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The Use of a Single Smart Card for Transit and Non-Transit Systems: A Singapore Case Study

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Abstract

Governments around the world are investing heavily in smart card infrastructure to enhance transport services. Studies show that smart card technology can improve reliability, reduce maintenance costs, provide a longer life span, and allow more applications to be incorporated in a transit card. As a result, policy makers and transport owners are interested in extending the use of smart cards from transit to non-transit systems to capitalise on their investment. However, little is known about the conditions under which customers would adopt transit cards for non-transit transactions.

In Singapore, a contactless transit smart card (ez-link card) was launched in April 2002 to replace the magnetic stored-value card, which was commissioned in December 1990. The ez-link card was introduced as an integrated public transport card for use both on buses and Mass Rapid Transit (MRT) and Light Rail Transit (LRT) trains. This study was undertaken to evaluate customers' response to the use of the ez-link card for non-transit transactions.

As the ez-link card is an information technology (IT) product and the first of its kind in the Singapore public transport system, there is a need to understand and appreciate how customers would respond to the change in its use. Various theories and models such as the Technology Acceptance Model (TAM), Theory of Diffusion (TD), Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) were reviewed for their potential to understand and predict customers' intentions to use the ez-link card for non-transit transactions. After much review, the TPB was adopted for identifying the research model and hypotheses in this study.

The TPB was used to develop the research model and hypotheses comprising one dependent variable (intention – INT) and three independent variables (attitude - ATT, subjective norm - SN and perceived behavioral control - PBC). The TPB was also used to design the questionnaire comprising 16 items to collect data from customers using the ez-link card at bus interchanges and train stations located around Singapore. A pilot survey was conducted on 21 respondents using the intercept interview technique. The data were collected

and analysed. With slight modifications, the questionnaire was then used with 300 respondents in the final survey.

Descriptive and inferential statistics were used to analyse the data collected from 293 respondents (seven were outliers) using the intercept interview technique in the final survey. Regression analysis explained 80% of the variance in the customers' intention to use the ez-link card for non-transit transactions. While the results provided initial support for the TPB, further examination of the data using exploratory factor analysis revealed high correlations between the ATT and SN.

This study concluded that a more parsimonious model would only extract two independent variables (Desirability - DES and Perceived Convenience – PEC) to predict customers' intention to use the ez-link card for non-transit transactions. DES and PEC were used to develop a new "Smart Card Usage" model which could be used to conduct future studies on customers' intention to use a transit smart card for non-transit transactions in and outside Singapore.

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List of Abbreviations

Abbreviation	Actual Term
ATT	Attitude
BI	Behavioral Intention
DES	Desirability
EZL	EZ-Link Pte Ltd
INT	Intention
NETS	Network for Electronic Transfers (Singapore) Pte Ltd
PBC	Perceived Behavioral Control
PEC	Perceived Convenience
PV	Purchased value
RV	Remaining value
SN	Subjective Norm
TAM	Technology Acceptance Model
TD	Theory of Diffusion
TL	Transit Link Pte Ltd
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Technology Acceptance and Use of Technology Model

Terms and Definitions

Theory of Planned Behavior (TPB)

The TPB (Ajzen, 1991) has three independent variables (Attitude - ATT, Subjective Norm – SN and Perceived Behavioral Control - PBC) to determine intention (INT). The TPB was developed in the United States of America (USA). As such, the word behavior is written in American English.

Transit Transactions

These are transactions generated by transit devices in the public transport system.

Non-Transit Transactions

These are transactions (products and services) generated by non-transit devices in the non-transit merchant company system.

Non-Transit Services

These are services offered by non-transit merchant companies (for example, cashless payment via smart card for fast food, road toll, car park, movie ticket, etc.).

Non-Transit Systems

These are systems operated by non-transit merchant companies.

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Chapter 1.0   <u>Introduction</u>

1.1   Chapter introduction

Very little research has been conducted on how customers respond to the use of information technology (IT) products in public transport systems around the world. This is particularly so for the cashless mode of payment. Most public transport systems still accept cash as payment for single trip rides. In the case of multiple trip rides, magnetic or paper-based stored valued tickets are often used. However, the scene is fast changing with the replacement of these media by smart cards for multiple trip rides.

Governments around the world are investing heavily in smart card infrastructure and technology that would improve ticket reliability, reduce system maintenance costs, provide a longer life span for the ticket media, and allow more applications to be incorporated in the smart card. To capitalise on the investment, policy makers and transport owners are interested in extending the use of smart cards from transit to non-transit systems where customers can make purchases for goods and services. However, little is known about the conditions under which customers would extend the use of smart cards from transit to non-transit transactions.

In addition, the techniques for studying customer response to new technology in the transport industry are also not well developed. Hence, this study will also contribute both to an understanding of the customer's view of IT innovations in the transport industry by studying attitudes toward extending the use of smart cards from transit to non-transit transactions, and to the theories, models and techniques that might be used for such a study.

1.2 Context of study

In April 2002, the Land Transport Authority (LTA) of Singapore launched the contactless smart card known as the ez-link card through its subsidiary company, EZ-Link Pte Ltd (EZL). The ez-link card replaced the magnetic farecard that was commissioned in 1990 by Transit Link Pte Ltd (TL), which is owned by two public transport operators, namely, the Singapore Mass Rapid Transit Corporation Ltd (SMRT) and Singapore Bus Services Transit Ltd (SBST).

Unlike the conventional contact smart cards, the ez-link card does not require the customer to slot the card into a reader for it to be processed to pay for a trip fare in the transit system. The customer only has to gently tap the ez-link card on the reader, or place his/her wallet/handbag containing the ez-link card on the reader.

When the ez-link card was first launched in 2002, it was only used in the transit system for payment of fares on buses and Mass Rapid Transit (MRT) and Light Rail Train (LRT) trains. It could not be used in non-transit systems even though EZL's long-term objective was to allow for a single card to be used in transit systems as well as non-transit systems such as retail and fast food outlets.

Before the launch of the ez-link card, NETS, a clearinghouse for the three major local banks, had already issued a contact smart card known as a cashcard. The cashcard could be used for non-transit transactions such as payment of car park fees, road tolls, fines for overdue books at public libraries, food stalls, fast-food outlets and photocopy services. The cash card could be topped-up at a bank Automatic Teller Machine (ATM), when the cash value in the cash card has been depleted.

Unlike the ez-link card, the cashcard could not be used in the transit system. In addition, the cashcard requires the customer to slot it into a reader for it to be validated to process a transaction. A complete cashcard (contact card) transaction usually takes a longer time than an

ez-link card (contactless card) transaction due to the performance and interface of the contact reader as well as customer interaction with the contact reader.

When the ez-link card was first introduced for transit transactions in Singapore, public transport companies in other countries such as Hong Kong and Korea had already commissioned a similar contactless smart card to be used in the transit and non-transit systems. However, the non-transit systems in these countries were in their early stages of development.

In the last quarter of 2002, EZL carried out a small-scale informal pilot project to study the use of the ez-link card in three non-transit systems (school, hotel and public library). The project proved to be successful in extending the use of the ez-link card in these non-transit systems. As a result, EZL engaged QB Pte Ltd to further extend the list of non-transit systems so that customers can purchase a wider variety of products and services with their ez-link cards.

In order to participate in the program, non-transit merchant companies are required to design specific application software to integrate the ez-link card readers with their existing systems to facilitate the transactions. These arrangements are costly, and substantial resources have to be allocated by the participating merchant companies. Hence, this program raises the following issues:

- Are customers ready to use a contactless smart card in non-transit systems?
- Are non-transit merchant companies ready to sign up for commercial arrangements, and venture into a business where returns on investments are not guaranteed?

1.3   Purpose of study

The purpose of this study is to address the first issue which is, "Are customers ready to use a contactless smart card in non-transit systems?" While the introduction of a contactless smart card (ez-link card) in the public transport system is not new, extending the use of this card from transit to non-transit systems is somewhat new in Singapore.

The researcher has many years of experience in the field of public transport, working at different levels and in different areas. He has been involved in the design and implementation of the contactless smart card in Singapore since 1997. He is regarded as an authority in the use of smart card technology in public transport systems, and also provides consultancy services to Dubai's transport authorities and companies. At the time when this study was undertaken and to the best of his knowledge and effort, the researcher was not aware of any form of scholarly work being carried out in and outside Singapore to formally study customers' response to extending the use of contactless smart cards from transit to non-transit systems.

As mentioned earlier, a small-scale informal pilot project was carried out by EZL to study the use of the ez-link card in three non-transit systems. However, the pilot project was not rigorous, as research issues such as sampling, method of data collection, reliability and validity of the instrument used, and method of data analysis were not considered. For example, the pilot project did not represent the total population of the customers who use the public transport system, and a valid and reliable instrument was not employed to collect the data. As such, the findings of the pilot project could not be published, and were confined to EZL's internal use only.

Hence, this study was initiated by the researcher to understand and predict customers' response to use of the ez-link card for non-transit transactions in Singapore. The findings of this study can then be used by LTA, EZL, QB Pte Ltd and other transport related companies and

organisations to further expand the use of the ez-link card in non-transit systems where the cashcard has already made its stronghold since 1996. In addition, the findings of this study, and the theories, models and techniques used in this study may also be useful to transport policy makers and researchers in and outside Singapore who are interested in studying customer response to IT initiatives (such as the contactless smart card) in the public transport industry.

In order to study customers' response to using the ez-link card for non-transit transactions in Singapore, the researcher embarked on the following tasks:

- To design a survey to meet the purpose and context of the study; and
- To look outside the transport industry for research models that would support the study

1.4   Research question

The research question was formulated as follows:

"What would encourage current transit customers to use a transit card (such as the ez-Link card) for non-transit transactions?"

1.5   Understanding the customer

There are many unknown factors in trying to understand customers in today's world. In Singapore, customers are spoilt for choice when selecting from a wide range of products and services available to them. Companies and marketers are constantly challenged to think of ways and means to increase their sales for existing or new products and services. Usually, they would embark on numerous marketing surveys, and publicity and marketing programs to reach out to their preferred customers. Indeed, one possible approach to the research question would have been to undertake a market survey.

However, understanding a customer goes beyond market surveys and programs. In this study, an attempt was made to construct a generic behavioral model to understand and measure how existing customers would respond to the use the ez-link card for non-transit transactions. Theories and models which are common to both marketing and information systems were reviewed and discussed.

1.6   Behavioral intention

We can characterise the use of a transit card for non-transit purposes as a human behavior. Social psychologists believe that actual behaviors result from intentions to perform a behavior, and that we can study how intentions are formed. Ajzen and Fishbein (1980) proposed in their Theory of Reasoned Action (TRA) that an intention (INT) is formed by two variables which are attitude toward the behavior (ATT), and subjective norms (SN) or normative or social pressures to perform the behavior. However, Ajzen (1991) proposed in his Theory of Planned Behavior (TPB) that when behavior is voluntary, a third variable, perceived behavioral control (PBC) also affects INT.

1.7   Research methodology

This study will use the TPB to study, understand and measure customers' response to use the ez-Link card for non-transit transactions. This study will also adopt a quantitative approach, and incorporate Ajzen's recommendations for measuring INT (Ajzen, 2002).

1.8   Chapter conclusion and summary of other chapters

Chapter 1 has presented the context of the study, purpose of research and research questions and a possible theoretical model to be used in the study.

Chapter 2 will outline the history of behavioral intention models and discuss alternative theoretical models. The research model and variables

used in this study will be presented. Chapter 2 will also provide information on contactless smart cards and highlight the challenges of extending their use from transit to non-transit transactions.

Chapter 3 will describe the research methodology used in this study. The hypotheses for the study will be presented. The population, sample and the number of responses required will also be discussed. The design of the questionnaire form, procedure for the survey, and the results of the pilot survey will also be explained in this chapter.

Chapter 4 will present the results of the final survey. Both descriptive and inferential statistics used to analyse the data collected will be presented. The research hypotheses will also be tested in this chapter.

Chapter 5 will discuss the research findings in detail. It will also relate back to the literature review and survey results presented in Chapter 2 and Chapter 4 respectively.

Finally, Chapter 6 will present a summary of the key findings of the study, implications of the study, limitations of the study, reflections of the researcher, and suggestions for future research, before drawing a final conclusion.

Chapter 2.0   <u>**Literature review**</u>

2.1   Chapter introduction

This chapter will begin with a review of contactless smart cards in the public transport system in and outside Singapore. The review will provide an understanding and appreciation of the advantages of contactless smart cards over magnetic cards as well as the use of contactless smart cards for both transit and non-transit transactions.

Contactless smart card trials and customer surveys which were previously carried out in and outside Singapore will also be outlined and discussed. The discussion will provide some guidelines on the type of research methodology to be adopted for this study.

Theoretical models (TD, TRA, TAM, extended TAM, TPB and Unified TAM) relevant to the study will also be presented and discussed in this chapter. Selected case studies based on these models will be highlighted before a suitable research model is identified for this study.

2.2   Contactless smart cards

Transport operators around the world have traditionally accepted cash or pre-paid tickets for trips made in the public transport system. In the 1970s, magnetic pre-paid cards were prevalent. These pre-paid cards were cheap to produce and operate, and offered single or multiple trips in the public transport system. However, since the 1990s, transport operators have gradually switched to contactless pre-paid smart cards using RF (radio frequency) technology. The reasons for the switch are as follows:

a) To provide for a higher level of security for the smart card and transaction data;

b) To integrate the smart card with more public transport service providers in the industry; and

c) To integrate the transit applications of the smart card with other non-transit applications.

The first contactless smart card was developed in France, and numerous trials and small-scale projects were implemented in France and the United States of America (USA) before it was introduced in Asian cities (Townend, 1996). In recent years, this technology has taken centre stage in major Asian cities such as Hong Kong (special administrative region of China), Seoul and Pusan (South Korea), Shanghai (China), Bangkok (Thailand), Delhi (India) and Singapore.

Singapore is similar to Hong Kong in many ways. Both these cities were once British colonies, and are without any natural resources. These cities depend on their strategic location to develop the economy as a business and financial centre, container port, airport hub, tourist destination, etc. In addition, the population in both cities is predominantly Chinese: Hong Kong is 96% (Census and Statistics Department, 2006) and Singapore is 75% (Singapore Department of Statistics, 2006). The two cities have always looked to one another in the development of fare collection for their public transport systems.

In the 1990s, Singapore was one of the first countries in the world to operate an integrated fare collection system (ITS) for its public transport, using the magnetic pre-paid card. In 1997, Hong Kong introduced a contactless smart card to replace its magnetic prepaid card but adopted Singapore's ITS for its public transport system. Singapore then followed suit, and introduced the contactless smart card for its public transport system in 2002. Currently, Singapore is closely observing Hong Kong's use of its card for both transit and non-transit transactions. However, it would not be easy to emulate Hong Kong as the financial situations and requirements in the two cities are different for the following reasons.

Creative Star Pte Ltd, the operator of the Octopus contactless smart card in Hong Kong, is both the Card Manager and Card Issuer. It has been granted a limited banking license by the Monetary Authority of Hong

Kong. The license allows Creative Star to withhold card deposits for multi-application cards, and to use the card for transit and non-transit transactions. However, the license limits the amount of non-transit transactions to no more than 35% of the total transactions (Rueter, 2006). As Creative Star is not a fully-fledged bank, the limits were set to ensure that it meets its customer liability requirements. After operating for just four years, Creative Star's non-transit transactions form about 20% of the total transactions of nine million Hong Kong dollars. Creative Star was determined to increase its non-transit business to 30% by end 2006 (Rueter, 2006). Currently, the non-transit transactions are still below 30%.

In Singapore, the Monetary Authority of Singapore (MAS) Act was passed in November 2005 to ensure that the Card Manager (EZL) engages a bank to be the Card Issuer if the deposits in the card exceed 30,000,000 Singapore dollars (Singapore Payment Systems Oversight Act, 2006). As Creative Star has a limited banking license to operate as a Card Manager as well as a Card Issuer, it can manage a deposit float. However, EZL has to engage Citibank Pte Ltd, Singapore as a Card Issuer to manage its deposit float. The deposit float and interest earned is substantial, and could run into millions of dollars over a period of five years. The deposit float could also be invested by developing the transit business and/or diversifying into non-transit businesses. In such a case, Creative Star would have an advantage over EZL in extending the use of the contactless smart card from transit to non-transit systems.

However, there are risks involved in developing and expanding the non-transit business as it is very much dependent on its customers. In the transit system, the customer uses the card to travel on the public transport system and hence, there is a guaranteed return of revenue. However, in the non-transit system, the customer cannot be forced to use the card to purchase products or services and hence, there is no guaranteed return of revenue. As such, there is a need to understand the customer's intentions in order to study the feasibility of extending the use of the card from the transit to non-transit systems.

2.3. Studies on transit smart cards

As of the time of writing, the most successful contactless smart cards for transit and non-transit systems in circulation are in Hong Kong (Octopus Card Limited, 2005) and South Korea (Asia Pacific Smartcard Association, 2006).

However, there are no published scholarly studies on customers' acceptance for using of a single contactless smart card for both transit and non-transit transactions in these countries although a trial field study was carried out in 1994 in Dublin, Ireland (Blythe 1996), and a pilot project and a focus group study were conducted in Singapore in 2002.

In Dublin, the "GAUDI" field trial was conducted over a period of three months by four organisations namely, Dublin Bus, Telecom Eireann, Irish Toll Roads and National Toll Roads. About 1,540 smart cards named 'DASH' were issued but only two thirds of the cards were used during the trial. A questionnaire form was sent out to 800 cardholders to elicit their general attitude on using a single card for multiple services. A response rate of 30% was achieved via mail.

The study showed that there was a general acceptance among respondents to use a single card for multiple services. While 87% of the respondents agreed that the system was easy to understand, 89% agreed that the card was easy to use to make payment for products and services (Blythe, 1996). In fact, 91% of the respondents said that they would continue to use DASH if it was extended citywide (Blythe, 1996). When asked, the respondents said that they preferred to use the card for services at bank ATMs, parking meters, supermarket check-outs and the cinema (Blythe, 1996).

Eighteen cities in the USA had awarded contracts costing over one billion in US dollars for the implementation of a smart card for use in both their public transport system and parking system. However, the use of the smart card in the parking system was not well received due to 'operational challenges' such as 'patron acceptance, distribution,

convenience, interoperability of systems and project costs' (Smart Card Alliance, 2006).

In the last quarter of 2002, EZL conducted a small-scale informal pilot project to study the use of the ez-link card in three non-transit systems - in twelve school canteens for students to buy food; in one hotel for guests to access their room and to buy pastries from the hotel bakery; and in two public libraries to pay fines for overdue books. The project proved to be successful in extending the use of the ez-link card in the three non-transit systems.

Encouraged by the results, in November 2002, EZL decided to sign a Memorandum of Understanding (MOM) with QB Pte Ltd to appoint it as their exclusive partner in order to further develop and expand the non-transit business in Singapore. QB Pte Ltd was entrusted with the task of inviting non-transit merchant companies to be included in the list of non-transit systems where customers can purchase products and services with their ez-link cards. QB Pte Ltd carried out an informal focus group study where about 100 merchant companies in Singapore were invited to participate in the program. The objectives of their study were to find out the following:

- What are the key considerations in using the ez-link card for non-transit transactions?
- Who are the people likely to use the ez-link card for non-transit transactions?

The findings of the study were not published due to its confidential nature and lack of rigour. However, a private conversation between the researcher and a Senior Officer of QB Pte Ltd revealed that several non-transit merchant companies were interested in participating in the program. On the other hand, the issue still remains as to whether customers would use of the ez-link card for non-transit transactions.

Hence, a formal and rigorous study to determine the intention of customers to use the ez-link card for non-transit transactions is crucial and necessary for LTA and EZL as well as the business community in Singapore. It would also be useful for researchers, policymakers and providers of public transport systems in and outside Singapore who are interested in using a single contactless smart card for transit and non-transit systems.

The remaining sections of this chapter will introduce and discuss potential models such as the Theory of Diffusion (TD), Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), Extended Technology Acceptance Model (TAM2) and Unified Technology Acceptance and Use of Technology Model (UTAUT). All these models which were designed to evaluate the use of IT (Zakour, 2004), were developed in the USA. As these models were developed in the USA and the study will be conducted in Singapore, there could be some variation in the results due to cultural differences in the two countries (Hosftede,1980). Section 2.12 will attempt to explain some of these cultural differences.

2.4   Theory of Diffusion (TD)

In 1903, Gabriel Tarde pioneered the "S-shaped diffusion curve" and later in 1943, Bryce Ryan and Neal Gross published their study on diffusion of hybrid corn among Iowa farmers (Rogers, 1976, p290). There were over 100 diffusion studies carried out in 1952, and the number increased to 1,800 at the end of 1974. However, the mid-1990s saw the greatest interest in diffusion theory especially, in the area of innovation of new products and consumer behavior research (Rogers et al, 1999).

Rogers (2002) defines innovation as "an idea, practice or object which is perceived as new" and diffusion as a "process through which an innovation is communicated among members of a social system" (p990).), How fast an innovation is adopted is known as the "rate of

adoption" and there are five characteristics that determine the rate of adoption which are (Rogers, 2002, p990):

- Relative advantage – "the degree to which an innovation is perceived as better than the idea it supersedes".
- Compatibility – "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters".
- Complexity – "the degree to which an innovation is perceived as difficult to understand and use".
- Trialability – "the degree to which an innovation may be experimented with on a limited basis".
- Observability – "the degree to which the results of an innovation are visible to others".

From the above characteristics, Rogers (2002) believes that individuals usually evaluate an innovation in terms of how it is perceived by their peers. The spread of an innovation takes place when people talk about it, decide and form an attitude to accept or reject the innovation (Rogers, 2002).

For example, the innovation of cellular phones was first offered to American consumers in 1983, and within a decade 130 million mobile phones were sold. In the next decade, the number of phones sold worldwide was 1.1 billion and nations that had the highest rates of adoption were Finland, Denmark, Sweden and Korea (Rogers, 2003). The rate of adoption of mobile phones in Finland from 1981 to 2002 is shown in Figure 1, where the S-shaped diffusion curve is clearly visible as predicted earlier by Gabriel Tarde in 1903.
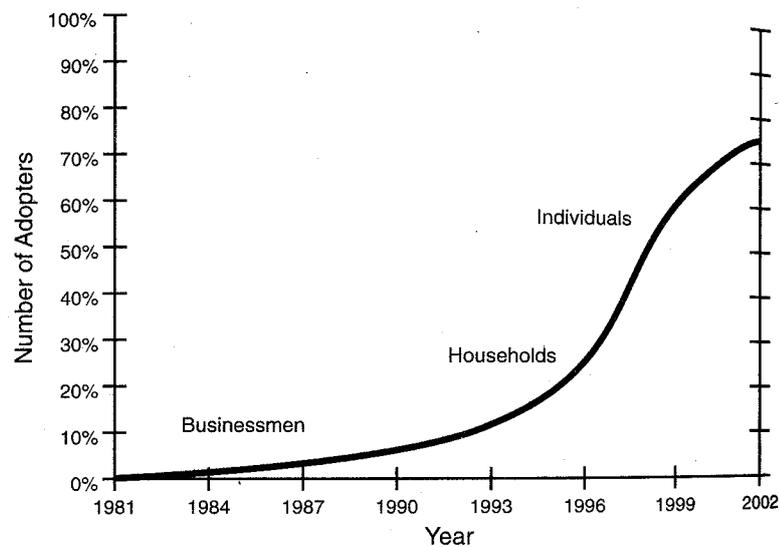
**Figure 1: Rate of adoption of mobile phones in Finland
(Source: Rogers, 2003, p262)**

2.5   Historical development leading to Theory of Reasoned Action

Since the 1930s, many psychologists have been studying attitude. Thurstone (1931), Likert (1932) and Osgood, Suci and Tannenbaum (1975) have designed various instruments to measure it (Ajzen & Kerbs, 1994). Between 1930 and 1960, a "uni-dimensional scaling procedure" was widely used to measure attitude, and it was believed to be quite satisfactory in dealing with social issues such as religion, capital punishment, racial discrimination and political liberalism/conservatism (Ajzen & Kerbs, 1994, p253).

