoppers have a lower mean than compared to German and Russia shoppers. For SP2, there is a greatest difference in means for German (4.58) versus Singapore (3.38) shoppers and for Russia (4.65) versus Singapore (3.38) shoppers. Almost half (47.22%) of the respondents in Singapore answered neutrally while only 2.78% strongly disagreed

and 12.50% strongly agreed with the statement. This is also congruent with previous research that when there is a high level of individualism, shoppers are more willing to adopt innovations than those with a low level (Schliewe and Pezoldt, 2010). Thus, social pressure is less important for the Singapore shoppers than compared to German and Russia shoppers.

For *self-efficacy*, we can see that for most of the items (SE1-2, SE4-6), Singapore shoppers have a lower mean than compared to German and Russia shoppers. For SE3, we can see that Singapore shoppers are more likely to use self-checkout kiosks if they could ask someone for help if they get stuck than compared to German shoppers since majority (72.84%) of Singapore respondents agreed with the statement. For items SE1 and SE5, majority (69.44% and 79.17% respectively) of Singapore shoppers are more likely to believe that they can use the self-checkout kiosks independently.

For *technology anxiety*, we can see that the mean values of Singapore shoppers are almost similar with German and Russia shoppers. For TA8, there is a greatest difference in means for German (1.74) versus Singapore (2.24) shoppers and for Russia (2.62) versus Singapore (2.24) shoppers. 27.78% of Singapore respondents strongly disagreed and 37.5% of them disagreed with the statement. Thus, this is congruent with previous research that there is low level of technology anxiety since Singapore has low level of uncertainty avoidance.

Although previous research states that there should be high levels of technology anxiety for German and Russia shoppers due to high level of uncertainty avoidance (Schliewe and Pezoldt, 2010), there are low levels of technology anxiety. This may be due to the chosen sample of young university students for Germany and Russia, in which it can be assumed that they are more technology savvy and thus have lower levels of technology anxiety.

(Schliewe and Pezoldt, 2010) commented that Future research in natural settings and with a focus on other influencing factors are needed to broaden our understanding of technology acceptance. Further

important questions are: “Would the same results emerge for groups with different demographic and socioeconomic characteristics?” and “Which differences exist between different age groups?”.

A contingency analysis is used to study the correlation between age group and whether the respondents have used the self-checkout kiosks before, and the correlation between education level and whether the respondents have used the self-checkout kiosks before. This is to find out whether age group and education level are factors which will affect the levels of social pressure, self-efficacy and technology anxiety.

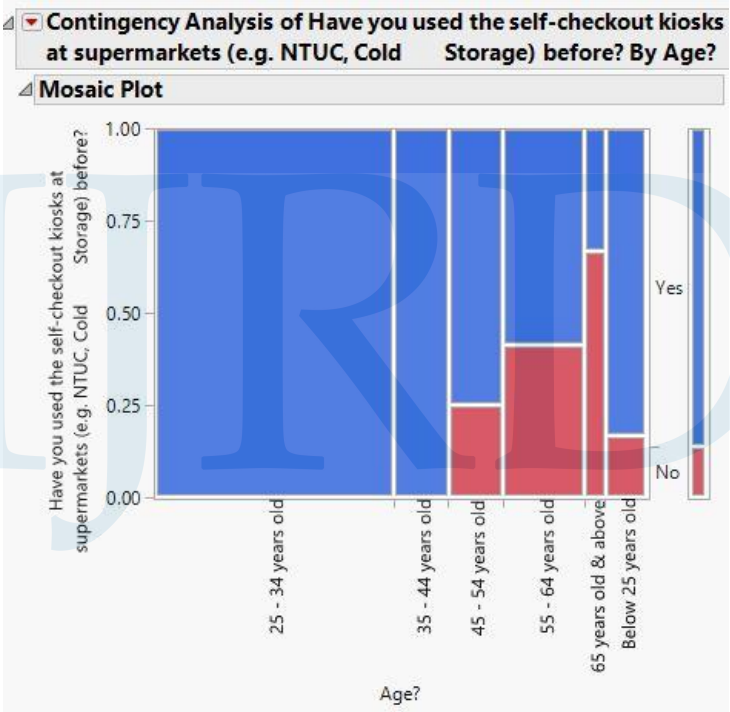

Figure 3

From the mosaic plot above, we can see that all of the respondents who are between 25 – 44 years old had used the self-checkout kiosks before. From 45 – 65 years old and above, there is an increase in the number of respondents who have not used the self-checkout kiosks before. It seems that the younger generation are more receptive to try out new technologies. Thus, this is congruent with the research by

Simon and Usunier, 2007 that age is a permanent factor in determining whether customers are willing to use the self-checkout kiosks.