However, Peak (1955) and Rosenberg (1956) proposed a narrower version of the summation of attitude that was later perfected by Fishbein (1963; 1967) into the well-known expectancy-value model of attitude (Ajzen & Kerbs, 1994). According to Fishbein (1963; 1967), "a person's overall attitude is determined by the subjective values or evaluations of the attributes associated with attitude object, and by the strength of these associations" (Ajzen & Kerbs, 1994, p255). The expectancy-value model

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can be expressed as follows (Ajzen & Kerbs, 1994, p255; Cohen, Fishbein & Ahtola, 1972, p457):

$$ATT = \sum_{i=1}^{n} b_i\, e_i$$

where,

ATT = attitude toward the object

b_i = strength of the belief that the object has attribute i_1

e_i = evaluation of attribute i_1

n = number of beliefs associated with the object

Dulany (1968) believed that there are many additional variables that influence behavior (Ajzen & Fishbein, 1969; and Ryan & Bonfield, 1975). There was great interest among consumer researchers in Dulany's formula, which integrates attitude and normative factors that influence behavior. The formula that expresses this relationship is shown below (Ryan & Bonfield, 1975, p119):

$$B \approx INT = [\,(RHd)\,(RSv)]\,w_o + [(BH)\,(MC)]\,w_1$$

where,

B = "overt behavior"

INT = "behavioral intention" (this serves as an intervening variable between the three predictors and overt behavior)

RHd = "hypothesis of distribution of reinforcement (that is, degree to which individual thinks that the behavior would lead to a reinforcement or reward)"

RSv = "the subjective value of reinforcer (that is, the value the individual places on a reward)"

BH = "behavioral hypothesis (that is, degree to which individual believes a particular behavior is expected of the individual by others)"

MC = "motivation to comply (that is, degree of the individual's desire to conform to BH)"

w_o and w_1 are empirically determined weights

Dulany conducted a number of experiments, and concluded that independent variables accounted for a large proportion of the variance in INT (50% to 77%), and INT accounted for large proportion of variance in B (80% to 88%). Fishbein (1972, p248) later remodeled Dulany's formula (refer below) which led to the development of the Theory of Reasoned Action (TRA):

$$B \approx INT = [ATT]\ w_o + [NB.\ MC]\ w_1$$

where,

>   ATT is defined as "attitude toward performance of a specific act", which is equal to $\{(RHd)\ x\ (RSv)\}$
>
>   NB = "a normative belief (that is, a degree of belief that others expect or do not expect the individual to perform a specific act)"
>
>   MC = "motivation to comply or not comply with the expectation of others".

2.6   Theory of Reasoned Action

The TRA suggests that to predict a single behavior, one must assess the "person's attitude towards the behavior", and not his "attitude towards the target" where the behavior is directed (Ajzen & Fishbein, 1980, p8). The TRA also indicates that "a person's intention is a function of two determinants" – "attitude toward the behavior" (ATT) which is personal in nature; and subjective norm (SN) which reflects social behavior (Ajzen & Fishbein, 1980, p6). ATT is an individual's "positive and negative consequences" (p8) in carrying out the behavior whilst, SN is an individual's "perception of the social pressures put on him to perform or not perform the behavior in question" (Ajzen & Fishbein, 1980, p6). These relationships are illustrated in Figure 2.

Ajzen and Fishbein (1980, p82) also recognize the importance of external variables such as "demographic" and "personality traits" which are shown in Figure 2. They believe that these variables may "influence the beliefs a person holds or the relative importance he attaches" (p9) to

attitudes and norms, or his behavior. However, they also believe that the external variables have little bearing on the validity of the TRA (Ajzen & Fishbein, 1980). Hence, they claim that the TRA already identifies a small set of concepts which account for relations (or lack of relations) between any external variable, and any kind of behavior that is under an individual's volitional control (Ajzen & Fishbein, 1980).
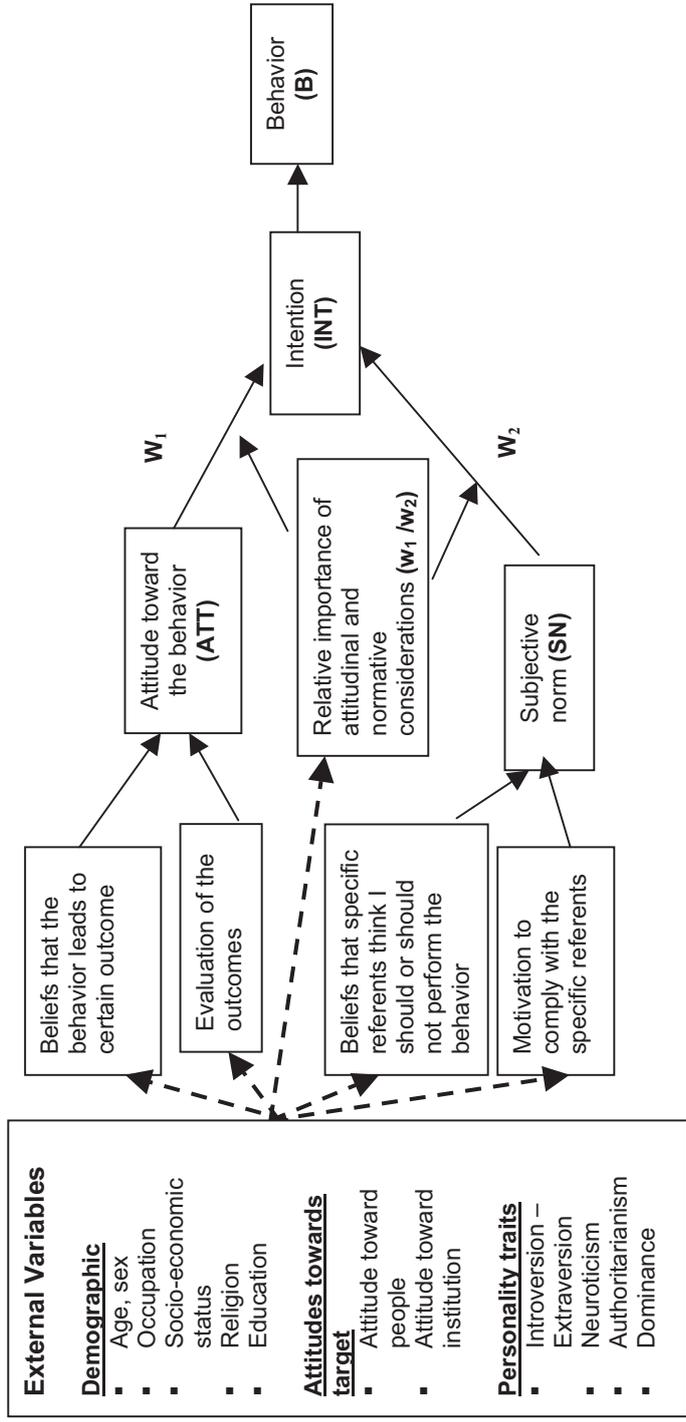
Figure 2: Theory of Reasoned Action
(Source: Ajzen & Fishbein, 1980, p84)

Ajzen and Kerbs (1994, p259) believe that ATT and SN combine in a weighted linear fashion to produce INT, and that "the complete model representation of the TRA" should be written as follows:

$$B \approx INT\ \alpha\ \ [w_1\ ATT + w_2\ SN]$$

where,

> B is behavior
> INT is intention
> ATT is the attitude towards the behavior
> SN is the subjective norm
> w_1 and w_2 are empirically determined weights

Sheppard, Hartwick and Warshaw (1988, p325) carried out a meta-analysis on eighty-seven previous studies to look into the effect and "limiting conditions" in predicting intentions based on ATT and SN in the TRA model. They found that the average correlation between INT and ATT and SN was 0.66

Hence, they concluded that the TRA model is supported. Over the past 25 years, hundreds of studies have evaluated the TRA and the "average correlation between intention and behavior was 0.62, and the average multiple correlation for prediction of intention was 0.68" (Ajzen & Krebs, 1994, p259).

2.7   Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is an extension of the TRA (Ajzen & Fishbein, 1980; and Fishbein & Ajzen, 1975). Ajzen (1991, p188) believes that the "more favorable" the ATT and SN "with respect to a behavior, and the greater" the PBC, "the stronger should be an individual's intention to perform the behavior under consideration". The TPB is illustrated in Figure 3.
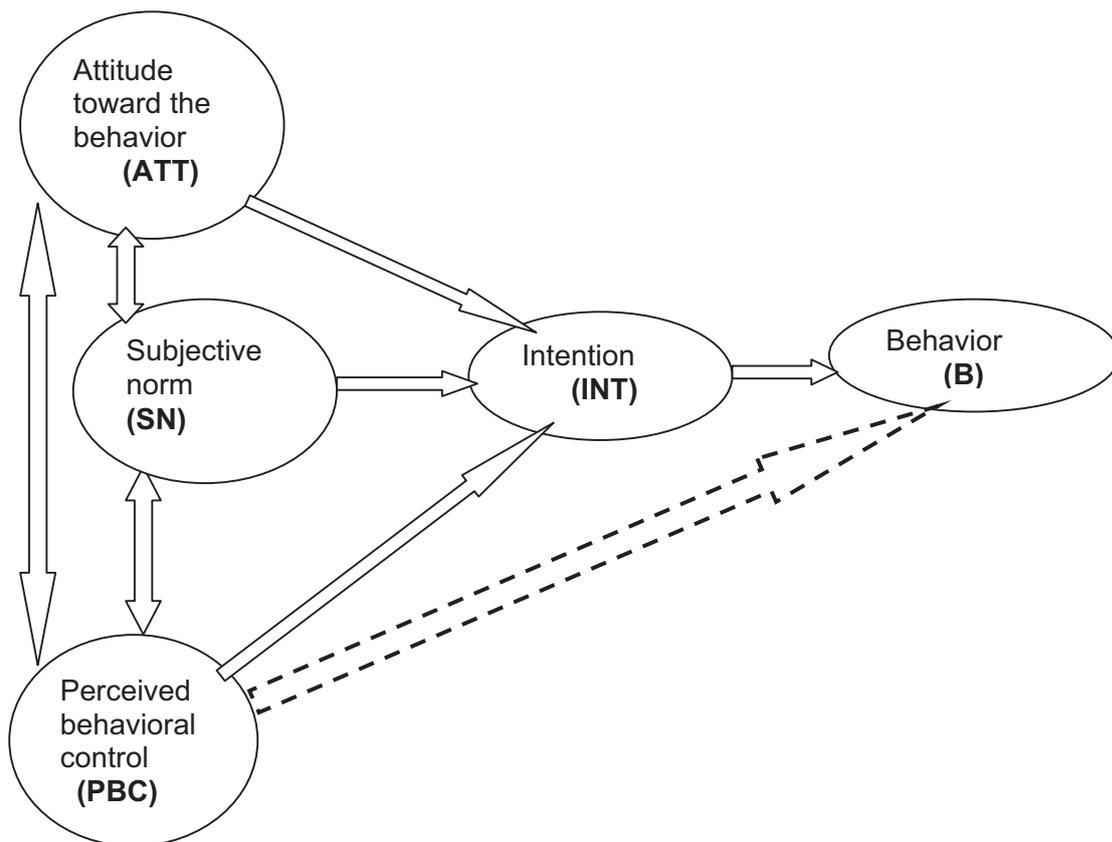
Figure 3: Theory of Planned Behavior
        (Source: Ajzen, 1991, p182)

With reference to Figure 3, the TPB differs from the TRA with the additional PBC variable. In the TPB, there are three independent variables to determine intentions (INT) and they are as follows (Ajzen, 1991):

- **Attitude towards behavior (ATT)** – refers to "degree to which a person has a favorable or unfavorable evaluation" (p188) of a

behavior that is to be determined; and can be expressed mathematically as:

$$ATT \quad \alpha \sum_{i=1}^{n} b_i \, e_i$$

where b_i is the strength of each salient belief; e_i is the subjective evaluation of the belief's attributes; n is the number of beliefs.

- **Subjective norm (SN)** - refers to "perceived social pressure to perform or not to perform the behavior" (p188); SN can be expressed mathematically as:

$$SN \quad \alpha \sum_{i=1}^{n} n_i \, m_i$$

where n_i is the strength of each normative belief; m_i is the "person's motivation to comply with the referent in question" (p188).

- **Perceived behavioral control (PBC)** – refers to "perceived ease/difficulty of performing the behavior and is assumed to reflect past experience and anticipated impediments and obstacles" (p188). PBC can be expressed mathematically as:

$$PBC \quad \alpha \sum_{i=1}^{n} c_i \, \rho_i$$

where c_i is each control belief; ρ_i is the perceived power of the particular control factor to facilitate or inhibit performance of the behavior.

Many studies have found that the inclusion of the PBC significantly improves prediction of intentions (INT), and in many instances also prediction of behavior (Ajzen & Krebs, 1994). Based on 16 studies, "the multiple correlations ranged from 0.43 to 0.94 with an average value of 0.71" in predicting intention, based on the three predictors of the TPB (Ajzen, 1991, p189). Ajzen and Krebs (1994) argue that the PBC is expected to interact with other constructs in the theory. The "ATT and SN should influence intentions to the extent that the PBC is high. Similarly, the effect of intention on behavior also depends on the degree of PBC" (p260):

$$B \approx PBC \cdot INT \; \alpha \; PBC \, [w_1 \, ATT + w_2 \, SN]$$

Ajzen and Kerbs (1994, p260) believe that "most of the variations in intention and behavior can be accounted for by linear combinations, and interactions" between them. As a result of these findings, "simpler linear models have actually been evaluated in most applications of the theory" as follows:

$$B \approx [w_1 \, INT + w_2 \, PBC]$$

$$INT \; \alpha \; [w_1 \, ATT + w_2 \, SN + w_3 \, PBC]$$

where,

      INT is intention to perform the behavior

      ATT is attitude towards the behavior

      SN is subjective norm

      PBC is perceived behavioral control

      w_1, w_2 and w_3 are empirically determined weights

There are two methods to measure intention (INT) and behavior which are: indirect (sum of weighted beliefs) and direct. These two methods are elaborated in Figure 4. Ajzen and Kerbs (1994, p260) believe that the constructs in Figure 4 can be mathematically expressed as follows:

$$B \; \alpha \; INT$$

where,

B is Behavior,

INT is Intention to perform the behavior

$$\text{INT } \alpha \pm w_1 \text{ ATT} + w_2 \text{ SN} \pm w_3 \text{ PBC}$$

where,

The following constructs can be used for **direct** measurement:

ATT is attitude

SN is subjective norm

PBC is perceived behavioral control

w_1, w_2 and w_3 are empirically determined weights

Alternatively, the following beliefs can be used for **indirect** measurement:

B_1 is behavioral beliefs about consequences of behavior

B_2 is normative beliefs about behavior

B_3 is control beliefs which provide the basics for perceptions of behavioral control
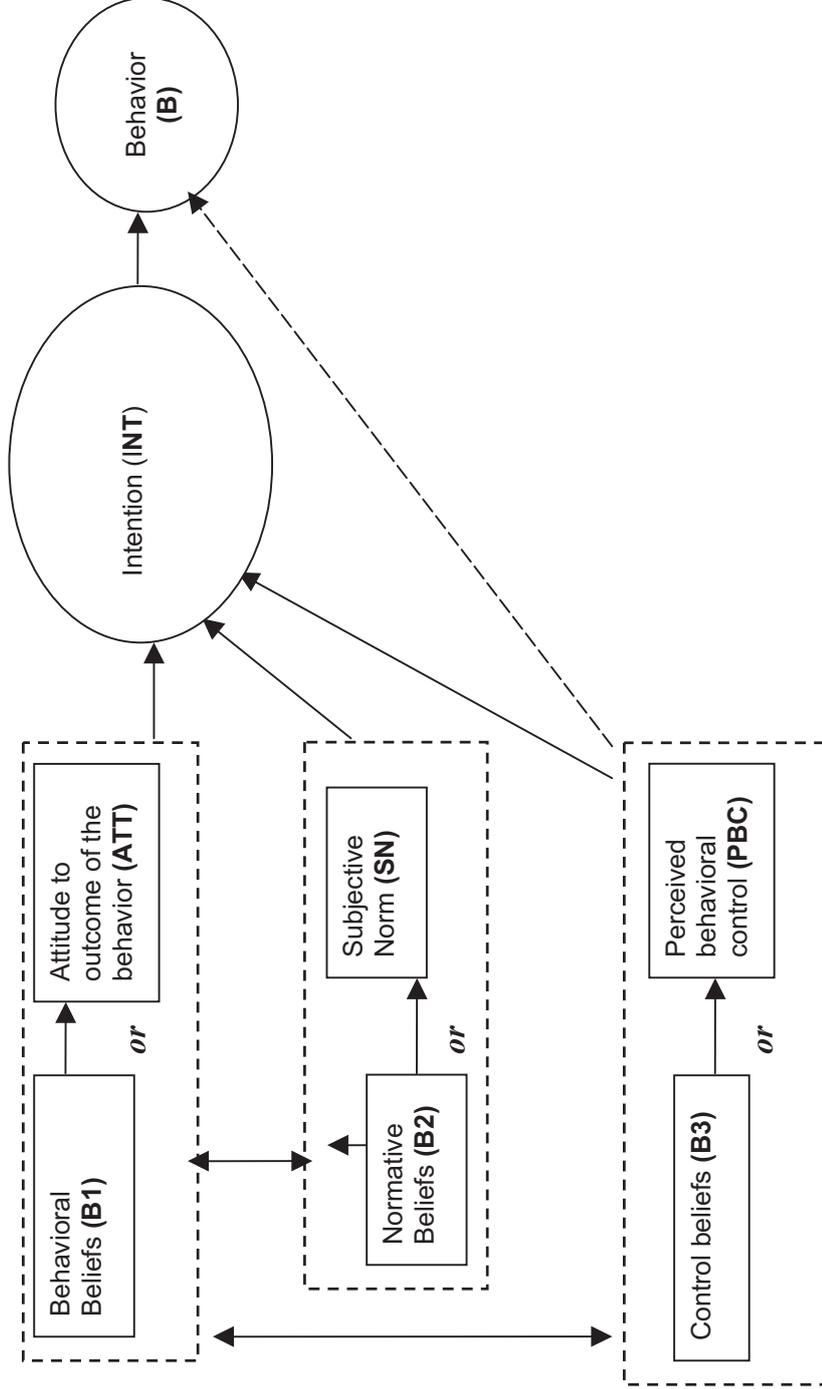
Figure 4: Theory of Planned Behavior with direct and indirect measurement (Source: Ajzen, 2002, p1)

Engel, Blackwell and Miniard (1995) argue that as behavior becomes more dependent on factors outside a person's control, the less the behavior is under volitional control (which represents the degree to which a behavior can be performed at will). Hence, the presence of uncontrollable factors can interfere with the person's ability to do what he or she intended to do. When this occurs, intentions will become less accurate predictors of behavior.

While Ajzen and Madden (1986, p246) support the TRA which "had been successful in predicting a variety of behaviors" such as blood donations and smoking marijuana, they believe that it would do poorly in predicting behaviors over which the individual had only limited control (because they require skills, abilities, opportunities or co-operation of others). They also believe that to improve predictions of this kind of behavior, a model "must assess not only intentions but also the extent to which the individual is capable of exerting control over the behavior in question" (p246). They carried out two studies to test and showed the improvements achieved between the TRA and TPB.

The first study was to test the hypothesis that a measure of PBC would improve the prediction of behavioral intentions (INT) over a prediction that is based solely on attitudes towards the behavior (ATT) and subjective norms (SN). The study was conducted in the context of regular class meetings where 169 college students (45 males and 124 females) were involved. The study was designed to discover why students attend or fail to attend class sessions. Attendance data was collected at 16 regular class sessions. A total of 11 possible consequences of attending class regularly or of missing some sessions were scored on a 7-point Likert scale. The 11 "consequences" developed by Fredricks and Dosset in 1983 were included in the questionnaire (Ajzen & Madden, 1986, p245). The 11 consequences served as a belief-based measure (indirect measure) of attitude (ATT) toward attending class were incorporated. The direct measure of attitude (ATT) was also obtained using 22 semantic differential scales.

Ajzen and Madden (1986) performed a confirmatory factor analysis which resulted in a set of eight semantic differentials for direct measurement of attitude (ATT): rewarding-punishing, useful-useless, good-bad, harmful-beneficial, wise-foolish, happy-sad, sharp-dull, and attractive-unattractive.

The two types of measure (direct and indirect) were used to predict intention (INT) and behavior for the TRA and TPB. Both measures showed reasonable correlation. Intention (INT) was accessed by means of three questions on estimates of likelihood of attending class. They used hierarchical regression to measure the contributions of each variable to prediction of intentions (INT) in the two theories, the TRA and TPB.

The results of the study showed that both attitude (ATT) and SN predicted intention (INT) resulting in a multiple correlation of 0.55. The introduction of PBC into the regression equation improved the multiple correlations from 0.55 to 0.68.

The second study looked at 90 American college students (34 males and 56 females) having to sit for three exams in each semester and seeking a grade 'A' in a course. The assumption made was that experience gained in taking two exams would increase students' accuracy of the control they perceived over their performance in these tests.

A pilot survey with 21 students was done to list advantages and disadvantages of getting a grade 'A' in a particular course, the people who might approve or disapprove of getting a grade 'A', and factors that might help prevent them from getting a grade 'A'. A total of 10 salient consequences of receiving a grade 'A', and a 7-point Likert scale were used. Data were collected twice – first, about three weeks into the spring semester; and second, sometime at the end of the semester. A belief-based measure of attitude (ATT) toward receiving a grade 'A' was developed. The subjective norms (SN) were also assessed and the Cronbach's alpha coefficients for the first and second waves were 0.79 and 0.81 respectively.

The results of the second study showed that ATT and SN predicted INT resulting in a multiple correlation of 0.48 for TRA. Using the TPB, the regression equation improved the multiple correlations from 0.48 to 0.65.

In the transport field, Bamberg, Ajzen and Schmidt (2003) carried out their research relying on the TPB to investigate the effect of an intervention in introducing a prepaid bus ticket to see if there was an increased use of the bus among college students. The first set of data (first wave) was collected during the spring semester registration period, about two months prior to introduction of the new bus ticket. A total of 3,491 questionnaire forms were distributed and 1,874 (54%) of them were returned. The second set of data collection (second wave) was done via mail, one year after the first wave. A total of 1,316 completed questionnaire forms were returned. The participants were 42% males (aged 20 to 37 years). Most of the items in the questionnaire were designed to assess the constructs of the TPB. Alternative travel modes such as driving a car, taking the bus, riding a bicycle, and walking were also considered.

Bamberg et al (2003) used structural equation modelling to analyse the data for bus and car. They found that introducing the pre-paid bus ticket influenced ATT, SN and PBC towards bus use. The ATT, SN and PBC accounted for 49% of the variance in INT in the first wave and 64% of variance in the second wave, and model fit was found to be adequate. The theory provided an accurate prediction of intention and behavior.

In the above case study, the INT to use a pre-paid bus ticket was evaluated. Similarly, INT to use the ez-link card non-transit transactions will be evaluated in the current study.

2.8　Technology Acceptance Model

According to Davis, Bagozzi, and Warshaw (1989, p985), the Technology Acceptance Model (TAM) was adapted from the TRA to understand "user acceptance of information systems". TAM is proposed to explain "user behavior across a broad range of end-user computing technologies"

Davis (1989), the founder of the TAM, carried out two studies involving 152 users and four software application programs. He developed two new belief variables which are: perceived usefulness (PU) and perceived ease of use (PEU). Davis, Bagozzi, and Warshaw (1989, p985) defines the two belief variables as follows:

- "perceived usefulness" (PU) – the belief that using a specific IT application system could improve "job performance within an organisation"
- "perceived ease of use" (PEU) – the degree to which a user perceives a system will be easy to use

The TAM defines intention as INT = PU + PEU as shown in Figure 5.
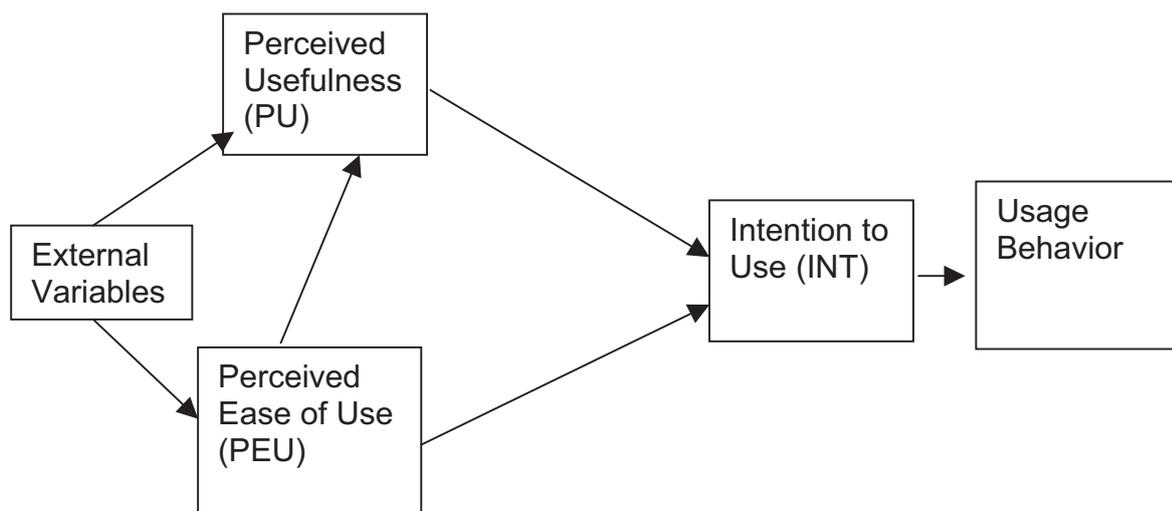
Figure 5: Technology Acceptance Model
(Source: Davis et al, 1989, p985)

Davis et al (1989) claimed that the external variables in Figure 5 provide a "bridge between the internal beliefs, attitudes and intentions" (p988). They argued that the TRA and TAM are similar in that ATT is determined by one's relevant beliefs. Davis et al (1989) also argued that the two theories are different in the following ways:

- Unlike the TRA, the TAM does not depend on SN to predict behavioral intentions (INT).
- In the case of the TRA, new salient beliefs are developed but in the case of TAM, a generalized set of beliefs could be used for users of different computer systems.
- In the TRA, the sums of beliefs (b_i) "multiplied by corresponding evaluation weights (e_i)" (p988) provide a single attitude construct, which is ATT $= \sum b_i \, e_i$. However, in the TAM, PU and PEU" are considered two "distinct constructs" (p988) which enable one to compare the relative influence of each belief in determining attitude.

Davis et al (1989) carried out a study on 107 full-time MBA students to find out whether the TRA or TAM could explain intentions to use word processing application software. When the data were collected and analysed, the behavioral intention (INT) for the TRA was 32% of the variance explained in the model for the first instance, and 26% for the second instance. Similarly, for the TAM, the variances explained for INT were 47% and 51% for the first and second instances respectively. The attitude (ATT) variances explained for the TRA were 7% and 30% for first and second instances respectively. For the TAM, the ATT explained were 37% and 36% for the first and second instances respectively.

Though this study reveals that the TAM showed an improvement in measuring the INT as compared to the TRA, Davis et al (1989) did not measure ATT in the manner proposed by Ajzen and Fishbein (1980) which is explained in Sections 2.6 and 2.7.

2.9   Extended Technology Acceptance Model

Venkatesh and Davis (2000) concluded that the TAM predicts usage intention (INT) and behavior better then the TRA or TPB. They claim that the TAM explains about 40% of the variance in usage intentions (INT). They also highlighted that after 10 years of using the TAM, it was noted that PU has been neglected. They suggest a modification to the TAM to incorporate "social influencing processes" (p187) and "cognitive instrumental processes" (p190) and they called it the extended Technology of Acceptance Model or TAM2 as shown in Figure 6.

Venkatash and Davis (2000) carried out four studies on the TAM2. The first study used 48 floor supervisors from a medium sized manufacturing firm. The supervisors were introduced to a proprietary system and training was provided over two days. The supervisors were not compelled to use the system though 38 completed the study. The second study engaged 50 staff in a financial services firm. The project involved staff moving from a mainframe to a Windows environment. The staff were given a one-and-a-half day training course and the use of the new system was voluntary. Altogether 39 staff used the new system.

The third study involved 51 employees from a small accounting firm who performed customer accounts and telephone customer service. The existing DOS-based system was replaced to a Window-based system. The staff were provided with a one-day training course, and use of the system was mandatory. A total of 43 staff provided their feedback. The fourth and final study engaged 51 staff in a small international investment-banking firm. These staff dealt with domestic and international stock management. A new system was introduced to help them in analysing and creating financial stock portfolios. The new custom-built system was DOS-based, like the old system, except that it provided new functionalities to perform risk assessment. The staff were provided with a four-hour training course, and it was mandatory for them to use the new system. Thirty-six staff provided their feedback.

Venkatash and Davis (2000) examined the relationship between the "usage determinants" (p194) in the TAM2 (the variables that precede INT in Figure 6) and INT over the three periods, which includes pre-implementation (after the first month) and post-implementation (after the second and third months). They found that the TAM2 explained between 37% and 52% of the variance (R^2) in usage intention (INT) for all four studies. The weight of PU was found to be in the range of 0.56 to 0.79, SN was in the range of 0.51 to 0.65 and PEU was in the range of 0.12 to 0.37. Incorporating the "social influence processes (SN, voluntariness and image) and cognitive instrumental process (job relevance, output quality, result demonstrability, perceived ease of use)" (p198), the TAM2 could explain 60% of the variance in INT.
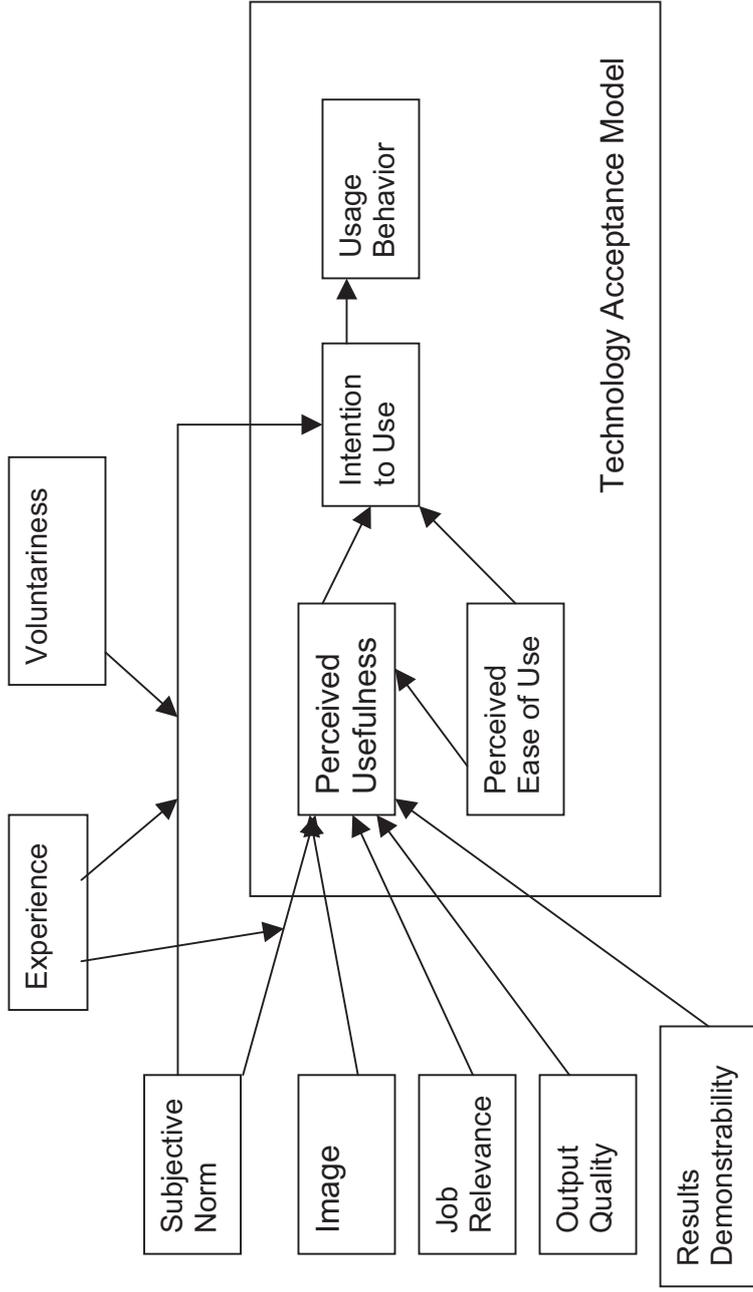
Figure 6: TAM2 – Extension of the Technology Acceptance Model (Source: Venkatesh and Davis, 2000, p188)

2.10 Unified Technology Acceptance and Use of Technology Model

Researchers are constantly studying and adapting existing theoretical models to develop new ones. For example, Davis et al (1989) adapted part of the TRA to develop the TAM (refer to Section 2.6); and thereafter, Venkatesh and Davis (2000) adapted parts of the TRA and TPB and combining them with the TAM to develop the TAM2 (refer to Section 2.9).

When involved in adapting existing theoretical models to develop new ones, researchers are often faced with the task of choosing the appropriate construct in a model to be adopted or ignored as well as having to carry out model comparison studies. Since a comprehensive comparison of key competing models was never carried out in a single study, Venkatesh, Morris, Davis and Davis (2003) decided to review eight models (TRA, TAM, TPB, C-TAM-TPB, IDT, MM, MPCU, and SCT) to form the Unified Technology Acceptance and Use of Technology (UTAUT) model. They highlighted that a total of five theoretical models (TRA, TAM, TPB, IDT, DTPB) were used as shown in Table 1.

Listed below are brief descriptions of some of the models that were used in the UTAUT model (Venkatesh et al, 2003, p428):

- Model of PC utilisation (MPCU): This model was refined by Thompson, Higgins and Howell (1991) to predict individual acceptance of PC utilisation or range of information technologies.

- Motivational Model (MM): This model includes extrinsic motivation (users want to perform an activity because of valued outcome such as improved job performance) and Intrinsic motivation (users want to perform an activity for no real reward but just wanting to perform the activity) (Davis et al, 1992).

- Combined TAM and TPB (C-TAM-TPB): This hybrid model combines the predictors of the TPB with PU from the TAM (Taylor & Todd, 1995a).

- Social Cognition Theory (SCT): The initial social cognition theory by Bandura (1986) was adapted by Compeau and Higgins (1995) to study individual acceptance and use of IT.

- Decomposed Theory of Planned Behavior (DTPB): This model is identical to the TPB in predicting intention. The DTPB 'decomposes' attitude, SN and PBC into their belief structures within technology adoption contexts (Taylor & Todd, 1995b)

- Innovation in Diffusion Theory (IDT): This model involves studying the impact of innovation characteristics on adoption and usage behavior, and shows differences in predictors of adoption versus usage behavior (Karahanna, Straub & Chervany, 1999).

Table 1: Comparison of theoretical models
(Source: Venkatesh et al, 2003)

Models compared by	Theories/Models compared	Findings
Davis et al (1989)	TRA, TAM	The variance in intention and use explained by TRA was 32% and 26%, and TAM was 47% and 51% respectively.
Mathieson (1991)	TAM, TPB	The variance in intention explained by TAM was 70% and TPB was 62%
Taylor & Todd (1995b)	TAM, TPB/DTPB	The variance in intention explained by TAM was 52%, TPB was 57% and DTPB was 60%.
Plouffe et al (2001)	TAM, IDT	The variance in intention explained by TAM was 33% and IDT was 45%.

Data were obtained from four organisations over a six-month period at three points of time (post-training, one month after implementation and three months after implementation). The data were collected from a mandatory-use setting for two organisations (Banking – sample size was

54; and Public Administration – sample size was 65) and a voluntary-use setting from another two organisations (Entertainment – sample size was 58; and Telecom Services – sample size was 38). A sample size of 215 was therefore available for each instance, and the total sample size for three instances was 645. The UTAUT model consists of four main variables to predict INT and they are: "performance expectancy", "effort expectancy", "social expectancy" and "facilitating conditions" (p447). There are also four moderating variables and they are: "gender", "age", "experience" and "voluntariness of use" as shown in Figure 7 (Venkatesh et al, 2003, p447).

The constructs in Figure 7 are defined as follows (Venkatesh et al, 2003):

- Performance expectancy – 'the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (p447). This performance expectancy is derived from five constructs which are: "perceived usefulness (TAM/TAM2 and C-TAM-TPB), extrinsic motivation (MM), job-fit (MPCU), relative advantage (IDT) and outcome expectations (SCT)" (p447).

- Effort expectancy – "the degree of ease associated with the use of the system" (p450). This effort expectancy is derived from three constructs which are: "perceived ease of use (TAM/TAM2), complexity (MPCU) and ease of use (IDT)" (p450).

- Social influence – "the degree to which an individual perceives that important others believe he or she should use the new system. Social influence as a direct determinant of behavioral intention is represented as SN in TRA, TAM2, TPB/DTPB and C-TAM-TPB, social factors in MPCU, and image in IDT" (p451).

- Facilitating conditions – "the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system" (p453). This concept encompasses

three constructs. They are: "perceived behavioral control (TPB/DTPB, C-TAM-TPB), facilitating conditions (MPCU) and compatibility (IDT)" (p453).

According to Venkatesh et al (2003), the individual models "explained between 17% and 53% of the variance in user intentions (INT) to use Information Technology" (p425). They found that by unifying the eight models that formed the UTAUT, the data from the four organisations explained 70% of the variance in INT "to explain individual acceptance and usage decisions in organisations" (p471). They carried out a cross validation test for UTAUT on another two organisations. The sample size was 133 for each instance and the total sample size for three instances of 399 was used. The cross-validation test was found to be consistent with the initial test where "70% of the variance" (p467) in INT could be explained.

However, a study done by Marchewka, Liu and Kostiwa (2007) on intention to use 'Blackboard' (a web-based tool) by 132 university students (50% - undergraduate, and 50% - graduate) did not support the UTAUT model.
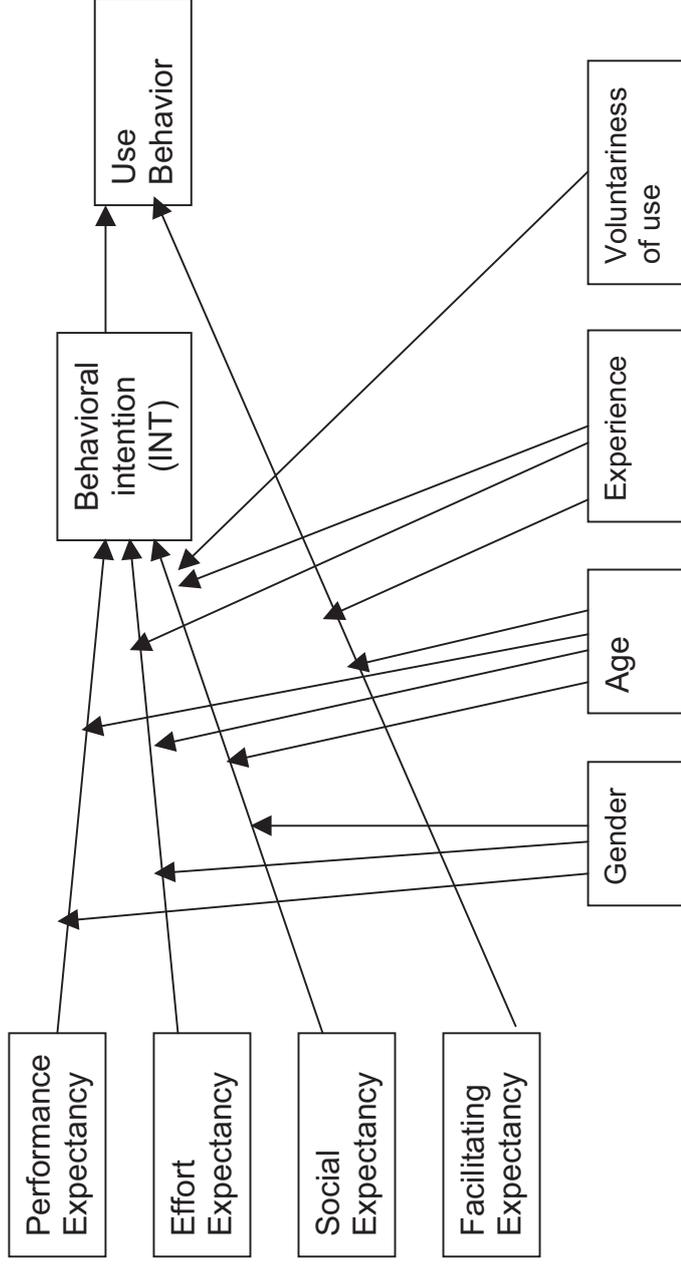
**Figure 7: The Unified Technology and Acceptance and Use of Technology Model
(Source: Venkatesh et al, 2003, p447)**

2.11   Selected model

It is evident from the above literature review that a wide range of research has been undertaken to study behavioral intentions (INT) to use IT using social psychological or information systems models.

It is also evident from the above literature review that there are not many scholarly studies conducted to establish if a contactless smart card (an IT product) is to be used for both transit and non-transit transactions, and to understand the behavioral intentions (INT) of customers in extending the use of a contactless smart card from transit to non-transit transactions. For customers using the public transport system in Singapore, to use the ez-link card for transit transactions is not new, but to use it for non-transit transactions is somewhat new.

In considering an appropriate model for this study, the TPB model was found to be suitable as compared to the TD, TRA, TAM, TAM2 and UTAUT models. While the TPB model has been used to study customer intention in the use of a prepaid bus ticket in the public transport system, no such study has been done using the other models. In addition, the TAM, TAM2 and UTAUT models which were developed to explain the use of IT in organizations (Venkatesh et al, 2003), do not seem to explain more variance in human behavior when compared to the TPB model (Benbasat & Barki, 2007, p214). This is illustrated in Table 2 which shows the summary of variance explained for intention in the various models.

Table 2: Summary of variance

Model	Average percentage of intention variance explained	Sources
TRA	68	Ajzen & Krebs (1994)
TPB	71	Ajzen (1991)
TAM	50	Davis et al (1989)
TAM2	60	Venkatash & Davis (2000)
UTAUT	70	Venkatesh et al (2003)

In contrast to the TAM which is used primarily for studies involving the use of organizational information systems, the TPB has been used to explain the behavior of customers using the public transport system. This is an indication that the TPB is a more appropriate model for this study.

The current study of the ez-link card involves the study of technological innovation that is applied to the field of information systems. In addition, it involves people who would be using new products and services. Based on the interdisciplinary nature of the study, the original works from social psychologist, Ajzen (1991) will be adapted and used in the study.

2.12   Consumer behavior and cultural consideration

The current study will be using Ajzen's TPB model which was developed in the USA, and may not produce similar results in Singapore due to the cultural differences between the two countries. Hence, this section will attempt to explain the cultural differences. Schutte and Ciarlante (1998) also claim that a product well received in the USA may not do as well in Asian countries due to cultural differences.

Hofstede (1980) defines culture as "collective mental programming" that "people have in common" (p43) in a geographical region and belonging to a social or professional group with the same education and life experiences. Between 1967 and 1973, he concluded an elaborate study in 50 countries on skilled to unskilled IBM (a USA-based multinational corporation) employees on their beliefs and values. Hofstede (1980) found four dimensions of cultural difference. They are as follows:

- "Power Distance" that "indicates the extent to which a society accepts the fact that power in institutions and organisations is distributed unequally" (p45).

- "Uncertainty Avoidance" that "indicates the extent to which a society feels threatened by uncertain and ambiguous situations" which they try to avoid by "establishing more formal rules", etc. (p45)

- "Individualism versus Collectivism" – "individualism" refers to a loose social framework where individuals are expected to "take care of themselves"; and "collectivism" refers to a "tight social framework" where individuals "expect their in-groups (relatives, clans and organisations)" to take care of them and their families (p45).

- Masculinity versus Femininity – "expresses the extent to which the dominant values in society are masculine" and are seen to be assertive, interested to acquire "money and things", and without "caring for others" (p46)

Hofstede (1994, p5) also conducted another study on students from 23 countries "using a questionnaire form designed by Chinese scholars" and found a fifth dimension which he termed "Long Term versus Short Term Orientation". This dimension concerns values "associated with long-term orientation" such as "thrift and perseverance"; and "values associated with short-term orientation" such as "respect for tradition, fulfilling social obligation and protecting one's" obligation.