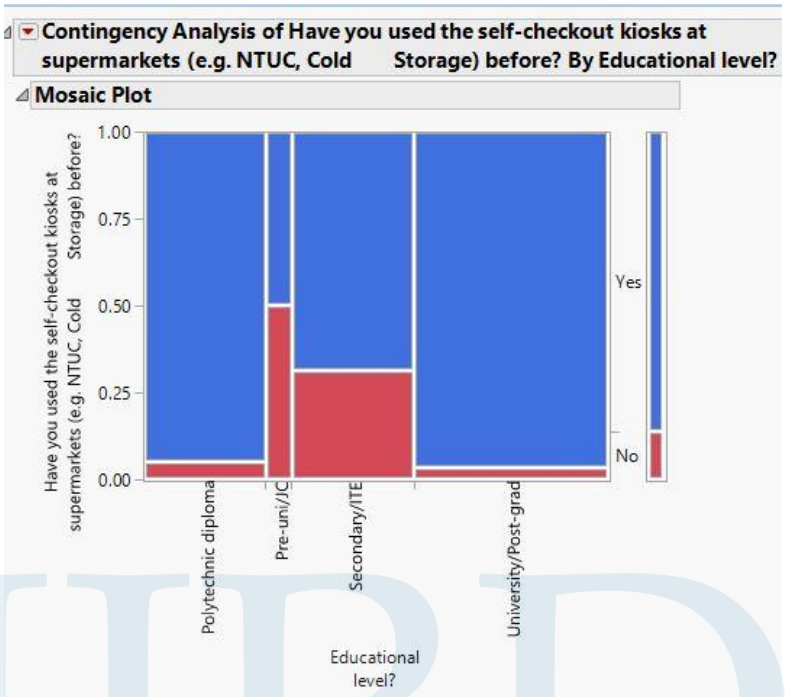

Figure 4

From the mosaic plot above, we can see that majority of the respondents whose education level is "Polytechnic diploma" or "University/Post-grad" had used the self-checkout kiosks before. For those with lower educational level of "Secondary/ITE" and "Pre-uni/JC", it seems that more respondents have not used the self-checkout kiosks before. This is congruent with research which states that people who are better educated are more likely to be innovators and early adopters of new technologies and therefore have a lower level of technology anxiety (Schliewe and Pezoldt, 2010). Thus, education level is a factor which affects whether customers are willing to use the self-checkout kiosks.

Since the research by Schliewe and Pezoldt, 2010 is based on young university students for Germany and Russia, the sample for our survey may not be the same as it comprises of respondents who have

different age groups and educational level. Thus, we filtered out respondents who are “Below 25 years old” and “25 – 34 years old” who have educational level “University/Post-grad” and there is a total of 24 respondents who fall into this “young university students” category.

The mean ratings for the measurement items for social pressure, self-efficacy and technology anxiety will be compared between our original sample and this “young university students” group to determine if there are any significant differences. When we compare the mean values of those respondents who are in the “young university students” group with the mean values of all respondents, it is realised that they have lower levels of social pressure, higher self-efficacy and lower technology anxiety.

Next, the Welch t-test will be used to see if the difference in means is significant and P_{Mean3} shows the corresponding P-values between the “young university students” group and all 72 respondents. The 0.05 significance level was chosen for all the Welch t-tests and the decision rule is that if $p < 0.05$, we reject null hypothesis and accept alternate hypothesis.

For social pressure and technology anxiety, the alternative hypotheses state that those in the “young university students” group have lower level of social pressure and technology anxiety than compared to all of the Singapore respondents, thus we are performing a left-tailed test. For self-efficacy, since our alternative hypothesis states that those in the “young university students” group have a higher level of self -efficacy than compared to all of the Singapore respondent, thus we are performing a right-tailed test.