The five dimensions could provide a "context within which to describe the nature of the problems which may occur as transfer of information technology unfolds" (Shore & Venkatachalam, 1996, p23).

Hofstede (1980) identified Singapore, Hong Kong, India and the Philippines as "high power distance and low uncertainty avoidance cultures" (p51). This is illustrated in Figure 8. He believes that these countries are willing to take risks on new procedures, and provide feedback to local and headquarter companies but need the support of their management to do so.

This suggests that American, European and Asian consumers may respond at different levels of acceptance to the introduction of IT due to the cultural differences in these societies. This important issue may impact on formation of intentions to use technology.
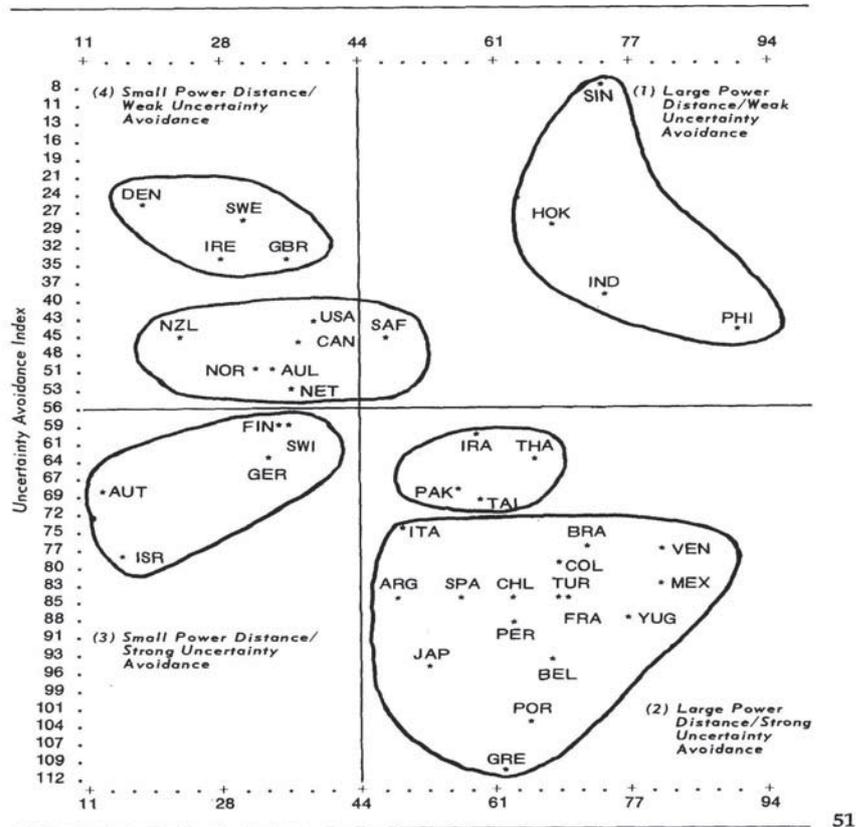
Figure 8: Hofstede Power Distance Model
(Source: Hofstede, 1980, p51)

2.13   Operational definition

The research question asks:

"What would encourage current transit customers to use a transit card (such as the ez-Link card) for non-transit transactions?"

The research question is applied to the TPB which is illustrated in Figure 4, where direct or indirect measurement could be used.

Currently, ez-link card customers are mainly using the card for transit transactions. They are not exposed to a wide variety of non-transit systems. Hence, it is not possible to measure behavior at this point. Therefore, this study will only undertake to measure intention of customers using the public transport system to use their ez-link card for non-transit transactions.

The operational definitions of the variables in this study are listed below and are further illustrated using the modified TPB model in Figure 9. The hypotheses for the study will be elaborated in Chapter 3.

INT =   Intention to use ez-link card for non-transit transactions

ATT =   Attitude towards the use of ez-link card for non-transit transactions

SN =   Subjective norms for use of ez-link card for non-transit transactions

PBC=   Perceived behavioral control of use of ez-link card for non-transit transactions

Intention (**INT**)

"*To use the ez-link card for non-transit transactions*"

Attitude (**ATT**)

Subjective Norm (**SN**)

Perceived behavioral control (**PBC**)
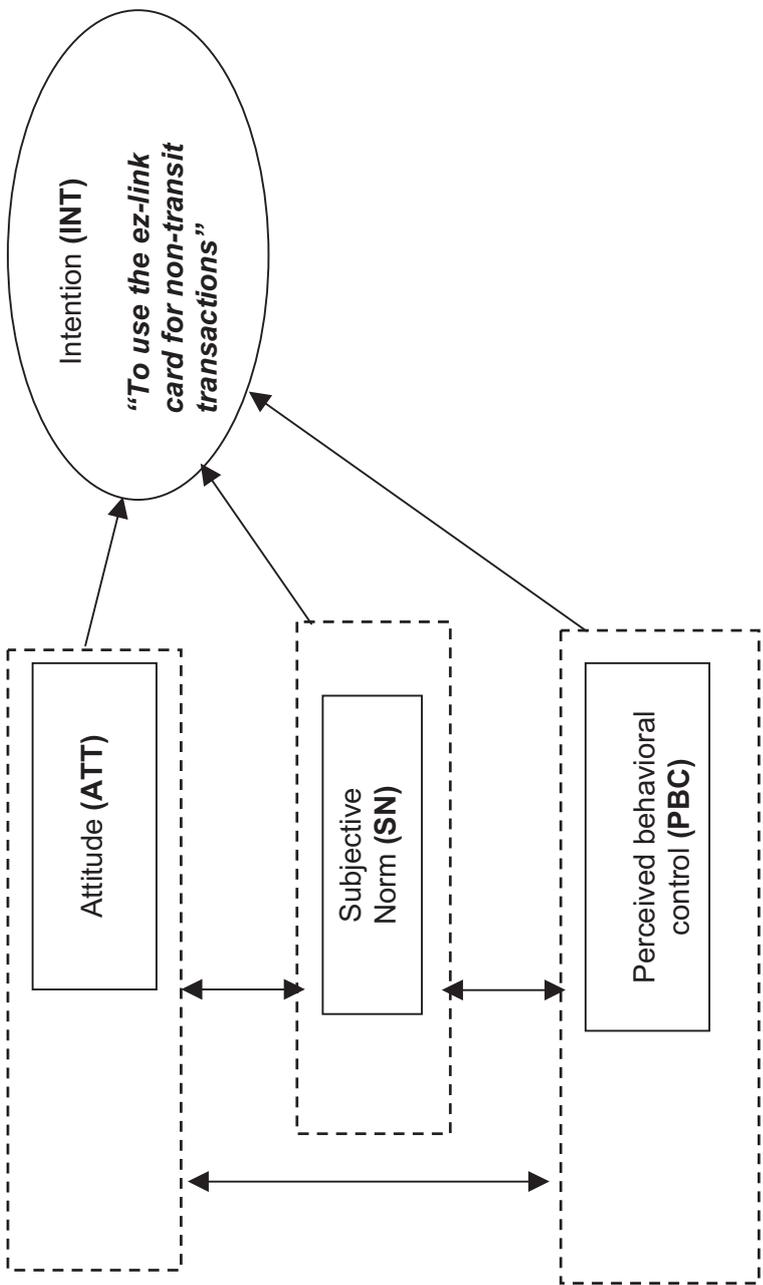
Figure 9: Modified TPB used in this study

2.14   Chapter conclusion

This chapter has looked at what a contactless smart card is, and why many public transport companies around the world are shifting from other types of media to the contactless smart card.

Various theoretical models were reviewed to identify an appropriate model for this study. Ajzen's TPB was found to be suitable for measuring customers' intention to use the ez-link card for non-transit systems. However, the current study will not focus on the measurement of the behavior variable because the ez-link card is presently not being widely used by customers for non-transit transactions. Hence, the study will only focus on intention to use the ez-link for non-transit transactions. The research question and operational definitions for this study were defined in this chapter.

In the next chapter, the research methodology, hypotheses, design of the questionnaire form and data collection techniques to be adopted for this study will be presented and discussed.

Chapter 3.0   Methodology

3.1   Chapter introduction

In the previous chapter, the research model used in this study was identified and operational definitions of variables were defined.

In this Chapter, hypotheses for the study will be drawn from the research model. Thereafter, the research methodology, questionnaire design and data collection techniques adopted for this study will be detailed and discussed. The questionnaire form, which was fine-tuned based on the findings of a pilot survey on 21 respondents, will be presented. Data collected from 50 respondents in the first phase, and 250 respondents in the second phase of the final survey will also be presented. The complete data analysis on the 300 respondents in both the phases will be detailed and discussed in Chapter 4.

3.2   Modified TPB

As mentioned in Chapter 2, the TPB was selected for this study as it is widely used to study intention (Table 2, p40). Furthermore, the TPB has been used previously in studies on the public transport system

As this study aimed to explain the future use of a transit card for non-transit transactions (and since there were so few opportunities for existing customers to use the transit card for non-transit transactions), it was inappropriate to measure behavior in the use of the transit card. Hence, this study focused only on the intention to use (and not the behavior in the use of) the transit card for non-transit transactions.

This study looked at measuring the intention (INT) of customers using the public transport system in Singapore to use the ez-link card for non-transit transactions. Consequently, the behavior variable, and the link between the PBC and behavior were excluded from the TPB model. This resulted in the modified TPB model is shown in Figure 10.
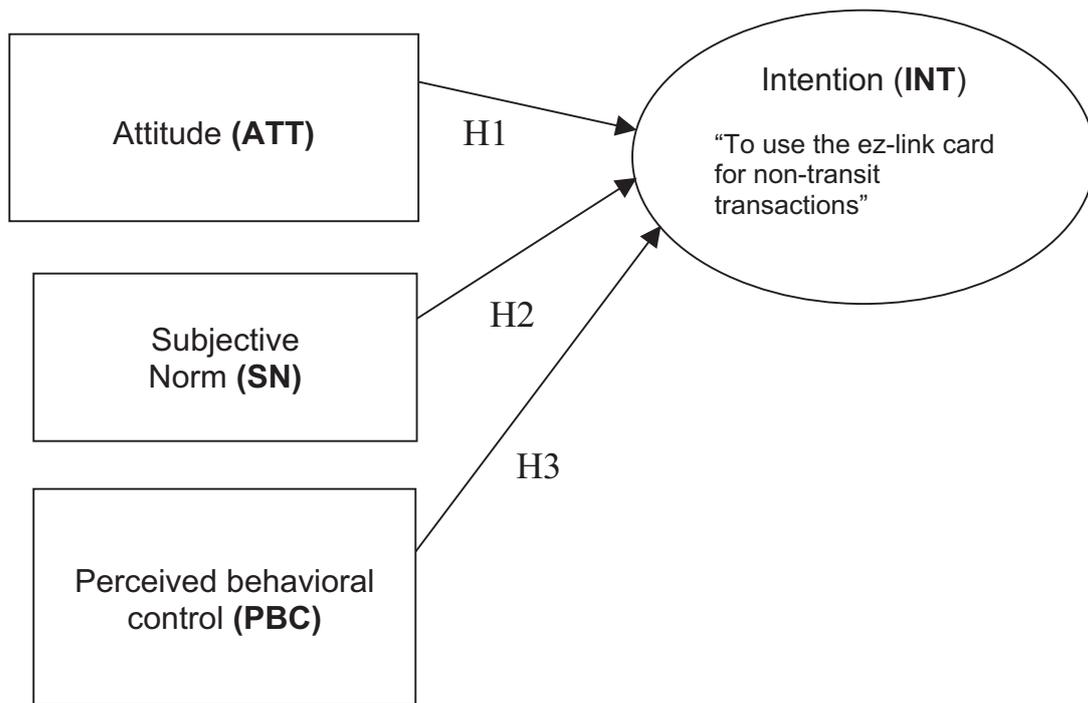
Figure 10: Modified TPB and hypotheses for this study

Based on the modified TPB, the following hypotheses were identified and listed to support the research question:

H1: The stronger the attitudes to outcomes of using ez-link card for non-transit transactions, the stronger the intentions to use the card for non-transit transactions.

H2: The more transit customers expect to please others by using the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions.

H3: The more transit customers perceive that they have control over the use of the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions.

3.3   Research methodology

This study adopted a quantitative approach to test the TPB model as suggested by Ajzen (2002). This approach was also adopted in 185 studies carried out by other researchers in the past (Armitage & Conner, 2001).

3.4   Measurement

Two approaches are available to measure the independent variables in the TPB, indirect and direct measurement (Ajzen, 2002).

In indirect measurement, insight into the underlying cognitive foundation or reasons why people hold certain ATT, SN and PBC could be explored by measuring beliefs (Ajzen, 2002). This information would be useful in designing effective programs for behavioral interventions. However, this was not a goal of this study, so the method of indirect measurement was not used. Instead, the direct method of measurement was used because it is simpler and quicker to use. This measurement does not require prior interviews to identify salient beliefs. All items were measured using 7-point semantic differentials as suggested by Ajzen (2002).

3.4.1   Dependent variable

The dependent variable included in this study is intention (INT). For the purpose of this study, INT is defined as the intention of the customers using the public transport system in Singapore to use the ez-link card for non-transit transactions.

Three items were initially developed to measure the INT. However, after the pilot survey reliability analysis (described in Section 3.11), an additional item (Q11: INT_not) was added to improve the reliability of the scale. The items used to measure the final INT are listed in Table 3.

Table 3: Items used to measure INT

INT	Item	Scale
INT_want	I want to use the EZ-Link card for non-transit services	Extremely unlikely (1) - Extremely likely (7)
INT_not	I will not use the EZ-Link card for non-transit services @ *	Strongly disagree (1) - Strongly agree (7)
INT_hope	I hope to use the EZ-Link card for the non-transit services*	Strongly agree (1) - Strongly disagree (7)
INT_use	I will use the EZ-Link card for non-transit services	Strongly disagree (1) - Strongly agree (7)
@ Item added after pilot testing * Negatively scored item.		

Cronbach's alpha for the final scale was high at 0.93, and INT was measured as the mean of the four items in the scale.

3.4.2   Independent variables

The three independent variables included in this study were attitude (ATT), subjective norm (SN) and perceived behavioral control (PBC).

For the purpose this study, ATT is defined as the customer's favourable or unfavourable attitude toward the use of the ez-link card for non-transit transactions; SN is defined as the perceived social pressure experienced by the customer to use or not to use the ez-link card for non-transit transactions; and PBC is defined as the perceived ease or difficulty with which the customer uses the ez-link card for non-transit transactions.

Each of these independent variables (ATT, SN and PBC) will be discussed in detail in the following sections.

3.4.2.1   Attitude (ATT)

A total of six items was initially developed to measure the ATT variable. After the pilot survey, one poorly correlated item (Q9: ATT_easy) was deleted. The final ATT scale was measured using five items as listed in Table 4, which produced a high Cronbach's alpha of 0.88.

Table 4: Items used to measure ATT

ATT	Item	Scale
ATT_risky	I would find using the EZ-Link card for non-transit services	Risky (1) – Safe (7)
ATT_fast	I would find using the EZ-Link card for non-transit services *	Fast (1) - Slow (7)
ATT_not trendy	I would find using the EZ-Link card for non-transit services	Not trendy (1) – Trendy (7)
ATT_not useful	I would find using the EZ-Link card for non-transit services	Not useful (1) – Useful (7)
ATT_norm	Using the EZ-Link card for non-transit services should be *	The norm (1) – Not the norm (7)
* Negatively scored item.		

3.4.2.2   Subjective Norm (SN)

A total of three items was developed to measure the SN variable in the pilot survey. All the three items listed in Table 5 were used in the final SN scale, which produced a satisfactory Cronbach's alpha of 0.85.

Table 5: Items used to measure SN

SN	Item	Scale
SN_I should	Most people who are important to me think that _____use the EZL-Link card for non-transit services *	I should (1) – I should not (7)
SN_disapprove	The people in my life whose options I value would _____ of me using the EZ-Link card for non-transit services	Disapprove (1) – Approve (7)
SN_agree	It is expected of me to use the EZ-Link card for the non-transit services *	Strongly agree (1) - Strongly disagree (7)
* Negatively scored item.		

3.4.2.3   Perceived Behavioral Control (PBC)

A total of four items was developed to measure the PBC variable in the pilot survey. In the final PBC scale, one item (Q13: PBC_no control) was deleted because it had a poor correlation with the rest of the items. On the other hand, a new item was added to obtain a high Cronbach's alpha of 0.74 as shown in Table 6.

Table 6: Items used to measure PBC

PBC	Item	Scale
PBC_easy	I would find using the EZ-Link card for non-transit services @	Easy (1) – Difficult (7)
PBC_impossible	For me to use the EZ-Link card for non-transit services would be _____. *	Impossible (1) - Possible (7)
PBC_true	I could use the EZ-Link card for non-transit services, if I wanted to.	Definitely true (1) – Definitely false (7)
PBC_agree	It is mostly up to me whether or not to use the EZ-Link card for non-transit services.	Strongly agree (1) - Strongly disagree (7)
@ Item added after pilot testing * Negatively scored item.		

3.5   Questionnaire design and format

In addition to the items developed to measure the variables in the TPB, general questions (such as personal information; amount they would spend on non-transit transactions (PV); remaining value (RV) in the card for non-transit transactions; type of non-transit transactions preferred; and type of loyalty scheme preferred) were incorporated in the questionnaire for the pilot survey. After the pilot survey, a few of the questions were then revised and incorporated in the questionnaire for the final survey.

The questionnaire for the pilot survey consisted of 25 questions, of which 16 questions were designed to measure the four variables (one dependent – INT, and 3 independent variables – ATT, SN and PBC), and 9 questions were designed to collect descriptive statistics. The questions were numbered Q1 to Q25, and were organised in the questionnaire as shown in Table 7.

Table 7: Summary of questions in the pilot survey questionnaire

Set	Type of Questions	Question number
1	**General Questions** (such as personal information; amount they would spend on non-transit transactions; remaining value in the card for non-transit transactions; type of non-transit transactions preferred; and type of loyalty scheme preferred)	Q1 to Q5
2	**Items to measure Attitude (ATT)**	Q6 to Q11
3	**Items to measure Subjective Norm (SN)**	Q12 to Q14
4	**Items to measure Perceived Behavioral Control (PBC)**	Q15 to Q18
5	**Items to measure Intention (INT)**	Q19 to Q21
6	**General Information about the Respondent** (such as occupation, age, gender, type of card they use and income group)	Q22 to Q25

The questionnaire also incorporated other information for the interviewer to complete such as location, day and time where the interview was carried out. This information was used to check that there were no systematic differences between interviewers, and the day and time of the interviews.

The questionnaire for the pilot survey is attached at Appendix 4. A formal application was submitted to the Research Ethics Committee of the University of Western Australia (UWA) to seek their approval for use in the study using the 'Application to undertake research involving human subject'. The Ethics Committee approved the research in December

2004 as sufficient justification was submitted that students would be ethically treated.

3.6 Population

The population for this study comprised customers who use the public transport system (both buses, and MRT and LRT trains) in Singapore. The number of cards issued to the various categories (namely, Adult, Student, Tertiary, National Service and Senior Citizen) was about 5.4 million. The number of customers who used the public transport daily was about 1.9 million. The details are listed in Table 8.

Table 8: Ez-link card distribution and usage, January 2005

Category	No. of cards issued		No. of customers using the public transport daily	
	Cards	%	Cards	%
Adult	4,304,256	79.50	1,388,632	72.3
Senior Citizen	298,142	5.51	136,754	7.1
Student	678,445	12.53	302,169	15.7
Tertiary	98,435	1.82	79,838	4.2
National Service	34,681	0.64	12,448	0.7
Total	5,413,959	100	1,919,841	100

(Source: Ez-link card central computer)

3.7 Method of sampling

Stratified quota sampling was used to select the sample for the study. A sample size of 300 respondents was drawn from the different categories of ez-link cards (refer to Table 8) issued to customers using the public transport system in Singapore. The responses which were required to be representative of each category are given in Table 9.

Table 9: Responses for each ez-link card category

Category	No. of responses required	% in sample
Adult	211	70.3
Senior Citizen	24	8.0
Student	43	14.3
Tertiary	13	4.3
National Service	9	3.0
Total	300	100

The Singapore 2005 population census was referenced in order to identify target proportions of male and female respondents in the study. According to the population census, the total population of Singapore was 4.35 million; sex ratio was 987 male persons for every 1000 female persons; total labour force was 2.37 million and of which, only 2.27 million were employed; and about 78.2 % of the male persons were employed as compared to 56.6% of the female persons (Statistics 2005). Taking into consideration that a higher proportion of male persons are working, serving national service and attending tertiary education, 173 male customers and 127 female customers were targeted for the survey in this study.

3.8   Method of data collection

There are various methods to collect the data such as, mail, telephone, personal interview, group interview and Internet. Each of these methods has strengths and weaknesses linked to the length of time it would take to complete the survey and implementation costs (Dillman, 2000a; Dillman, 2000b; and Fowler, 1993).

For this study, the data were collected through face-to-face interview using an intercept technique. According to Dillman (2000a) and Fowler (1993), this technique of interview is probably the most effective way of getting cooperation for most populations. Technicians working in the same company (TL) as the researcher were engaged as interviewers. The Technicians maintain ez-link card sales (top-up) equipment, and all have more than seven years of working experience in TL. Face-to-face interview was chosen because the interviewers were familiar with the public transport system in Singapore and its customers. The merits of using the Technicians as compared to using some others who are not related to the public transport system as interviewers can be summarized as follows:

- The technicians can easily identify the various categories of the ez-link cards and customers;

- The technicians make better facilitators in interpreting the questionnaire for the researcher; and

- The technicians are able to identify potential survey candidates for the research study (to be further elaborated later in this section).

In the transit environment, customers are often in a hurry to connect between one mode of travel to another (for example, bus to train and vice-versa) and as such, not all customers are willing to participate in a survey. In addressing this problem, interviewers identified potential respondents who were waiting in the queue to top-up their ez-link card at the sales machines. The interviewers introduced themselves before seeking the customers' permission to conduct the survey. A response

rate of 90% was achieved from such approaches with customers. As for the 10% of refusals, the interviewers used re-tries. When a customer approached by the interviewer declined to participate in the survey, the interviewer would approach another customer until the targeted number of responses (as set up by the schedule on "additional instructions" listed in Appendices 5 and 7a to 7d, and described later in this section) was achieved. The interviewers took about 15 minutes on the average to complete each interview.

Interviewers could affect the response rate in the way they influence or handle the respondents in the data collection process. In order to obtain a good response rate, the interviewing process should be standardised as far as possible (Fowler & Mangione, 1990). A balance must also be sought between "persistence and responsiveness to reluctant respondents" in an interview survey (Fowler, 1993, p44). Respondents must participate on a voluntary basis, and they must be briefed on the purpose and benefit of the survey (Fowler, 1993). In this study, instructions to the interviewer, and information for the respondents were clearly incorporated in the interview process.

Two briefings were conducted for the interviewers. The first briefing was for the pilot survey, and the second briefing was for the final survey. The interviewers were briefed on the purpose of the research, information about the survey, how to conduct the interview, structure of the questionnaire, and additional instructions on the different categories of respondents to be interviewed. They were also briefed on the instructions that they had to follow in conducting the interview with the respondents.

A summary of the documents provided to the interviewers is as follows:

First Briefing for Pilot survey   (for two Interviewers):

- Cover letter for this study (Appendix 1)

- Information sheet for this study (Appendix 2)

- Instructions to interviewer for pilot survey (Appendix 3)

- Questionnaire form for pilot survey (Appendix 4)

- Additional instructions for pilot survey (Appendix 5)

Second Briefing for Final survey (for five Interviewers):

- Cover letter for this study (Appendix 1)

- Information sheet for this study (Appendix 2)

- Instructions to interviewer for final survey (Appendix 6)

- Additional instructions for final survey (Appendix 7a to 7d)

- Questionnaire form for the final survey (Appendix 8)

The purpose of using several interviewers for the final survey was to reduce the total time needed for data collection as well as to reduce the possibility of biases that may occur if only one interviewer was deployed. An allocation table was maintained by the researcher to keep track of all the interviewers who interviewed the different categories of respondents (Appendix 9), as well as to evenly distribute the tasks amongst the interviewers.

A pilot survey was carried out to test the questionnaire before embarking on the final survey. Based on the findings from the pilot survey, a questionnaire was formulated for the final survey.

3.9   Pilot survey

Fowler (1993) claims that once a survey instrument has been designed and was ready to be used, it is useful to conduct a pre-test with 20 to 50 respondents in the field. This provides an appreciation of how data is collected using the survey instruments in a real situation (Fowler, 1993).

A pilot survey   was conducted with 21 respondents using two interviewers. The data collected from the pilot survey   was used to verify data reliability as well as instrument reliability. The pilot survey was conducted to establish if a questionnaire form could be completed within

15 minutes by the interviewer and respondent as well as if the interviewer could manage the interview with the different categories of respondents. The pilot survey was also conducted to establish if the items in the questionnaire form needs to be fine-tuned (especially, those items involving the dependent and independent variables) as well as if essential items have been missed out in the questionnaire design stage.

The two pilot survey interviewers covered all the five categories (Student, Tertiary, National Service, Adult and Senior Citizen) of respondents as required in this study. The responses were received from ten locations. People from different walks of life were interviewed which is representative of the entire population of ez-link card customers. The distribution of the questionnaires between the interviewers is listed in Table 10.

Table 10: Category of respondents interviewed by each interviewer in the pilot survey

Interviewer	No. of respondents by category					Total
	Student	Tertiary	Nation Service	Adult	Senior Citizen	
Interviewer 1	2	1	1	5	2	11
Interviewer 2	2	2	1	4	1	10
Total	4	3	2	9	3	21

The data collected from the pilot survey was used to improve or enhance the following:

- Design of the research questions
- Reliability and validity of the scale and questionnaire items
- Feedback from respondent to improve the questionnaire
- Incorporate additional questions that were not envisaged earlier in the questionnaire design stage
- The average length of time taken by each respondent and interviewer to complete the questionnaire survey form
- Assess how each category (Student, Tertiary, Adult, National Service and Senior Citizen) responds to the questions on the use of the ez-link card for non-transit transactions

Descriptive statistics and inferential statistics (regression analysis and exploratory factor analysis) were used to analyse the data collected from the pilot survey. The descriptive analysis and inferential analysis will be detailed and discussed in Section 3.10 & Section 3.11 respectively.

3.10   Descriptive analysis for pilot survey

3.10.1   Type of non-transit transactions

Table 11 below illustrates the choice of non-transit transactions preferred by respondents in the pilot survey. The order of preference for non-transit transactions is listed in descending order. According to Table 11, about 71% opted to use the ez-link card for non-transit transactions. Most of the respondents seemed to prefer to use the ez-link card for loyalty schemes and showed less preference for photocopy or other services.

Table 11: Type of non-transit transactions preferred by respondents

	Type of non-transit txn	Yes		No	
		n	%	n	%
1	Use ez-link card for non-transit txn	15	71	6	29
2	Prefer loyalty scheme	15	71	6	29
3	Increase the ez-link card value to use it for non-transit txn	14	67	7	33
4	Use it at fast food outlets	11	52	10	48
5	Use at Supermarket	11	52	10	48
6	Use for Taxi Services	9	43	11	67
7	Use for Car Park	9	43	11	67
8	Use it to buy Movie Tickets	7	33	14	77
9	Use at Book & Stationary Shops	7	33	14	77
10	Use at Places of Interest (eg Zoo)	7	33	14	77
11	Use for Photocopy Services	5	24	16	76
12	Use for Other Services	1	5	20	95

Note: txn – transaction

3.10.2 Purchase value

Table 12 highlights the amount of money or purchase value (PV) that respondents in the pilot survey would use their ez-link card for non-transit transactions. It revealed that about 72% of the respondents are willing to spend more than $5, whilst about 28% of them are not sure how much they would spend on non-transit transactions.

Table 12: Purchase value preferred by respondents

	Item valued at	Yes		No	
		n	%	N	%
1	Less than $5	0	0	6	28
2	Less than $10	1	5		
3	Less than $15	2	10		
4	Less than $20	4	19		
5	Less than $30	3	14		
4	More than $30	5	24		
		15	72	6	28

3.10.3 Type of loyalty scheme

Table 13 shows the type of loyalty scheme preferred by respondents in the pilot survey. It shows that they prefer bonus points for redemption of gifts the most, and priority booking for tickets, the least.

Table 13: Preferred loyalty scheme

	Type of loyalty scheme	n	(%)
1	Bonus points for redemption of gifts	10	48
2	Outright discount at selected stores	7	33
3	Priority booking of tickets (eg. movie, plays, etc.)	4	19
4	Others	0	0
	Total	21	100

The descriptive statistics allow us to appreciate the intention (INT) of respondents in using the ez-link card for non-transit transactions. It also shows their preference, expectation, and type of loyalty scheme and how much they would or intend to spend on non-transit transactions.

The next section, Section 3.11 will discuss the reliability of the pilot survey questionnaire.

3.11 Revisions to questionnaire following pilot study

The next important task was to carry out a reliability analysis of the questionnaire used in the pilot survey to determine if changes were needed to be made for the final survey.

There were three independent variables and one dependent variable to be tested. The first step was a preliminary test of the reliability of the scales for each of the following variables:

Independent variables

- Attitude (ATT)
- Subject Norm (SN)
- Perceived Behavioral Control (PBC)

Dependent variable

- Intention (INT)

In the pilot survey questionnaire (Appendix 4), Q6 to Q21 were designed to answer the research question, and they were allotted according to the four variables as shown in Table 14.

Table 14: Questions associated with the four variables

Questions	Variables
Q6 – Q11	6 questions to measure Attitude (ATT)
Q12 – Q14	3 questions to measure Subjective Norm (SN)
Q15 – Q18	4 questions to measure Perceived Behavioral Control (PBC)
Q19 – Q21	3 questions to measure Intention (INT)

A preliminary indication of the reliability of the scales used to measure the four variables was obtained by calculating Cronbach's alpha using the Statistical Package for the Social Sciences (SPSS). Where necessary, some questions were deleted or reversed to achieve the appropriate results. In summary, all the variables showed high alpha value except for INT which showed a low reliability of 0.48. The summary of reliability values for the 4 variables is listed in Table 15 below.

Table 15: Cronbach alpha for pilot survey questionnaire

Variable	Original number of items	Final number of items	Alpha
ATT	6	6	0.909
SN	3	3	0.933
PBC	4	3	0.691
INT	3	3	0.483
Total	16	15	

The next step was to review the questionnaire used in the pilot survey to see if it needed to be fine-tuned for the final survey. It was noted that questions (Q6 to Q21) that were grouped together for each variable should be rearranged so that the interviewee would not detect a link between the questions and the four variables. It was also noted that the orientation of some of the questions needed to be changed, too (as shown in Table 16).

Table 16: Changes made to the pilot survey questionnaire for final survey

Construct	Item	Original scale orientation		Action taken for the questionnaire form for the final survey
		LHS	RHS	
PBC	Q15	-	+	Q15 –> Q8
	Q16	+	-	**Q16 Revised (as shown in p66)**
	Q17	-	+	Q17 -> Q13
	Q18	+	-	Q18 –> Q21
INT	Q19	-	+	Q19 –> Q10
	Q20	-	+	**Q20 –> Q19 (revised orientation as shown in p66**)
	Q21	-	+	Q21 –> Q22
		-	+	**Introduced new question** (**Q11** in the Final Survey as shown below)
ATT	Q6	-	+	Q6
	Q7 to Q11	+	-	Q7 –> Q9 Q8 –> Q12 **Q9 revised orientation (Q9 -> Q15**) **Q10 –> Q17 (revised orientation)** Q11 -> Q18
SN	Q12	+	-	Q12 –> Q7
	Q13	+	-	Q13 –> Q20
	Q14	+	-	**Q14 Revised orientation**

Note: a)   LHS = left hand side of scale. RHS = right hand side of scale. b) In above table, question order in the pilot survey   was revised for the final survey (for example, Q15 -> Q18).

Table 17 highlights changes made to the pilot survey questionnaire. The questionnaire used in the final survey is attached at Appendix 8.

Table 17: Summary of revisions to questionnaire for final survey

Q/No	Type of Survey	Changes made to the Questionnaire
9	Pilot	I would find using the ez-link card for non-transit services…. 　　　Trendy　　　　　　　　　　　　　Not Trendy 　　　1　　　　　　　　　　　　　　　7
15	Final	I would find using the ez-link card for non-transit services…. 　　　Not Trendy　　　　　　　　　　　Trendy 　　　1　　　　　　　　　　　　　　　7
10	Pilot	I would find using the ez-link card for non-transit services…. 　　　*Useful*　　　　　　　　　　　　　*Not Useful* 　　　*1*　　　　　　　　　　　　　　　*7*
17	Final	I would find using the ez-link card for non-transit services…. 　　　*Not Useful*　　　　　　　　　　　*Useful* 　　　*1*　　　　　　　　　　　　　　　*7*
14	Pilot	The people in my life whose opinion I value would _____ of me using the ez-link card for non-transit services. 　　　*Approve*　　　　　　　　　　　　*Disapprove* 　　　*1*　　　　　　　　　　　　　　　*7*
14	Final	The people in my life whose opinion I value would _____ of me using the ez-link card for non-transit services. 　　　*Disapprove*　　　　　　　　　　*Approve* 　　　*1*　　　　　　　　　　　　　　　*7*
16	Pilot	*If I wanted to I could use the ez-link card for non-transit services.* 　　　Definitely true　　　　　　　　　　Definitely false 　　　1　　　　　　　　　　　　　　　7
16	Final	*I could use the ez-link card for non-transit services, if I wanted to.* 　　　Definitely true　　　　　　　　　　Definitely false 　　　1　　　　　　　　　　　　　　　7
20	Pilot	I hope to use the ez-link card for non-transit services. 　　　Strongly disagree　　　　　　　　Strongly agree 　　　1　　　　　　　　　　　　　　　7
19	Final	I hope to use the ez-link card for non-transit services. 　　　Strongly agree　　　　　　　　　　Strongly disagree 　　　1　　　　　　　　　　　　　　　7
21	Pilot	I will use the ez-link card for non-transit services only. 　　　Strongly disagree　　　　　　　　Strongly agree 　　　1　　　　　　　　　　　　　　　7
22	Final	I will use the ez-link card for non-transit services. 　　　Strongly disagree　　　　　　　　Strongly agree 　　　1　　　　　　　　　　　　　　　7
11	Final (New)	I will not use the ez-link card for non-transit services. 　　　Strongly disagree　　　　　　　　Strongly agree 　　　1　　　　　　　　　　　　　　　7

Table 17 (cont'd): Summary of Revisions to Questionnaire for Final survey

Q/No	Type of Survey	Changes made to the Questionnaire
22	Pilot	What is your occupation?
			Office Worker	Field Worker	Shift Worker	Home-Maker	Retiree	Student	Other (specify)
23	Final	What is your occupation?
			Office Worker	Field Worker	Shift Worker	Home-Maker	Retiree	Stu-dent	*National Service*	Other (specify)
23	Pilot	In which age group are you?
			15 to 18 yrs	19 to *22* yrs	25 to 35 yrs	36 to 59 yrs	60 yrs and above
24	Final	In which age group are you?
			15 to 18 yrs	19 to *24* yrs	25 to 35 yrs	36 to 59 yrs	60 yrs and above

Note: Q/No. – Questionnaire Number

3.12   Conclusion of pilot study

Although the sample size was small, a stepwise regression was carried out on the data collected in the pilot survey. The R-square value of 0.5 supported the research model.

3.13   Final survey

The final survey was carried out in two phases - 50 customers were interviewed in the first phase; and 250 customers were interviewed in the second phase. The two phases will be discussed further in Section 3.13.1 and Section 3.13.3 respectively.

3.13.1　First phase

In the first phase of the final survey, a total of 50 questionnaires was issued to five interviewers (Table 18), each of whom was to cover all the five categories of respondents. The survey which was conducted from 28 January 2005 to 5 February 2005, received responses from different locations covering Mass Rapid Transit (MRT) stations, bus interchanges and shopping complexes next to the MRT stations or bus interchanges. The interviews were done at 30 locations to reach out to a wide number and range of public transport customers across Singapore.

Table 18: Distribution of questionnaires for first phase of final survey

Interviewer	Number of respondents by category					Total
	Student	Tertiary	National Service	Adult	Senior Citizen	
Interviewer 1	2	1	1	5	2	11
Interviewer 2	2	1	1	5	1	10
Interviewer 3	2	2	1	5	1	11
Interviewer 4	1	1	1	5	1	9
Interviewer 5	1	1	0	6	1	9
Total	8	6	4	26	6	50

Similar to the pilot survey, descriptive analysis was carried out on the data collected from the 50 respondents who were interviewed. The number of ez-link respondents intending to use the ez-link card for non-transit transactions was noted to be 76%. This provided further encouragement for the researcher to proceed with the study. A full report of the descriptive analysis and findings will be presented and discussed in Chapter 4.

Similar to the pilot survey again, reliability analysis was performed for all the four TPB variables. In summary, all the variables were satisfactory. The details are shown in Table 19.

Table 19: Cronbach alpha for questionnaire used in first phase of final survey

Variables	Final number of items	Alpha
ATT	5	0.78
SN	3	0.79
PBC	3	0.63
INT	4	0.92
Total	15	

3.13.2 Conclusion of first phase

The reliability analysis of the first phase with 50 respondents showed improvement to the alpha value for the INT. In the pilot survey, the INT alpha value was 0.48 (Table 15), and in the first phase of the final survey, it was 0.92 (Table 19). In the case of the PBC, the alpha value in the pilot survey was 0.69, and it was 0.63 in the first phase of the final survey.

Similar to the pilot survey, stepwise regression analysis was carried out using the SPSS. The mean and standard deviation of the variables are listed in Table 20.

Table 20: Mean and standard deviation of TPB variables, pilot study

Variable	Mean	Standard Deviation
INT	5.44	7.22
ATT	5.77	5.23
SN	5.38	4.69
PBC	5.46	3.74

The R-square was 0.63. This suggests that the model was satisfactory and that the study could proceed to the next stage which is the second phase of the final survey.

3.13.3 Second phase

In the second phase of the final survey, the remaining 250 questionnaire forms were divided among the 5 interviewers (as shown in Table 21) to cover all the 5 categories of respondents in this study. The interviews were conducted from 17 February 2005 to 6 March 2005. The responses were received from 60 locations.

Table 21: Distribution of the questionnaire for second phase of the final survey

Interviewer	Number of respondents by category					Total
	Student	Tertiary	National Service	Adult	Senior Citizen	
Interviewer 1	5	0	0	35	5	45
Interviewer 2	6	0	0	36	3	45
Interviewer 3	8	0	1	39	4	52
Interviewer 4	8	4	2	37	3	54
Interviewer 5	9	3	2	37	3	54
Total	36	7	5	184	18	250

The interviews were carried out over seven days in a week. About 80% of the interviews were done between 8am to 5pm, when it was easier to find customers using the public transport system. Another 17% of the interviews were done between 5pm to 8pm, whilst the remaining 3% of the interviews were done between 8pm to 10pm.

When the survey was completed, two debriefs were conducted with the interviewers to close the study. During debriefs, the interviewers shared their experiences during the interviews, for example, on the questions posed by respondents; language problems they encountered with respondents; and other issues. A detailed account of debriefs is presented in Appendix 10.

In the case of the respondents in the Senior Citizen category, about 80% of them had to be assisted by the interviewers to translate the questions. They found the questions to be long and expected the scale to be one to five (instead of seven). They were generally willing to participate since they had the time to spare. They were more concerned with increases in transport fares and preferred to use cash for non-transit transactions.

In the case of the respondents in the Adult category, they too highlighted that the scale should be one to five (instead of seven). They preferred the questionnaire format to be redesigned with the questions on one side and the scale beside them. They generally took about 10 minutes to complete the questions.

In the case of respondents in the Student and Tertiary categories, they too indicated that the number of questions could be reduced and agreed that the scale range should be limited to five. They found souvenir more useful and encouraged their friends to participate in the interview.

Finally, in the case of the respondents in the National Service category they also confirmed that the scale range should be limited to five and the number of questions should be reduced. They preferred that the ez-link card be used to purchase shoes, shorts and other things during their in-camp training.

On the other hand, the interviewers felt that the questionnaire format and length were appropriate to administer the interviews. They found it easier to interview respondents in the Senior Citizens and Students categories compared to respondents in the other categories. They also found the instructions given to them to conduct the interviews were sufficient.

Finally, both the interviewers and researcher felt that the interviews done by technicians gave respondents a sense of ease as compared to being carried out by a third party since the interviews were conducted by the company (TL) that is providing the ez-link card services.

3.14 Data preparation

The list of statistics and plots which were used to examine the data collected from the 300 respondents in the final survey is as follows:

- mean
- median
- skewness
- kurtosis
- m-estimators
- extreme values (five highest and five lowest)
- test of normality (Kolmogorov-Smirnov and Shapiro-Wilk)
- histogram
- frequency versus Stem-and-leaf plot
- normal Q-Q plot
- detrended normal Q-Q plot
- box plot

A number of outliers were identified on four items (Table 22) and the details are described thereafter.

Table 22: Outliers in box plots

Questions	Responses that were identified
Q9: ATT_easy or diff	74, 157, 146, 209, 76 – outliers
Q12: ATT_fast or slow	146, 143, 199, 76, 236 – outliers
Q16: PBC_true or false	154, 146, 209, 82 – outliers
Q21: PBC_agree or disagree	154, 126, 26, 143, 137 – extreme outlier 23, 142, 177, 239 - outliers 121, 286, 201, 298, 181 – outliers

Seven outliers were removed by picking out cases with repeated outliers from the questions shown in Table 22 (cases: 146, 209, 143, 154, 126, 26, 137). Hence, the analysis reported in this study was based on the responses of 293 rather than 300 cases.

The reliability tests showed that: INT=0.93, ATT=0.88, SN=0.85 and PBC=0.74.

3.15   Final data analysis

As mentioned earlier, the final survey was done in two phases to ensure that modifications to the questionnaire after the pilot survey did not introduce new problems.

In the final data analysis, the research question and hypotheses were examined based on Q6 to Q22 in the final questionnaire. First, a reliability analysis was carried out to establish the reliability of scales for the four variables in this study. Next, regression analysis, correlation test, collinearity test, exploratory factor analysis and rotated factor analysis were carried out. The regression analysis tested the three hypotheses shown in Figure 10. A complete data analysis will be described for all respondents in the next chapter.

3.16   Chapter conclusion

In this chapter, the design of the questionnaire, sampling strategy, method of data collection and method of data analysis used in this study were outlined and discussed.

A questionnaire based on the TPB was used to measure the four variables (INT, ATT, SN and PBC) in the study. A stratified quota sampling technique was used to identify the respondents in the five categories (Student, Tertiary, National Service, Adult and Senior Citizen) for the survey, and the interviewers were carefully selected and briefed to collect the data using the intercept interview technique.

Data were collected in three stages – pilot survey   (21 respondents), final survey phase 1 (50 respondents) and final survey phase 2 (250 respondents). Descriptive and inferential statistics were used to analyse the data collected in the pilot survey. The results of this analysis were presented and discussed in this chapter. The questionnaire was fine-tuned and then used in the final survey.

In the next chapter, the results of analyses of the data collected will be presented.

Chapter 4.0　　　　Results

4.1　　Chapter introduction

In the previous chapter, the research methodology adopted for the study was outlined and discussed in detail. The questionnaire was based on the TPB to measure the four variables (one dependent and three independent) was also presented.

In this chapter, analysis of the data collected in the final survey will be reported. Both the descriptive analysis and inferential analysis of the data collected will be presented, and the research model and hypotheses will be tested.

4.2　　Data analysis

In the final survey, the data were collected in two phases from 300 respondents as mentioned in Chapter 3, Section 3.13. After deleting seven outliers, data from 293 respondents were finally analysed.

The data analysis began with a descriptive analysis of responses from the different categories of respondents who had participated in the survey. The survey included the preferred purchase value (PV) for non-transit transactions, preferred non-transit transactions and the type of loyalty schemes preferred by the respondents. These results will be presented in Sections 4.4 and 4.5. The inferential analysis and hypothesis testing will be presented in Sections 4.6 to 4.10.

4.3　　Profile of respondents

A total of five categories (Student, Tertiary, Adult, National Service and Senior Citizen) of ez-link card customers were involved in the survey. Table 23a compares the percentage of respondents in each category with the percentage of ez-link cards issued to each category. The proportions in each category are similar.

Table 23a: Breakdown of respondents by categories

Category	% in sample [a]	% of Cards [b]
Adult	70.0	79.5
Student	14.3	12.5
Senior Citizen	7.8	5.5
Tertiary	4.5	1.8
National Service	3.4	0.6
Total	100.0	100.0

Notes: a. sample size = 293, and b. Total cards issued = 5,413,959

Table 23b (refer to Q23) provides information on the occupation of the respondents interviewed. It shows that the respondents are from all walks of life, and are representative of the total population of customers who use the public transport system.

Table 23b: Breakdown of respondents by occupation

Occupation	n	%
Office worker	68	23.2
Shift worker	61	20.8
Student	55	18.8
Field worker	40	13.7
Home maker	26	8.9
Retiree	20	6.8
Others	13	4.4
National Service	10	3.4
Total	293	100

Table 23c (refer to Q24 and Q27) shows the breakdown of respondents by gender and age group, and Table 23d (refer to Q24

and Q27) shows the percentage of respondents by gender and age group. A reasonable mix of male and female respondents was interviewed except for respondents in the National Service category, where National Service men are all male.