Item	Mean (Spore)	Mean (Young Uni)	P_{Mean3} [Mean (Spore) vs Mean (Young Uni)]
SP1: The people who are important to me would think I should use the self-checkout kiosks.	3	2.83	0.0808
SP2: It is expected that people like me would use self-checkout kiosks.	3.38	3.46	0.4959
SP3: People I look up to would expect me to use self-checkout kiosks.	2.96	2.88	0.4858
SP4: Most people who are important to me would approve of using self-checkout kiosks.	3.36	3.33	0.4408
SP5: The people who are important to me would agree that using self-checkout kiosks is a good thing.	3.32	3.17	0.1836
SP Overall	3.2	3.13	0.2922
SE1: I could use self-checkout kiosks without the help of others.	3.74	4.17	**0.0034**
SE2: I could use self-checkout kiosks if I had never used them before.	3.71	3.79	0.2516
SE3: I could use self-checkout kiosks if I could ask someone for help if I got stuck.	3.67	3.88	0.1248
SE4: I could use self-checkout kiosks if no one showed me how to do it first.	3.69	3.92	0.0676
SE5: I could use self-checkout kiosks on my own.	4.03	4.33	**0.0075**
SE6: I could use self-checkout kiosks if I had seen someone else using them before.	3.43	3.67	0.1403
SE Overall	3.71	3.96	**0.0098**
TA1: I am unconfident that I can learn technology-related skills.	2.07	1.83	0.0707
TA2: I have difficulty understanding most technological matters.	2.18	1.92	0.0549
TA3: When given the opportunity to use technology, I fear I might damage it in some way.	2.24	2.13	0.2788
TA4: I feel apprehensive about using technology.	2.71	2.79	0.6313
TA5: Technological terminology sounds like confusing jargon to me.	2.36	1.88	**0.002**
TA6: I hesitate to use technology for fear of making mistakes I cannot correct.	2.54	2.17	**0.029**
TA7: I have avoided technology because it is unfamiliar to me.	2.11	1.75	**0.0182**
TA8: I am not able to keep up with important technological advances.	2.24	2	0.1308
TA Overall	2.31	2.06	**0.0404**

Table 3: Overview of the mean values for Mean (Spore), Mean (Young Uni) and also the significance of differences between these two groups which is indicated by P(Mean3). Significant differences are marked in bold.

When we compare those in the "young university" group with all of the Singapore respondents, there is significant mean value differences for 5 items (SE1, SE5, TA5-7).

For social pressure, there is no significant differences in the levels of social pressure faced by all the Singapore respondents and the "young university" group.

For self-efficacy, we can see that those in the "young university" group have higher self-efficacy than compared to all of the Singapore respondents. For SE1 and SE5, the majority of those in the "young university" group, 91.67% and 95.83% respectively, feel that they are able to use the self-checkout kiosks on their own without the help of others.

For technology anxiety, we can see that those in the "young university" group have lower technology anxiety than compared to all of the Singapore respondents. For TA5 and TA7, the majority (87.5%) of those in the "young university" group disagreed that they are unfamiliar with technology and they also will not avoid technology.