Table 23c: Breakdown of respondents by gender and age group

Respondent's Age	Gender		Total
	Male	Female	
15 to 18 yrs	28	22	50
19 to 24 yrs	22	11	33
25 to 35 yrs	58	40	98
36 to 59	49	40	89
60 and above	13	10	23
Total	170	123	293

Table 23d: Percentage of respondents by gender and age group

Respondent's Age	Gender		Total
	Male	Female	
15 to 18 yrs	56.0	44.0	17.07[a]
19 to 24 yrs	66.7	33.3	11.26
25 to 35 yrs	59.2	40.8	33.45
36 to 59	55.1	44.9	30.37
60 and above	56.5	43.5	7.85
Total	58.0	42.0	100

Note: a. is equal to 50/293 (reference to Table 23c)

Table 23e (refer to Q26) shows the breakdown of respondents by income group. While 46.8% of respondents earn an income of between $1,000 and $3,000 per month, 35.2% of respondents (made up largely of homemakers, students and retirees) did not earn an income at all.

Table 23e: Breakdown of respondents by income group

Monthly Income	n	%
Below $1000	36	12.3
$1001 to $3000	137	46.8
$3001 to $5000	15	5.1
Above $5000	2	0.7
Not Applicable[a]	103	35.2
Total	293	100

Note: a. Responses mainly from homemakers, students and retirees

Table 23f (refer to Q24 and Q25) shows a breakdown of respondents by age group and category (Adult, Senior Citizen, Student, Tertiary and National Service). It appears that respondents in the Adult category, and aged between 25 and 35 years (33.4%), are most willing to use the ez-link card for non-transit transactions.

Table 23f: Breakdown of respondents by age group and categories

Card Type / Age (Yrs)	Adult		Snr Citizen		Student		Tertiary		National Service	
	n	%	n	%	n	%	n	%	n	%
15- 18	-	-	-	-	42	14.3	8	2.7	-	-
19-24	19	6.5	-	-	-	-	5	1.7	9	3.1
25-35	98	33.4	-	-	-	-	-	-	-	-
36-59	89	30.4	-	-	-	-	-	-	-	-
60 and Above	-		23	7.8	-	-	-	-	-	-

4.4 Profile of supportive respondents

This section analyses how ez-link card customers responded to the question about whether they intend to use the ez-link card for non-transit

transactions. Two hundred and six out of 293 respondents said that they would use their ez-link card for non-transit transactions.

Table 24a (refer to Q1 and Q25) shows the percentage of respondents in each category who would use the ez-link card for non-transit transactions. It appears that respondents in the National Service category (88.9%) are most willing and respondents in the Senior Citizen category (21.7%) are least willing to use their ez-link card for non-transit transactions.

Table 24a: Percentage of respondents in each category who would use their ez-link card for non-transit transactions

Category	n	%
Adult	146	70.9
Student	36	85.7
Tertiary	11	84.6
National Service	8	88.9
Senior Citizen	5	21.7
Total	206	70.3

Table 24b (refer to Q1 and Q24) shows the percentage of respondents in each age group who would use the ez-link card for non-transit transactions. It appears that respondents' aged between 15 and 35 are more willing to use their ez-link card for non-transit transactions as compared to respondents aged 36 and above.

Table 24b: Percentage of respondents in each age group who would use their ez-link card for non-transit transactions

Age	n	%
15-18	43	86.0
19-24	29	87.9
25-35	79	80.6
36-59	50	56.2
60 and above	5	21.7
Total	206	70.3

Table 24c (refer to Q1 and Q26) shows the percentage of respondents in each income group who would use their ez-link card for non-transit transactions. The respondents in the $1,000 to $3,000 income group

(51%) are the most willing and respondents in the $5,000 and above income group (0.5%) are the least willing to use their ez-link card for non-transit transactions. Surprisingly, 32% of respondents who do not earn an income (for example, homemakers, students and retirees) were willing to use the ez-link card for non-transit transactions.

Table 24c: Percentage of respondents in each income group who would use their ez-link card for non-transit transactions

Monthly Income	n	%
Below $1000	22	10.7
$1001 to $3000	105	51.0
$3001 to $5000	12	5.8
Above $5000	1	0.5
Not Applicable[a]	66	32.0
Total	206	100

Note: a. Responses mainly from homemakers, students and retirees

4.5 Preferences of supportive respondents

This section discusses the amount of money that respondents would spend on non-transit transactions (PV), the increase in the amount of remaining value (RV) in the ez-link card for PV, and the type of loyalty scheme they would prefer. The data collected from the 293 respondents in the final survey provided a broad sense of customer preferences and intention (INT) in wanting to use their ez-link card for non-transit transactions.

4.5.1 Purchase value (PV)

Table 25a (refer to Q3 and Q25) shows the percentage of respondents in each category who would spend different amounts of money on individual non-transit transactions. It appears that respondents in general are willing to spend $15 and above on non-transit transactions. However,

39% of respondents in the Adult category were willing to spend more than $30 on non-transit transactions.

Table 25a: Purchase value (PV)

| Category | Amount to be spent on non-transit transactions (%of 206 respondents) | | | | | | | Total in % |
	$0	<$5	<$10	<$15	<$20	<$30	Other values	
Adult	0.7	0.7	8.9	7.5	18.5	24.7	39.0	100
Student	0	2.8	8.3	25.0	38.9	16.7	8.3	100
Tertiary	0	0	0	18.2	36.4	18.2	27.3	100
National service	0	0	0	0	25.0	50.0	25.0	100
Senior Citizen	0	0	0	20.0	20.0	40.0	20.0	100

Further analysis of the data showed that there were no major differences between gender and the amount of money respondents were willing to spend on non-transit transactions.

4.5.2 Remaining value (RV)

Table 25b shows the percentage of respondents in each category who would increase the remaining value (RV) in their ez-link card. It appears that almost all of the respondents (203 out of 206) who are willing to spend on non-transit transactions are also willing to increase the RV in their ez-link card.

The highest amount by which respondents were willing to increase the RV in their ez-link card in each of categories was as follows: Adult - $50 (44.1%); Student - $30 (36.1%); Tertiary - $20 (27.3%) and $50 (27.3%); National Service - $40 (37.5%); and Senior Citizen - $20 (60%). When asked to specify other amounts, only 11.2 % of respondents in the Adult category and 9.1% of respondents in the Tertiary category were interested to increase the remaining value beyond $50. The decision to increase the RV in the ez-link card in each category may have some relationship with their disposable income.

Further examination showed that there were no major differences between the increase in the RV in the ez-link card and the gender of the respondents in the five categories.

Table 25b: Remaining value (RV)

Category	Amount to be increased in the ez-link card to use for non-transit transaction (%of 206 respondents)					
	$10	$20	$30	$40	$50	Other values
Adult	7	9.1	17.5	11.2	44.1	11.2
Student	11.1	27.8	36.1	13.9	11.1	0
Tertiary	9.1	27.3	9.1	18.2	27.3	9.1
National service	0	12.5	2.5	37.5	25	0
Senior Citizen	20	60	0	0	20	0

4.5.3 Type of non-transit transactions

Table 25c (Q2 and Q25) shows the number of respondents in each category who would use their ez-link for each type of non-transit transaction. They could select more than one type of non-transit transaction. The analysis was done by comparing the type of non-transit transaction against the category of respondents, and the following conclusions were derived:

- Of all the respondents, those in the 'Student' and 'Tertiary' categories are the most and those in the 'Senior Citizen' category are the least interested in using the ez-link card for non-transit transactions.

- The most preferred non-transit transactions for each category are:
  - Adult - fast food and groceries
  - Student - fast food, movie tickets and books
  - Tertiary - fast food, movie tickets and books

- o National Service - fast food, shoes and shorts
- o Senior Citizen – groceries

- Only a few of the respondents in each of category responded to the question or provided suggestions on what other types of products or services that they would like to include in the list of non-transit transactions.

Table 25c: **Expected type of non-transit transaction (no. of respondents)**

	MT	FF	T	CP	B	PI	G	PS	O
Adult	82	121	81	51	76	62	127	64	17
Student	24	30	14	6	25	21	22	22	2
Tertiary	10	10	6	5	10	6	8	7	0
National Service	5	8	6	5	6	4	7	4	0
Senior Citizen	0	2	2	0	3	2	5	1	0
Total	121	171	109	67	120	95	165	98	19

Note: MM- Movie Ticket, FF- Fast food, T- Taxi, CP- Car Park fee, B- Books, PI- Places of Interest, G- Groceries, PS- Photocopy services and O- other services.

4.5.4 Type of loyalty program

Table 25d (refer to Q4 and Q25) shows the number of respondents in each category who chose each type of loyalty program offered. They were allowed to select more than one type of loyalty program.

A total of 158 (76.7%) of the respondents in all the categories chose outright discount at selected stores and bonus points for redemption of gifts. However, the respondents in the Adult category (57, 39%) and Student category (26, 72%) also chose priority booking for example, for movie tickets, airline tickets, etc. Very few respondents provided further suggestions for other types of loyalty programs.

Table 25d: Interest in loyalty programs (no. of respondents)

	Outright discount	Bonus point	Priority booking	Others	Total
Adult	113	117	57	11	298
Student	25	25	26	1	77
Tertiary	11	8	9	0	28
National Service	7	6	4	0	17
Senior Citizen	2	1	0	0	3
Total	158	157	96	12	

4.6 Reliability analysis

Before testing the research model, the reliability of the scales used to measure the variables in the model was examined. The results obtained from the reliability analysis were satisfactory, and the details are listed in Tables 26a to 26d. The selected items, including those which were reversed to calculate the Cronbach alpha values using SPSS for each variable, are also reflected in Tables 26a to 26d.

Table 26a shows the items used to measure INT. No item was deleted and a Cronbach alpha of 0.93 was obtained. INT was calculated as the mean (after reversing the score of the reverse scored items) of the four items as presented in Table 26a.

Table 26a: Intention (INT) variable

Abbrev Initial	Items	Abbreviation
INT_want (Q10)	I want to use the EZ-Link card for non-transit services. Extremely unlikely…………………Extremely likely (1) (7)	INT_want to use_unlikely or likely
INT_not (*Q11r)	I will not use the EZ-Link card for non-transit services Strongly disagree ...………………Strongly agree (1) (7)	INT_will not use_disagree or agree
INT_hope (*Q19r)	I hope to use the EZ-Link card for the non-transit services. Strongly agree….………………Strongly disagree (1) (7)	INT_hope to use_agree or disagree
INT_use (Q22)	I will use the EZ-Link card for non-transit services. Strongly disagree….………………Strongly agree (1) (7)	INT_use NTA_disagree or agree

*Note: * Reverse scored*

Table 26b shows the items used to measure ATT. ATT was calculated as the mean (after reversing the score of the reverse scored items) of five items as presented in Table 26b.

Table 26b: Attitude (ATT) variable

Abbrev Initial	Items	Abbreviation
ATT_risky (Q6)	I would find using the EZ-Link card for non-transit services … Risky …………………………………………Safe (1) (7)	ATT_risk or safe
ATT_fast (*Q12r)	I would find using the EZ-Link card for non-transit services….. Fast ………………………………………………Slow (1) (7)	ATT_fast or slow
ATT_not trendy (Q15)	I would find using the EZ-Link card for non-transit services… Not Trendy……………………………………Trend (1) (7)	ATT_not trendy or trendy
ATT_not useful (Q17)	I would find using the EZ-Link card for non-transit services… Not Useful………………………………………Useful (1) (7)	ATT_not useful or useful
ATT_norm (*Q18r)	Using the EZ-Link card for non-transit services should be… The Norm……………………………..Not the Norm (1) (7)	ATT_norm or not the norm

Note: * Reverse scored

Table 26c shows the items used to measure SN. No item was deleted and a Cronbach alpha of 0.85 was obtained. SN was calculated as a mean (after reversing the score of the reverse scored items) of three items in Table 28c.

Table 26c: Subjective Norm (SN) variable

Abbrev Initial	Items	Abbreviation
SN_I should (*Q7r)	Most people who are important to me think that _____use of EZ-Link card for the non-transit services. I should …………………………………..I should not (1) (7)	SN_I should or should not
SN_disapprove (Q14)	The people in my life whose opinions I value would _____of me using the EZ-Link card for non-transit services. Disapprove…………………………………Approve (1) (7)	SN_disapprove or approve
SN_agree (*Q20r)	It is expected of me to use the EZ-Link card for non-transit services. Strongly agree…..…………..…Strongly disagree (1) (7)	SN_agree or disagree

Note: * Reverse scored

Table 26d shows the items used to measure PBC. No item was deleted and a Cronbach alpha of 0.74 was obtained. PBC was calculated as a mean (after reversing the score of the reverse scored items) of four items as presented in Table 26d.

Table 26d: Perceived Behavioral Control (PBC) variable

Abbrev Initial	Items	Abbreviation
PBC_easy (Q9)	I would find using the EZ-Link card for non-transit services... Easy……………………………………….Difficult (1) (7)	PBC_easy or difficult
PBC_impossible (*Q8r)	For me to use the EZ-Link card for the non-transit services would be_____. Impossible……………….…………….Possible (1) (7)	PBC_ impossible or possible
PBC_true (Q16)	I could use the EZ-Link card for non-transit services, if I wanted to. Definitely true.………………………Definitely false (1) (7)	PBC_true or false
PBC_agree (Q21)	It is mostly up to me whether or not to use the EZ-Link card for non-transit services. Strongly agree.……………..…Strongly disagree (1) (7)	PBC_agree or disagree

Note: * Reverse scored

A summary of the mean (on a 7-point Likert scale) and standard deviation for each of the four variables (INT, ATT, SN and PBC) is given in Table 27. The standard deviation for all the variables was above 1.1, indicating that there was sufficient variation in the data to support the proposed analysis.

The four variables in the research model had acceptable Cronbach alpha values (0.7 and above) which support the use of Ajzen's recommendations for designing the questionnaire form. The high Cronbach's alpha values for the four variables also suggest a satisfactory internal consistency for these variables. The mean values for the four variables are listed in Table 27.

Table 27: Mean and standard deviation of TPB variables, final study

Variable	K	Scale Statistics	
		Mean	Std dev
INT	4	5.04	1.81
ATT	5	4.95	1.46
SN	3	4.88	1.60
PBC	4	5.66	1.15

Note: k – number of items in the scale.

4.7 Regression analysis

Stepwise multiple regression was used to test the research model and hypotheses.

4.7.1 Testing of the research model

All of the three independent variables (ATT, SN and PBC) were entered into the research model. Table 28 summarises the stepwise multiple regression process.

Table 28: Summary of the stepwise regression model

Step	Variable Entered	R Square	F	df	$p(F)$	ΔF	$p(\Delta F)$
1	SN	0.73	780.1	1, 291	<0.001	780.1	<0.001
2	ATT	0.79	530.2	2, 290	<0.001	76.8	<0.001
3	PBC	0.80	385.0	3, 289	<0.001	21.1	<0.001

The full research model with all three independent variables had an R-square value of 0.80, indicating that the model explains 80% of the variance in INT of the respondents to use the ez-link card for non-transit transactions. The research model was statistically significant with an F value of 385 (df = 3,289, p< 0.001).

4.7.2 Testing of the hypotheses

In Section 3.2 of Chapter 3, the modified TPB was discussed and the three hypotheses were identified to support the research question as shown in the research model in Figure 11.
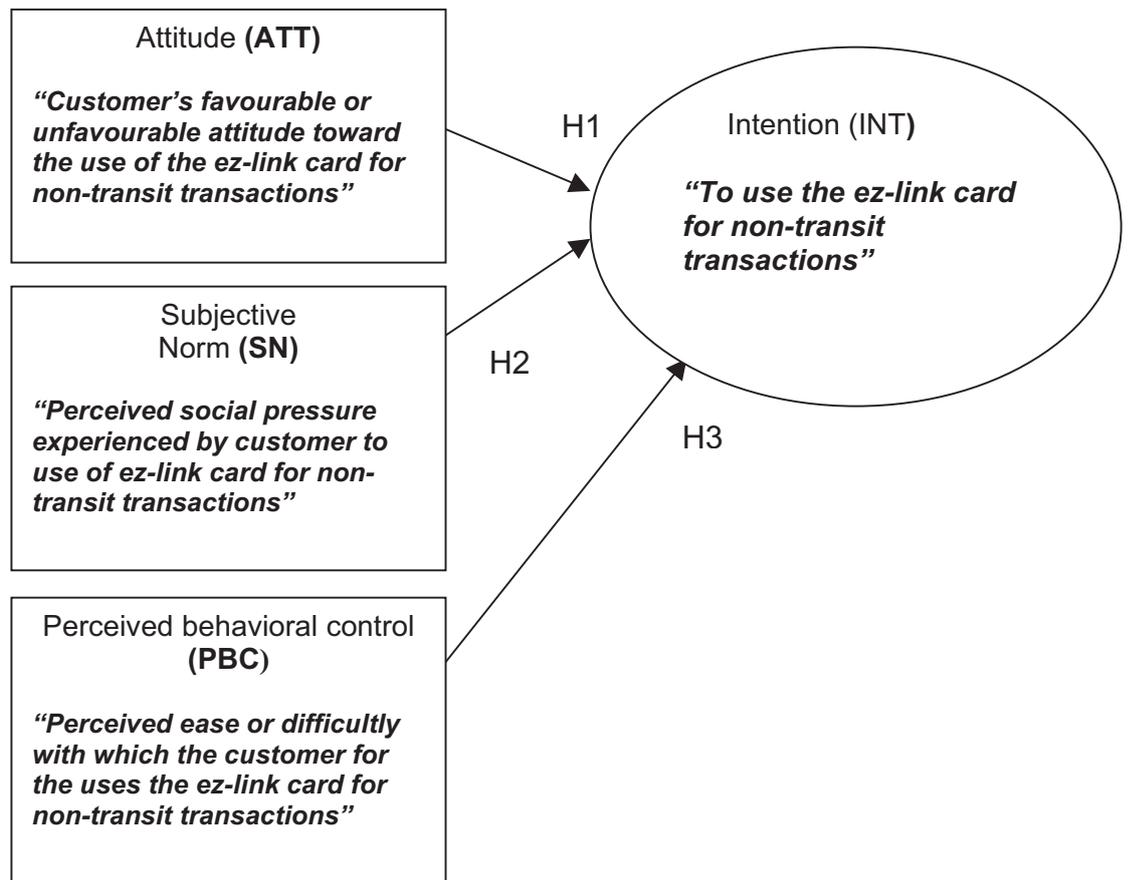
Figure 11: Research model and hypotheses

The regression coefficients for the model are significant as shown in Table 29.

Table 29: Regression coefficients for research model

Variable	B	Std err	β	t	p
(Constant)	-1.13	0.24		-4.65	<0.001
ATT	0.42	0.07	0.34	6.11	<0.001
SN	0.48	0.06	0.43	8.42	<0.001
PBC	0.31	0.07	0.20	4.60	<0.001

The standardized coefficient (β) presented in Table 29 shows that SN has the strongest influence on INT. This influence is more than 2 times the contribution of PBC.

When the unstandardized coefficients (B) presented in Table 29 are applied as weights in a regression equation, the dependent variable (INT) can be expressed in terms of its independent variables (ATT, SN and PBC). Hence, the regression equation can be expressed as follows:

INT = - 1.13 + 0.42 ATT + 0.48 SN + 0.31 PBC

From the above regression equation, it can be seen that ATT, SN and PBC have a positive influence on INT. The interpretation of the regression equation on the three hypotheses is as follows:

The first hypothesis states that:

H1: The stronger the attitudes to outcomes of using the ez-link card for non-transit transactions, the stronger the intentions to use the card for non-transit transactions.

Through the regression analysis, the relationship between ATT and INT was found to be positive. An increase of 1 point on the ATT scale would result in an average increase of 0.42 in INT. This observation supports H1 that the stronger the attitudes to the outcomes of using the ez-link card for non-transit transactions, the stronger the intentions to use the card for non-transit transactions.

The second hypothesis states that:

H2: The more transit customers expect to please others by using the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions.

The regression analysis shows that the relationship between SN and INT was found to be positive. An increase of 1 point on the SN scale would result in an average increase of 0.48 in INT. This observation supports H2 that the more transit customers expect to please others by using the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions

The third hypothesis states that:

H3: The more transit customers perceive that they have control over the use of the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions

The regression analysis shows that the relationship between PBC and INT was found to be positive. An increase of 1 point on the PBC scale would result in an average increase of 0.31 in INT. This observation supports H3 that the more transit customers perceive that they have

control over the use of the ez-link card for non-transit transactions, the stronger their intentions to use the card for non-transit transactions.

4.8 Collinearity tests

An important assumption of multiple regression is that there is independence between the variables. This assumption could be tested by examining the correlation between the variables, and looking for collinearity between or multicollinearity among the variables. Collinearity occurs when two independent variables are correlated whilst multicollinearity occurs when three or more independent variables are correlated (Hair et al, 1998, p143). The correlation and collinearity or multicollinearity tests will be discussed in Section 4.8.1 and Section 4.8.2 respectively.

4.8.1 Correlation test

The Pearson correlation coefficient, which ranges from −1 to 1, is a measure of linear association between two variables. Table 30 shows the correlation between the variables in this study. All correlations are strong (>0.70) and the significance level is very small (<0.05) which means that the correlation is significant, and each pair of variables is strongly and linearly related. ATT and SN are particularly highly correlated (0.85). Since these two variables are highly correlated, there is a possibility of multicollinearity. Tests for multicollinearity are described in the next section.

Table 30: Correlation between dependent and independent variables in the modified TPB

	Variables	INT	ATT	SN	PBC
Pearson Correlation	INT	1.00	0.85	0.85	0.77
	ATT	0.85	1.00	0.85	0.78
	SN	0.85	0.85	1.00	0.73
	PBC	0.77	0.78	0.73	1.00

Note: All correlations were significant at <0.001 with n = 293.

4.8.2   Collinearity diagnostics

The variance inflation factor (VIF) provides a clue to detect multicollinearity among the independent variables. A large VIF, typically more than 5, suggests multicollinearity between the independent variables (Hair et al, 1998, p193). Since the VIFs are all less than 5 as shown in Table 31, they indicate that the variables cannot be classified as multicollinear according to this test.

Table 31: Collinearity diagnostics

Independent Variable	VIF
ATT	4.40
SN	3.70
PBC	2.62

4.8.3   Eigenvalues

The eigenvalues reported by SPSS in the regression collinearity test provide an indication of how many distinct dimensions there are among the independent variables. When few eigenvalues are close to zero, it is possible that the independent variables are highly correlated (Green & Salkind, 2003, p284).

Condition indices are the square roots of the ratios of the largest eigenvalue to each successive eigenvalue. If the condition index is between 15 and 30, then there is possible collinearity between the independent variables. Any value higher than 30 is potentially a serious issue (Hair et al, 1998, p220).

Table 32 reports two dimensions with eigenvalues close to zero and condition indices greater than 15. Hence, further analysis was done to identify the number of independent variables in this study.

Table 32: Collinearity test results

Dimension	Eigenvalue	Condition index
1	3.92	1.00
2	0.06	8.25
3	0.02	16.59
4	0.01	19.64

4.9   Exploratory factor analysis

Tables 31 and 32 above suggest that an exploratory factor analysis be carried out to find out how many independent variables can be identified in this study.

Exploratory factor analysis was performed on all the 293 responses in the final survey and all the independent variable items included in the questionnaire.

Principal Axis Factoring with varimax rotation was used to produce factors which are not correlated with one another. This method was chosen to identify independent factors which could be used in the subsequent regression analysis.

Round 1

All the items used to measure the three independent variables were included in Round 1 of the analysis. The determinant of the correlation matrix was very close to 0.00 indicating that at least two variables are likely to be highly correlated. The two items, SN_disapprove and SN_I should (r = -0.793), were most highly correlated.

The significance of Bartlett's test was less than 0.05 which suggested sufficient correlation among the items for factor analysis. The measure of sampling adequacy (KMO MSA) was 0.93 which further suggests that the items are fit for factor analysis (Hair et al, 1998, p99).

Inspecting the correlation matrix revealed that PBC_control did not appear to be correlated with any other item. The MSA for individual items

showed that PBC_control was low (0.489). The communality report also showed a relatively low value of 0.41 for PBC_control.

Extraction communalities provide a criterion for the decision to retain or remove a factor based on the variance reported (Hair et al, 1988, p99). Values greater than one or less than 0 can be deleted and suggest that the items do not fit well with the factor solution (Hair et al, 1998, p102). Hence, PBC_control was omitted in the next round of factor analysis.

Round 2

The 12 items included in Round 2 were: Q6, Q7, Q8, Q9, Q12, Q14, Q15, Q16, Q17, Q18, Q20 & Q21.

The determinant was still close to 0.00. Two other highly correlated SN items were noted. The item SN_disapprove was omitted because it had higher average correlation with all the other items (0.605) than SN_should (0.539).

Round 3

The 11 items included in Round 3 were: Q6, Q7, Q8, Q9, Q12, Q15, Q16, Q17, Q18, Q20 & Q21.

The determinant was now higher at 0.001, and the KMO MSA and Bartlett's tests remained satisfactory. The MSAs of individual items were satisfactory. On inspecting the communalities, it was clear that PBC_agree did not form a factor with the other variables (communality = 0.147). Hence, PBC_agree was omitted and the factor analysis was repeated.

Round 4

The 10 items included in Round 4 were: Q6, Q7, Q8, Q9, Q12, Q15, Q16, Q17, Q18 & Q20.
All diagnostics were satisfactory. The rotated factor solution with factor loadings below 0.4, typically acceptable in management studies (Hair et al, 1998, p111), was suppressed as shown in Table 33.

Table 33: Rotated factor matrix – round 4

Item	Factor	
	1	2
Att_norm or not the norm	0.78	
PBC_impossible or possible	-0.76	
Att_risk or safe	-0.75	
SN_I should or should not	0.74	
Att_not useful or useful	-0.72	-0.48
SN_agree or disagree	0.70	0.42
Att_not trendy or trendy	-0.64	
Att_easy or diff		0.78
Att_fast or slow		0.74
PBC_true or false		0.68

Total variance explained was 65.59%. Factor 1 accounted for 40.21% of the variance, while Factor 2 accounted for 25.38% of the variance. Cronbach's alpha for Factor 1 was 0.928, and for Factor 2 was 0.842. Both scales were internally consistent. The solution was satisfactory but ATT_not useful and SN_agree loaded moderately strongly on both Factor 1 and Factor 2.

Round 5

In Round 5, ATT_not useful was omitted since it loads more on Factor 2. The solution was satisfactory as before but had fewer items which indicates that it was more "parsimonious" (Kline, 2002, p64).

Round 6

In Round 6, SN_agree was omitted to find out if a better result could be established since it loads on both Factor 1 and Factor 2. Table 34 shows the final factor matrix with Factor 1 accounting for 37.0% of the variance, and Factor 2 accounting for 27.4% of the variance. Total variance explained was 64.4%. Both Factor 1 and Factor 2 scales were internally consistent.

Table 34: Rotated factor matrix – round 6

Item	Factor	
	1	2
Att_risk or safe	-0.79	
SN_I should or should not	0.77	
PBC_impossible or possible	-0.74	
Att_norm or not the norm	0.74	
Att_not trendy or trendy	-0.62	
Att_easy or diff		0.78
Att_fast or slow		0.75
PBC_true or false		0.68
Variance explained	37.03	27.38
Cronbach's alpha	0.90	0.84

Compared to Round 6, Round 4 shows better total variance explained and higher Cronbach's alpha values for both the Factor 1 and Factor 2 scales. However, the results of Round 6 are preferred, since each item loads significantly on only one factor (Factor 1 or Factor 2) as shown in Table 34.

Based on this analysis, there were five items in Factor 1 as shown in Table 34. They are: Att_risky or safe, SN_I should or should not, PBC_impossible or possible, ATT_norm or not norm and ATT_not trendy or trendy. These items have something in common which relates to desire to extend the use of the ez-link card from transit to non-transit transactions. The Oxford dictionary defines "Desirable" as "wished for being attractive, useful or necessary". Hence, the first factor variable was named "Desirability".

There were three items in Factor 2 as shown in Table 34. They are: ATT_easy or difficult, ATT_fast or slow and PBC_true or false. These items highlight how convenient the ez-link card could be to use. Hence, the second factor or variable was named "Perceived Convenience", a name that had been established earlier by Klobas (1995, p110) in her study on the influences on the use of information resources using the TPB model.

4.10 Regression analysis for two factor model

Based on the two variables, Desirability (DES) and Perceived Convenience (PEC) established in the previous section, another regression analysis was performed.

Before the regression analysis, both DES (5 items) and PC (3 items) representing the independent variables, and INT (4 items) representing the dependent variable were tested for scale reliability. Cronbach's alpha for DES was 0.89, for PEC was 0.84 and for INT was 0.94. Hence, the scales were confirmed as internally consistent.

Subsequently, a stepwise regression was performed and the R-square value for the model was 0.77. The model was statistically significant with F=473 (df = 2,290, p< 0.001).

The correlations between the two independent variables were relatively high, although they were not collinear. However, the regression residuals suggest the following problems:

a. There are 5 outliers for which the regression equation underestimates INT as shown in Table 35.

b. The normal probability (PP) plot from SPSS as shown in Figure 12, indicates that the regression model tends to underestimate INT (which is consistent with the above item a.).

Table 35: Casewise diagnostics [a]

Case number	Std. residual	INT_mean	Predicted value	Residual
28	4.256	7.00	3.2563	3.74369
47	3.094	6.75	4.0285	2.72155
72	3.000	6.75	4.1111	2.63891
176	3.289	6.75	3.8566	2.89338
181	3.084	7.00	4.2873	2.71271

a Dependent Variable: INT_mean
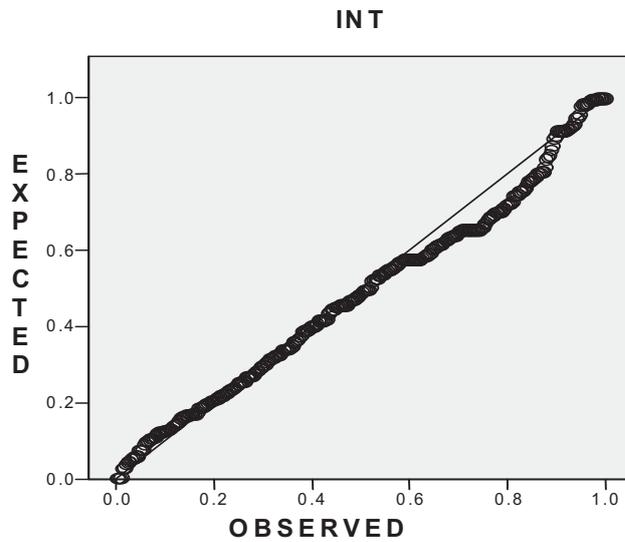
Figure 12: Normal probability (PP) plot

Further review of the outliers reflected in the SPSS Casewise diagnostics as shown in Table 35 indicated that the most extreme (high residual value) of these was Case 28 (Respondent 29), which was deleted and another regression analysis was performed.

The result was about the same as before, and the R-square value for the model was 0.77. The model was statistically significant with F=501 (df = 2,289, P< 0.001). The regression equation still underestimated INT even after eliminating the outlier. There could be a possibility that other untapped variables needed to be further explored. However, no further analysis was carried out for this study.

The model derived from this analysis to explain INT to use the ez-link card for non-transit transactions is shown in the Smart Card Usage model below (Figure 13). It comprises the two independent variables, DES and PEC, to measure INT.
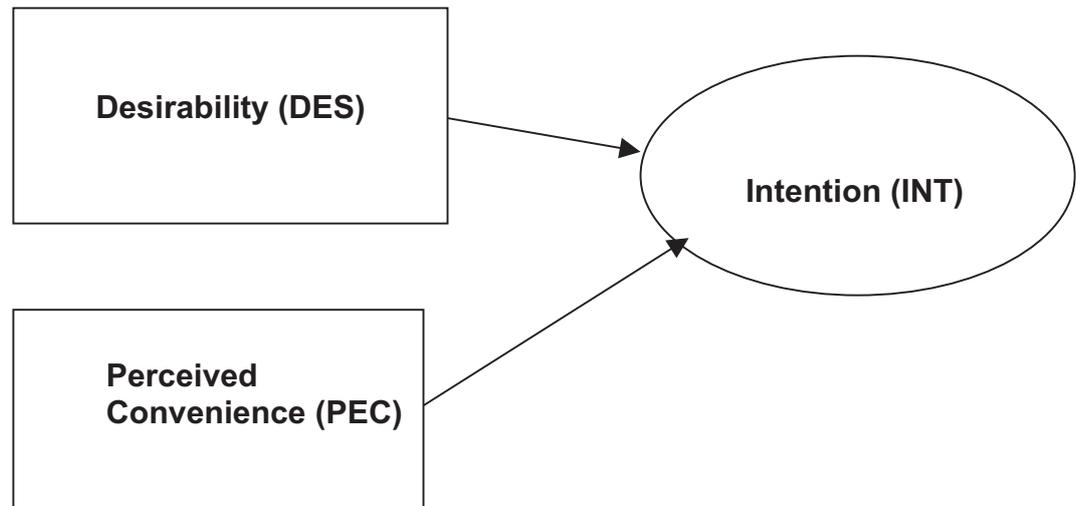
Figure 13: Smart Card Usage Model

The regression coefficients for the model are significant as shown in Table 36.

Table 36: Regression coefficients for Smart Card Usage Model

Variable	B	Std err	β	t	p
(Constant)	-0.45	0.12		-3.80	<0.001
DES	0.86	0.04	0.75	20.86	<0.001
PEC	0.25	0.05	0.18	5.11	<0.001

The standardized coefficient (β) shows that DES has the stronger influence on INT. This influence is more than three times the contribution of PEC.

When the unstandardized coefficients (B) presented in Table 36 are applied as weights in a regression equation, the dependent variable (INT) can be expressed in terms of its independent variables (DES and PEC). Hence, the regression equation can be expressed as follows:

INT = - 0.45 + 0.86 DES + 0.25 PEC

From the above equation, it can be seen that DES and PEC have a positive influence on INT.

4.11 Chapter conclusion

In this chapter, a total of 293 responses were analysed. About 58% male and 42% female respondents were interviewed. There was a good representation of both genders in all categories except for those in the category of National Service. About 47% of the respondents said that they were earning between $1000 and $3000 per month whilst 35% were not earning an income (mainly, homemakers, students and retirees).

Most of the respondents (206 out of 293) said that they were willing to use the ez-link card for non-transit transactions. While respondents in the Student and Tertiary categories were most willing, respondents in the Senior Citizen category were the least willing to use the ez-link card for non-transit transactions.

The initial research model with the three independent variables (ATT, SN and PBC) had an R-square value of 0.80. ATT, SN and PBC had an influence on INT but further examination uncovered high correlations between ATT and SN in particular.

Exploratory factor analysis was carried out and this study concluded that a parsimonious model containing only two variables, DES and PEC, could be used to explain INT to use the ez-link card for non-transit transactions.

In the next chapter, studies by other researchers will be examined. This will help to clearly draw some conclusions about whether the results obtained in this study were due to aspects of the TPB or other conditions.

Chapter 5.0   Discussion

5.1   Chapter introduction

In the previous chapter, the data collected was analysed to test the research model and hypotheses.

This chapter will discuss the results of the analyses carried out. Although the research model was supported at the first level of examination, detailed examination revealed that there was high correlation (0.85) between two of the independent variables, ATT and SN. Exploratory factor analysis identified a parsimonious model containing only two independent variables, DES and PEC.

A new model named Smart Card Usage model, comprising the DES and PEC, was developed.

This chapter will discuss the Smart Card Usage model and attempt to explain the issues faced in this study.

5.2   Summary of analyses

This study was conducted with 300 respondents and after deleting seven outliers, the data was analysed with 293 responses. Initial regression analysis suggested that the research model was supported. It was found that the research model with three independent variables (ATT, SN and PBC) explained 80% of the variance in the dependent variable (INT). However, collinearity tests (Chapter 4, Section 4.8) revealed that there was high correlation between ATT and SN. Exploratory factor analysis revealed that there were only two factors or variables (DES and PEC). These two variables were able to account for 64.4% of the total variance explained.   While the Cronbach's alpha value for both variables was above 0.8, the R-square from multiple regression using these two variables was 0.77. Hence, a new model (Smart Card Usage model)

comprising the two new independent variables, DES and PEC, was developed (Figure 13, p101).

The Smart Card Usage model differs from the initial research model in that there are now only two independent variables (DES and PEC) instead of three independent variables (ATT, SN and PBC) to predict the dependent variable, INT.

In order to explain why a two variable model might have emerged in this study, the following areas were examined:

- Validity and reliability of the variables used in this study (refer to Section 5.3)

- Did other researchers find high correlation or a collinearity or multicollinearity issue in Ajzen's (1991) TPB model? (refer to Section 5.5)

- Is there a problem in the Ajzen and Fishbein (1980) TRA model which is a building block for the Ajzen (1991) TPB model? (refer to Sections 5.6 to 5.8)

- Cultural issues (refer to Section 5.7).

5.3   Validity and reliability of variables

Before searching for causes of the high correlation between ATT and SN, there is a need to re-examine the questionnaire items for ATT and SN. This is to establish if any errors were made in this study that led to this problem.

In designing the questionnaire, one could arbitrarily ask questions or adapt items from previous studies, which could lead to low reliabilities and poor relationships among the variables in the TPB (Ajzen, 2002, p3). This was not the case in this study, where the reliability of all the variables (INT, ATT, SN and PBC) was reasonably high. Furthermore, different items that were used were appropriate for the study, and these

items were separated in a non-systematic order as recommended by Ajzen (2002).

In designing the questionnaire items to measure ATT, Ajzen (2002) suggests that semantic differentials scales with qualitative aspects of the evaluation should be incorporated, for example, "valuable - worthless" and "harmful – beneficial" (p5).

In this study, a total of five items to measure ATT and three items to measure SN were included in the questionnaire. The details of these items will be discussed in the Section 5.3.1 and Section 5.3.2 respectively.

5.3.1 Attitude (ATT) items

The five items that formed a reliable ATT scale in this study were:

- I would find using the EZ-Link card for Non-Transit services…………………………………………………………risky>>>>>>>>>safe

- I would find using the EZ-Link card for Non-Transit services……………………………………………………fast >>>>>>>>>>>slow

- I would find using the EZ-Link card for Non-Transit services…………………………………………………..…not trendy>>>>>>trendy

- I would find using the EZ-Link card for Non-Transit services…………………………………………………….not useful>>>>>>>useful

- Using the EZ-Link card for Non-Transit services should be. ……………………………………………………….……the norm>>>not the norm

All the five questions fulfilled Ajzen's recommendations where the ATT variable has items with bipolar adjectives, "good – bad" scale and "positive and negative endpoints" (Ajzen, 2002, p5).

5.3.2 Subjective Norm (SN) items

SN is the second variable that was revisited. However, before we review the SN items, there are a few terms that need to be first defined or clarified. Cialdini (2003) claims that general information could produce negative results and that it depends on how it is communicated to achieve a positive result. He suggests that by "aligning descriptive norms (what people typically do) with injunctive norms (what people typically approve or disapprove)" one can "optimise the power of normative appeals" (p105).

Ajzen (2002) highlighted that items with "injunctive quality" were found to have responses of "low variability because important others are generally perceived to approve of desirable behavior and disapprove of undesirable behaviors" (p6). This is illustrated in the following examples:

i.   Most people who are important to me think that

      (1)   (7)
    I should ……………………………..…………..I should not
                   Walk on a treadmill for at least
                   30 minutes each day in the
                   forthcoming month

ii. It is expected of me that I walk on a treadmill for at least 30 minutes each day in the forthcoming month

      (1)   (7)
    extremely likely…………………………..………extremely unlikely

In order to resolve the problem of low variability and to produce a high degree of internal consistency, Ajzen (2002) recommends that SN items should capture the "descriptive norm" (p7). This is illustrated in the following examples:

ii. Most people who are important to me walk on a treadmill for at least 30 minutes each day

      (1)   (7)
    completely true……………………….……..…completely false

iii. The people in my life whose opinion I value

      (1)   (7)
    walk…………………………………………….…do not walk
         on a treadmill for at least 30 minutes each day

In this study, three SN items were designed. The items which were used to achieve a reliable scale for SN are listed below.

- Most people who are important to me think that _____use of EZ-Link card for the Non-Transit services …………………………I should>>>>>>>>>>> should not

- The people in my life whose opinions I value would _____of me using the EZ-Link card for Non-Transit services……………………...Disapprove>>>>>>>>>>Approve

- It is expected of me to use the EZ-Link card for Non-Transit Service…………………………………Strongly agree>>>>>>>>>Strongly disagree

Although items with descriptive norm were found to have high variability, and items with injunctive quality were found to have low variability (Ajzen, 2002), the above three SN items with injunctive quality were used in this study. SN items with descriptive norms could not be used in this study as customers did not have the opportunity to observe important others using the ez-link card for non-transit transactions. As Table 27 shows, sufficient variation was observed in SN, even though it was measured with injunctive items in this study.

The focus will now be shifted to the work done by other researchers, to see if they have encountered high correlation between ATT and SN when using the TPB.

5.4 Observations of other researchers

This study was conducted on customers using the ez-link card in the public transport system in Singapore. The survey was carried out at different locations covering MRT stations, bus interchanges and shopping complexes (near bus interchanges and MRT stations). Prior to this study, no scholarly studies had been done to study customers' response to use a single contactless smart card on both transit and non-transit transactions, except for the following:

- "GAUDI" field trial in Dublin (Chapter 2, Section 2.3, p12),

- pilot survey   in Singapore (Chapter 2, Section 2.3, p12)

- focus group study in Singapore (Chapter 2, Section 2.2, p13)

- study by Bamberg et al (2003) (Chapter 2, Section 2.7, p28)

This illustrates that very limited studies have been done using the TPB for both transit and non-transit systems.

According to Hagger and Chatzisarantis (2005), SN has lesser influence in predicting INT in the TPB as compared to ATT and PBC. However, a review done by Ajzen (1991) on 19 TPB studies found that the relationship between ATT and INT was substantial compared to the relationship between SN and INT. Hagger and Chatzisarantis (2005) claim that a "low predictive value" of SN could be attributed to the "narrow conceptualisation and measurement focusing solely on the social pressures placed on individuals when a making decision to act" (p517). In this study, it was observed that SN combined with ATT to form a new variable (DES), to predict INT. This is significantly different from what was observed by other researchers.

Based on 47 empirical articles (5 related to the TRA and 33 related to the TPB) published in four premier health psychology journals from 1997 to 2001, Ogden (2003) argues that the TPB and TRA did not generate the relevant hypotheses for the variables to be tested. Ogden (2003) also claims that SN has no role in the TPB based on the review of other studies (p425). Similarly, Ogden (2003) highlights that there is no predictive role for the PBC, and in some cases, there is no role for ATT (p425). In summary, Odgen (2003) observed that most of the articles left unexplained variance in INT ranging from 14% to 92 % (p425).

In response to Ogden's (2003) claim, Ajzen and Fishbein (2004, p432) refute that

There is nothing in the theory to suggest that attitude, subjective norm and perceived behavioral control will each make a significant contribution to the prediction of intention. The relative importance of these three factors is likely to vary from one behavior to another and from one population to another. In some cases, one or another of the three factors will be found to have no significant effect on intention. Assuming that factors were measured with equal reliability, lack of predictive validity merely indicates that for this particular behavior and population, the factor in question is not an important consideration in the formation of intention.

In this study, it was found that very high reliability was achieved for all the variables in the research model. Furthermore, the regression analysis also supported the research model. As such, Ogden's (2003) claim cannot be supported. Furthermore, he did not consider the relationship between ATT and SN.

Based on 185 independent studies reviewed by Armitage and Conner (2001), the TPB accounted for about 39% of unexplained variance in INT. This is much better compared to Ogden's (2003) claim where it was up to 92% (which means that the independent variables in the TPB are unable to predict INT). Armitage and Conner (2001) argue that some of the unexplained variance may be due to random measurement error that could be supported by structural equation modelling for the TPB. In the current study, 20% of the variance in INT was unexplained which is quite low compared to the average value of 39% as observed by Armitage and Conner (2001).

It is now evident that the TRA (a building block for the TPB) used by other researchers should be examined to find out the cause of the strong correlation between ATT and SN.

5.5   Collinearity between Attitude (ATT) and Subjective Norm (SN)

Miniard and Cohen (1979) note collinearity between ATT and SN in the TRA. They question if the influences of ATT and SN could be separated,

and highlight conceptual and operational problems involved in separating these influences. They note that in Fishbein and Ajzen's (1975) model, SN (which includes the normative belief) measures "the degree to which people believe that referents think the person should perform the behavior" (p104).

As such, Miniard and Cohen (1979) argue that there is no separation between an individual wanting to do something because "I want to do it" and because "other people think he should'' (p104), and they find that SN is vulnerable to "attitudinal contamination" (p109). Hence, they suggest that a clear distinction between ATT and SN be developed.

5.6   Interdependency of Attitude (ATT) and Subjective Norm (SN)

Ryan (1982) carried out a study to investigate the possible interdependency of ATT and SN. He notes that Fishbein and Ajzen's (1975) modified the formula shown below from Fishbein's (1972) model where SN is represented by a product of the NB and MC (refer to Chapter 2, Section 2.5).

$$B \sim INT = (ATT) w_0 + (SN) w_1$$

$$\text{where,} \quad ATT = \sum_{i=1}^{n} B_i\, a_i \;, \quad SN = \sum_{j=1}^{k} NB_j\, MC_j \;, \quad B = \text{overt behavior,}$$

INT	=	behavioral intention,
B_i	=	the expectation that the performance of a behavior will lead to i^{th} behavior,
a_i	=	positive or negative evaluation of the ith outcome,
n	=	number of salient outcomes, SN subjective norm,
NB_j	=	expectation the performance of a specific behavior is expected by j^{th} group or individual,
MC_j	=	motivation to comply or not to comply with expectation of the jth group or individual,
k	=	the number of salient groups or individuals and
$w_0\, w_1$	=	empirically determined standardized regression coefficients.