Differential waiting times

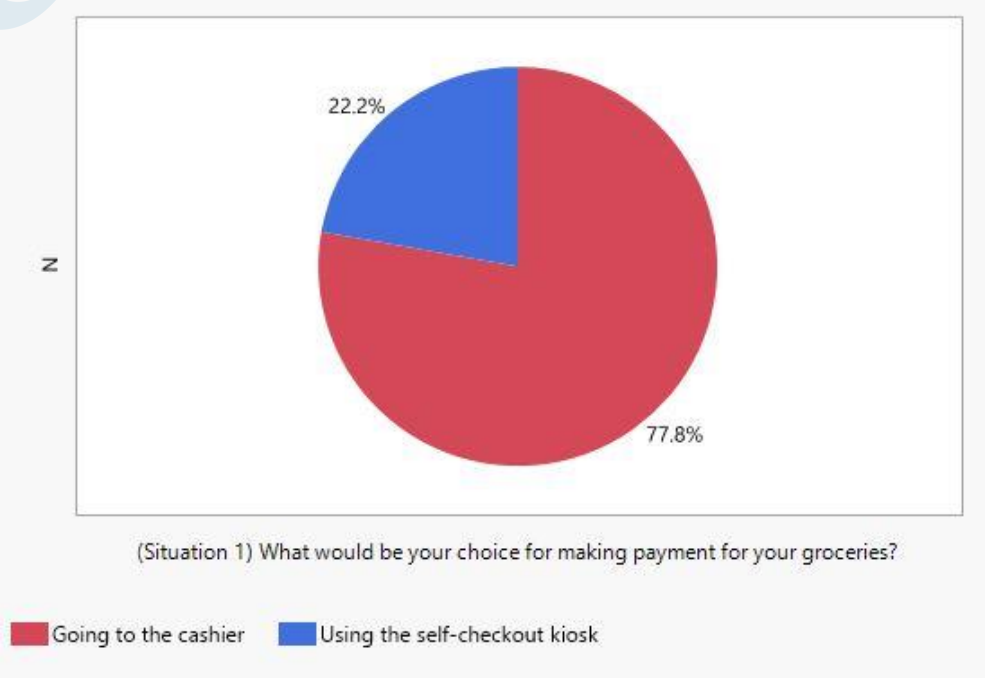

Figure 5

For Situation 1, we can see that a large majority of people (77.8%) will prefer to go to the cashier when there is no crowd at both the cashiers and self-checkout kiosks. Thus, this supports *Hypothesis 7*: When there is no queue at the cashiers and self-checkout kiosks, shoppers will choose to go to the cashiers.

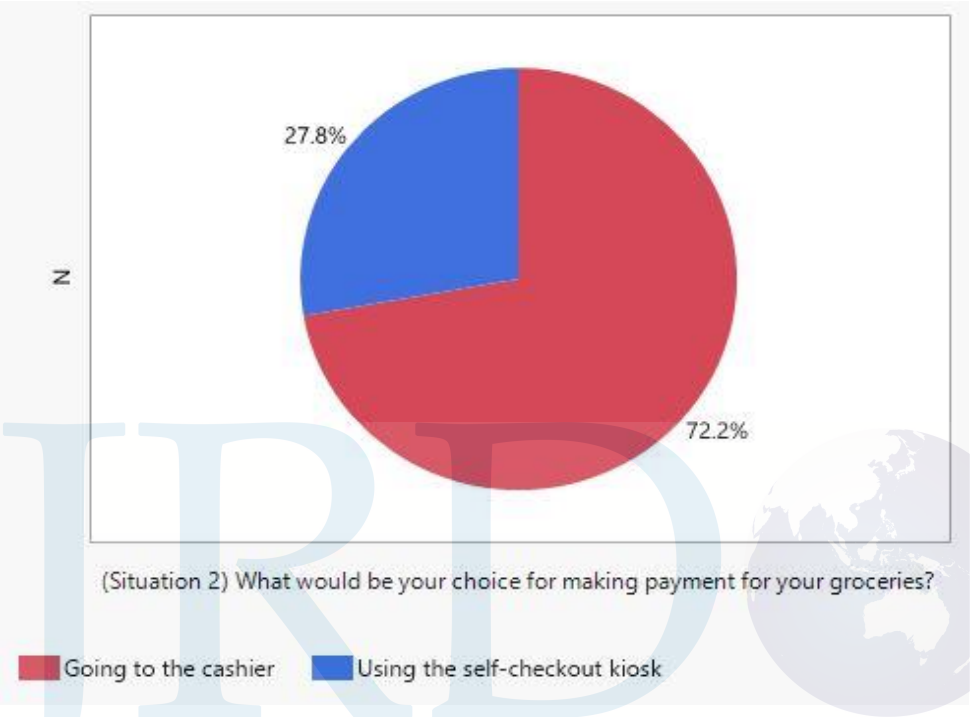

Figure 6

For Situation 2, we can see that a large majority of people (72.2%) will prefer to go to the cashier when they see a longer queue at the self-checkout kiosks. Thus, this supports *Hypothesis 8:* When there is longer queue at the self-checkout kiosks, shoppers will choose to go to the cashiers.

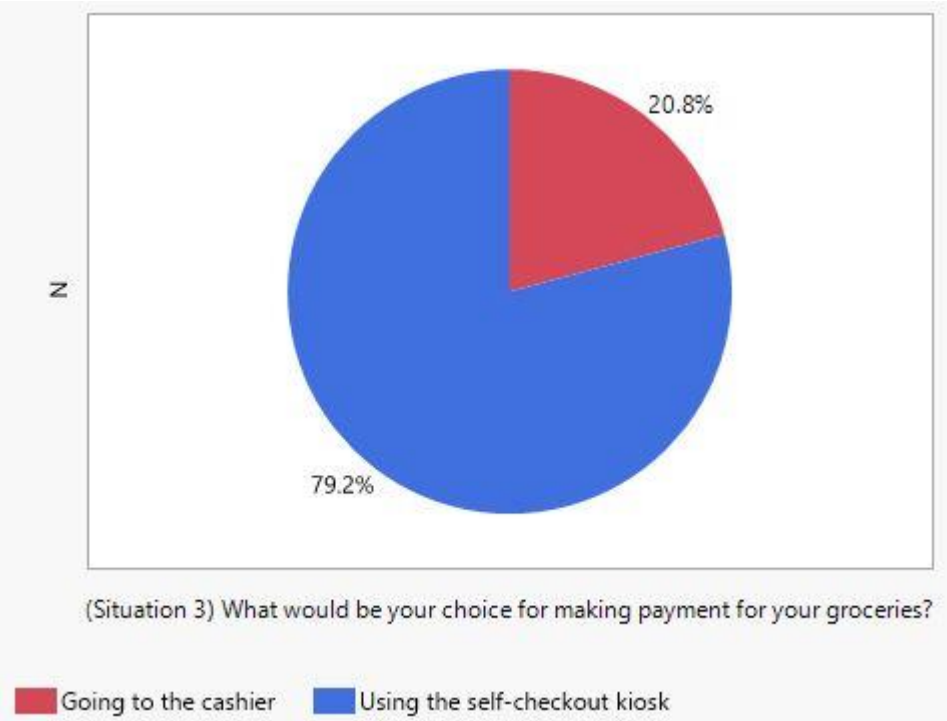

Figure 7

For Situation 3, we can see that the majority of people (79.2%) will use the self-checkout kiosks when there is a longer queue at the cashiers. Thus, this supports *Hypothesis 9:* When there is a longer queue at the cashiers, shoppers will choose to go to the self-checkout kiosks.

6. Concluding Remarks

Major supermarket chains in Singapore had introduced self-checkout kiosks but it is unknown on whether the self-checkout kiosks will really help to counter the labour crunch since the shoppers will have to be willing to use the self-checkout kiosks (Langrehr and Robinson, 1979). This research is an exploratory study to identify some of the factors influencing the usage of the self-checkout kiosks.

Prior research have shown that differential waiting times and three psychological constructs: social pressure, self-efficacy and technology anxiety are some of the factors which affect the usage of self-checkout kiosks. This paper finds that differential waiting times play a part on whether shoppers will use the self-checkout kiosks. Societal factors such as individualism and uncertainty avoidance and

demographic factors such as age and educational level also plays a part in determining the levels of social pressure, self-efficacy and technology anxiety. Singapore shoppers have a lower level of social pressure and self-efficacy than compared with Germany and Russian shoppers while the level of technology anxiety faced is in between Germany and Russian shoppers.

Some respondents to the survey have shared their preference to pay using cash as the main reason for not using the self-checkout since the self-checkout kiosks only allows payment by credit cards. This is congruent to the survey done by the National Productivity Council in which 17% of them prefer to pay using cash (Ministry of Trade and Industry, 2012). Therefore, supermarkets will have to look into including cash as one of the payment modes available.

This research only focused on social pressure, self-efficacy, technology anxiety and differential waiting times as factors which affect the usage of the self-checkout kiosks. There are other factors that may affect the usage of the self-checkout kiosks which are not covered in this research study, such as SSTQUAL, a new 20-item seven-dimension scale that is developed to measure the service quality for self-service technologies from the customer's perspective since it is believed that the service quality of the self-service technologies will affect customers' usage decision (Lin and Hsieh, 2011). Thus, further research is needed to find out what other factors will influence the usage of the self-checkout kiosks.

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