Ryan (1982) believes that Fishbein and Ajzen's (1975) model does not provide a clear and precise explanation of the relationship between ATT and SN, which has led others to assume interdependencies between these variables. He suggests that the explanation given by Fishbein and Ajzen's (1975) model could be an "oversimplification for the sake of elegance" (p264) of the TRA as shown in Figure 14 below. He claims that Fishbein and Ajzen's (1975) model only provided a concept of relationship between ATT and SN, and a simple formula to predict INT.

Ryan (1982) suggests that the main force driving the TRA in Figure 14 could be the belief formation and change process that Fishben and Ajzen (1975) label as antecedents. He highlights three beliefs, which are: "descriptive" (derived from direct experience); "informative" (formed by accepting information from some source); and "inferential" (derived through a process of inference from descriptive, informational, or other inferential beliefs).

According to Ryan (1982, p264), the inferential belief "creates the possibility that attitudinal belief (B_i) may be formed from normative beliefs (NB_j) and vice-versa". Fishbein and Ajzen (1981) argue that it is useful to separate ATT and SN even though they may be highly correlated (cited in Ryan, 1982, p265). However, Ryan (1982) claims that the "utility would be more apparent" if ATT and SN show "differential effects" in the model (p265).
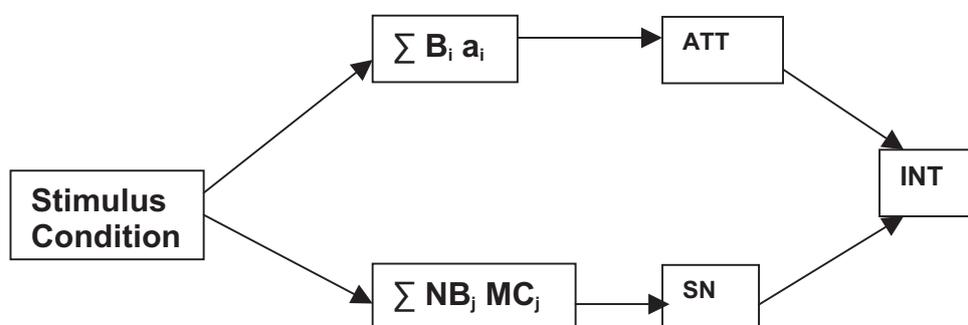
Figure 14: Theory of Reasoned Action (TRA)
(source: Fishbein and Ajzen, 1975, p334)

5. 6.1 Crossover relationships

Ryan (1982) examined the antecedents of ATT and SN ($\sum B_i a_i$ and $\sum NB_j MC_j$) to establish if there were "crossover relationships" (p266) between ATT and SN. With his model, shown in Figure 15, he found that the R^2 value for the "prediction for INT from $\sum B_i a_i$ and $\sum NB_j MC_j$" was "0.29" (p271). He also found that the R^2 value was 0.72 when for all the four variables were used, which supports Fishbein and Ajzen's (1975) claim that it is useful to separate ATT and SN in predicting INT (p271).
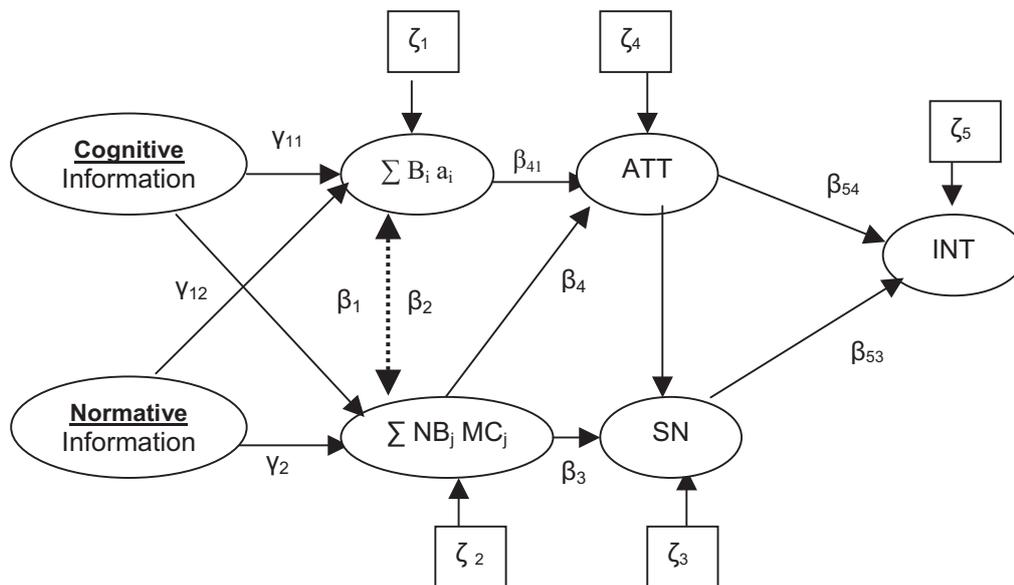
Figure 15: Crossover relationships in the TRA
(Source: Ryan 1982, p266)

Ryan (1982) then examined the crossover relationships based on the "endogenous" variables (γ - emotion or behavior from within and, and β - action coming from outside the system) in the model as shown in Figure 15 (p273). He found that both the "manipulation of normative information" and "formation of normative structure" had effects on the "cognitive structure" (p273). Similarly, he found that "normative structure ($\sum NB_j MC_j$)" had equal relationships with its "hypothesized causes including cognitive information" (p273).

Ryan (1982) suggests that normative structure affects ATT more than cognitive structure. He points out that the low value of cognitive

information ($\gamma_{11 =0.10}$) shows it has little effect on the cognitive structure ($\sum B_i a_i$) compared to the effect of normative information. He notes that ATT seems to be related to both the normative and attitudinal variables but that SN does not seem to be related to ATT as shown in Figure 15 (p274). He also notes that both the cognitive and normative information affects INT equally ($\beta_{54}=0.48$ and $\beta_{53}=0.45$) which once again supports Fishbein and Ajzen's (1975) claim. Ryan (1982) argues that ATT nevertheless seems to be related to both SN and INT.

In another study, Miniard and Cohen (1983) observed that personal attitude (ATT) and social influences (SN) played an important role in consumer decision-making. They agree that Fishbein and Ajzen's (1975) model in Figure 14 does not aim to separate "personal from normative evaluation from the overall evaluation" instead it separates "beliefs from one's perceptions of what others believe one should do" (p169). They also note that Fishbein and Ajzen's (1975) model considered the normative component to represent all forms of social influences whilst other researchers (for example, Deutsch & Gerard, 1955; French & Raven, 1959; and Kelman, 1961) show differences among various types of social influence based on their "motivational properties" (p170).

As a result, Miniard and Cohen (1983) claim that some social influences will capture both ATT and SN. They provide an example where one would form favourable beliefs to buy a product (which affects ATT towards buying) if an expert advises that the product is technically superior compared to a competing product. They also claim that SN would register the same influence where people "want to do" based on the expert's advice, and this contributes to a double counting effect (p170). They suggest that, to reduce the double counting effect, it would be necessary to provide a narrower conceptual domain for ATT than that of Fishbein and Ajzen's (1975) model. They devised a model to predict INT (using global measures of personal and normative components) and compared it against Fishbein and Ajzen's (1975) model. Their proposed model (Miniard and Cohen, 1983, p171) is listed below as follows:

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$$B \sim INT = w_1 (PE) + w2 (NE)$$

where $PE = \sum_{i=1}^{n} bpc_i \, epc_i$, $NE = \sum_{j=1}^{k} bnc_j \, enc_j$,

PE /NE: is   the   evaluation   of   behavior   B   based   on personal/normative considerations,

bpc/bnc: is the belief that performing the behavior B leads to personal/normative consequences i / j,

n/k :   is   the   number   of   salient   personal/normative consequences.

B: Behavior

BI: Behavioral Intention

w_1 / w_2:   Empirically determined weights

Two other studies were carried out by Miniard and Cohen (1983) to establish the importance of separating personal (ATT) and normative (SN) components. They found that both their model (which explains 70% of variance in INT) and the TRA model (which explains 81% of variance in INT) did well in predicting INT.

5.6.2   Double-counting effect

The potential interdependency of ATT and SN prompted other researchers to conduct their own research on interdependency. Shimp and Kavas (1984) made use of the TRA to study the impact on consumer choice and brand switching with the use of coupons. They claim that it is common for consumers to make use of coupons to purchase a product via various marketing programs. They devised two models. The first model represented the conventional TRA, where $\sum b_i \, a_i$ represented aggregated personal beliefs about coupon usage and their corresponding evaluations. Similarly, $\sum NB_j MC_j$ represented normative beliefs associated with motivations to comply (MC) with important others' expectation in the use of coupons.

The second model consisted of multiple expectancy-value components (EV_1 to EV_3) as proposed by Bagozzi (1981, 1982) instead of the

unidimensional $\sum b_i a_i$ component represented in the TRA. Similarly, they used a multi-dimensional normative component (NB_1MC_1 to NB_3MC_3) as proposed by Ryan and Bonfield (1980) instead of the unidimensional $\sum NB_i MC_i$ component represented in the TRA.

Shimp and Kavas (1984) found that in both the models, ATT and SN influenced INT, supporting the TRA. However, they noted the double counting effect that was observed by Miniard and Cohen (1983, p170). They also noted the crossover relationships that were observed by Ryan (1982, p266). Shimp and Kavas (1984) believe that these double counting effect and crossover relationships indicate that the "shoppers' internalised norms" are influenced partially by "their personal beliefs towards coupon usage", and that their attitudes are influenced by "internalisations of others' beliefs" (p802).

Oliver and Bearden (1985) carried out a study to confirm the concept of the crossover relationships and the double counting effect. They gave a non-prescription drug (a diet suppressant capsule) to a group of consumer panelists who represented families in urban and suburban areas, and then measured the attributed expectation, attitudes (ATT) and normative influences (SN) of the capsule. They found that while the TRA model was supported, ATT had a higher value of prediction on INT compared to SN on INT. Their study supported the findings of Shimp and Kavas (1984) on the crossover relationship between the influences of SN and ATT.

All the case studies presented above showed that the TRA is a complex model where due consideration should be given to the definition of variables and design of questionnaires to measure these variables. The TPB is built on top of the TRA, and both models would therefore have similar characteristics, including a high correlation between ATT and SN.

5.7 Cultural context

The TRA and TPB were developed and used mainly in the USA. This raises the issue of cultural context. Hence, there is a need to consider this aspect, too.

Lee and Green (1991) examined the cross-cultural issue and questioned if the TRA was applicable in Asian countries (for example, Korea). They argue that Americans were individual-centered and Koreans were group-centred. Similarly, Hofstede (1980) grouped Chinese, Japanese and Koreans as collectivist who share a Confucian culture, and are motivated toward conforming to the norms (SN) of a group than an individual goal. They found that Koreans gave greater importance to SN whilst Americans gave more importance to ATT.

Bagozzi and Schnedlitz (1985) further probed the influence of social variables (SN) on INT. They carried out a study on two drinks (Coca-Cola and Fanta) and two clothings (green, bell-shaped style; and navy-blue, pleated style) where data were collected using structured questionnaires from 120 female trainee teachers (aged 19 to 24 years) in Austria. They found that SN influenced ATT depending "upon the degree of need for approval and the strength" and "visibility of the social context" (p370). In Austria, consumption of Coca-Cola (introduced in 1929) had more visibility and greater social impact than Fanta (introduced in 1962). However, in Austria, their social context varied through consumption classes where ATT ceased to impact INT.

Bagozzi, Wong, Abe and Bergami (2000) observe that the TRA has been widely used in consumer research in various sectors (such as automobile, banking, computer software, coupons, detergents and soft drinks) in the USA but not to the same extent in other cultures. They carried out a study in four countries on eating alone versus eating with friends. The first two countries (USA and Italy) were described as independent-based culture where people "tend to be individualistic, egocentric, autonomous, self-reliant and self-contained"; and the second

two countries (Japan and China) were described as inter-dependent-based culture where people "tend to be obedient, socio-centric, holistic, connected and relation oriented" (p98).

Bagozzi et al (2000) found that both American and Chinese enjoyed eating with friends, giving rise to a stronger relationship between SN and INT. However, they found that both Japanese and Italians showed a weaker relationship between SN and INT. They concluded the following: that SN was found to influence decision-making when eating with friends; ATT or preferences mattered most when patronizing fast food outlets in both Eastern and Western cultures; and SN captured the effects of peer pressure when eating with friends as it created an opportunity for direct experience of social pressure. However, they suggested that further tests needed to be done on other products and services across cultures.

Bagozzi et al (2000) also found that SN was influenced by external factors (for example, peers, society and environment) whereas ATT could be influenced by individual preferences. Hence, in a "collective society" such as Singapore (Hofstede, 1980, p45), the crossover relationship between ATT and SN might be stronger due to the strong emphasis on SN.

5.8   Influence of age

In the current study, responses were obtained from respondents in five categories (Adult, Student, Tertiary, National Service and Senior Citizen) of customers who use the ez-link card in the public transport system in Singapore. Hence, it would also be important to find out if age has an influence on ATT and SN and, if so, how the strength of these variables could lead to crossover relationships or high correlation.

Trafimow, Brown, Grace, Thompson and Sheeran (2002) observe that, according to the psychoanalytic theory of Freud (1961), as people age, they tend to be controlled by ATT instead of SN. However, according to the symbolic interactionism theory of Mead (1934), people become more

socialized as they age, which means that SN becomes more important with age.

Trafimow et al (2002) carried out a study on 313 children aged eight to sixteen years to measure ATT, SN and INT for 34 types of behaviors. They found that ATT and SN were not influenced by age. The current study supports these findings for respondents aged between 15 and 35 years (Adult, Student, Tertiary and National Service categories) but not for older respondents (Senior Citizen category). In 20 to 30 years' time, the senior citizen population would grow steadily, and Singapore will experience a 'greying population' as in Japan. However, with a better educated and more employable senior citizen population, the willingness to use the ez-link card for non-transit transactions may increase. Hence, the findings by Trafimow et al (2002) may be supported for all age categories in the future.

5.9   Possible alternatives to the TPB Model

Before embarking on the current study, various models were reviewed in Chapter 2 and of all of them, the TPB was found to be the most suitable for this study. Ajzen (2002) suggests two methods of measuring the variables: direct and indirect. This study was conducted using the direct method of measurement, and it supported Ajzen's (1991) model when a regression analysis was done. Collinearity testing showed that although ATT and SN were highly correlated, there was no multicollinearity. Exploratory factor analysis revealed that two variables (DES and PEC) instead of three variables (ATT, SN and PBC) would provide a more parsimonious representation of the data. The current findings and work done by other researchers revealed that the following issues could be present:

- low predictability of SN
- crossover relationships between ATT and SN
- interdependency between ATT and SN
- double-counting effect of ATT and SN on INT
- influence of age on INT

This study was only carried out in Singapore and in order to see if culture has an influence on prediction of INT, further studies need to be carried out in other countries.

Looking at the findings from the current study, the question of whether this study could have adopted other models arises. It should be noted that the TPB was built upon the TRA model, and that a number of researchers argue that the TRA suffers from collinearity. The following sections look at work done by other researchers in exploring other models compared to the TRA or TPB.

5.9.1   Comparison between the TRA and TD

Karahanna, Straub and Chervany (1999) combined the Theory of Diffusion with the TRA to examine differences in pre-adoption beliefs and attitudes. They used the indirect method to measure ATT (behavioral beliefs) and SN (normative beliefs) in their study conducted in a marketing context. They found that ATT (product visibility and image beliefs) were highly correlated with SN. They suggest that these "two beliefs influence behavior through the normative rather than attitudinal components" (p202). They recommend that the TPB be used in future studies as PBC reflects how the "successful performance of the intended behavior is contingent on the person's control over the many factors that may prevent it" (Ajzen, 1988, p132).

The above study reveals the benefits of indirect measurement which could be explored for the TPB in future.

5.9.2   Comparison between the TAM and TPB

Benbasat and Barki (2007) highlight how the UTAUT by Venkatesh et al (2003) relates back to the origin of the TAM. They state that the two variables, "social influences" and "facilitating conditions" overlap considerably with SN and PBC, and if added to the TAM, the resulting model is similar to the TPB (p213).

Benbasat and Barki (2007) note that researchers are already beginning to use the TPB instead of the TAM. They point out that the TPB has its own limitations and recommend that researchers examine the TPB carefully in order to better understand what influences adoption and acceptance of IT (p216).

In recent articles published in the *Journal of the Association for Information Systems*, many scholars have pointed out the weakness of the TAM. Bagozzi (2007) notes that, for nearly 20 years, researchers have been introducing predictors to TAM, without contributing to the theory or explaining their decisions. He cites the UTAUT by Venkatesh et al (2003), which has 41 independent variables for predicting INT. He claims that this leads to confusion and ill-advised decision-making in terms of technology adoption, acceptance and rejection.

Bagozzi (2007) noted that the TAM has not considered cultural and social aspects of decision-making and usage. He recommends that both attitudes and emotions be considered to determine the success or failure of goals in the use of technology (p249) and that a new paradigm be considered to understand and explore technology adoption, acceptance and rejection (p250). His new decision-making core model comprises variables such as Goal desire, Goal intention, Action desire, and Action intention as shown in Figure 16.
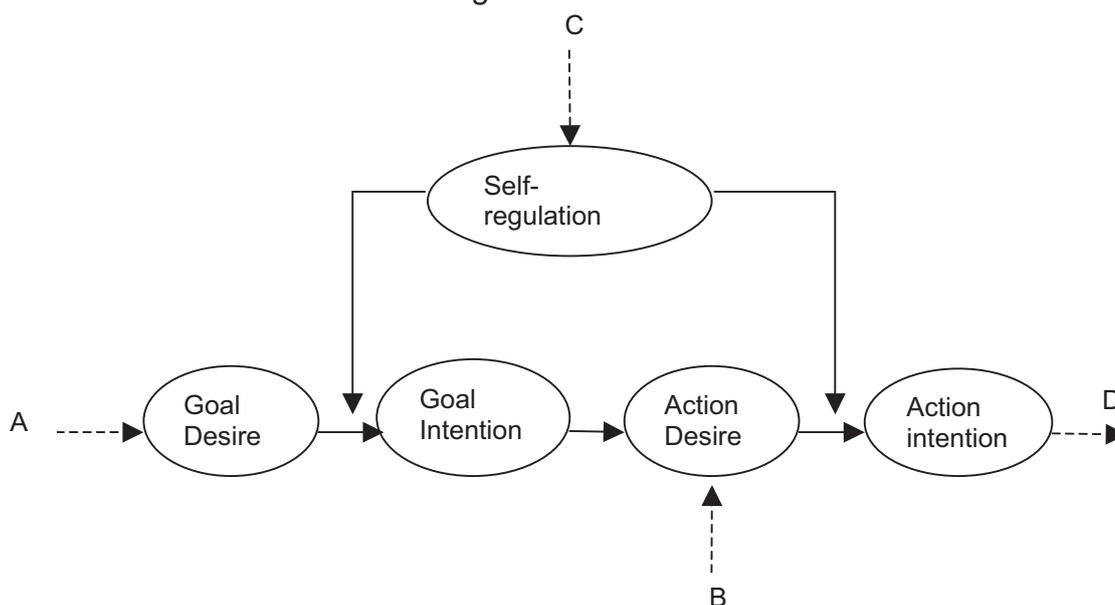
**Figure 16: Decision-making core model
(Source: Bagozzi, 2007, p250)**

The causes are labeled as A and B, and the effect is labeled as D in Figure 16. Self-regulation moderates the effects of desires on intentions, and these processes are based on reasoning. Hence, the behavioral intention (INT) models need to consider self-regulation in the decision-making process.

5.10   Chapter conclusion

This chapter presented and discussed the research findings in detail, making reference to the literature review and survey results presented in Chapter 2 and Chapter 4 respectively. The "Smart Card Usage" model (Chapter 4, Figure 13) comprising the two new variables (DES and PEC), and issues faced in this study were also discussed in this chapter.

A review of the questionnaire which was designed to measure ATT and SN revealed that the high correlation between ATT and SN was due to the design of the TPB as it was built on the TRA. Other researchers, such as Miniard and Cohen (1979), found that both the SN and MC measures of normative influence were vulnerable to "attitudinal contamination" (p109). They suggest that a clear distinction be made between attitudinal and normative influences. While Ryan (1982) observed crossover relationships among the attitudinal and normative variables, Miniard and Cohen (1983) observed double counting effects in the normative and attitudinal components. These findings indicate that SN affects ATT.

The literature confirms that the TPB is a better model compared to the TRA, where the PBC remained unaffected by the relationship between ATT and SN. However, it is important to note that the TPB is complex and due consideration must be given in designing the questionnaire (to measure independent variables) and adopting the appropriate direct or indirect measurement techniques. Since the TPB was developed and used mainly in the USA, cultural issues need to be considered when it is

used in other countries, especially in Asian countries. Other variables such as age also need to be considered when using the TPB.

In the next chapter, implications and limitations of the study, suggestions for future research and reflections of the researcher will be presented.

Chapter 6.0   Conclusion

6.1   Chapter introduction

This study was carried out to answer the research question, which is, **"What would encourage current transit customers to use a transit card (such as the ez-Link card) for non-transit transactions?"**

After an extensive literature review, a suitable model and hypotheses were identified for the study. The TPB developed by Ajzen (1991) was selected. A questionnaire comprising 16 items was designed to measure three independent variables (ATT, SN and PBC) and one dependent variable (INT). A pilot survey was conducted to test the questionnaire before it was used in the final survey in two phases. Three hundred respondents from five categories (namely, Adult, Student, Tertiary, National Service and Senior Citizen) were interviewed in the final survey.

Responses from 300 respondents were collected and the 293 usable responses were analysed using descriptive and inferential statistics (regression and exploratory factor analysis) and the results were then, carefully organised and discussed.

This chapter will present a summary of key findings of the study, implications of the study, limitations of the study, suggestions for future research and reflections of the researcher before drawing a final conclusion.

6.2   Summary of key findings of the study

The descriptive analysis showed that 206 out of the 293 (70.3%) respondents (70.8% of Adult, 86.0% of Student, 86.4% of Tertiary, 87.1% of National Service and 21.8% of Senior Citizen categories) agreed that they would use their ez-link card for non-transit transactions.

Regression analysis showed that the three independent variables in the TPB (ATT, SN and PBC) explained 80% of the variance in intention (INT) to use the ez-link card for non-transit transactions. However, exploratory factor analysis suggested a more parsimonious model would extract only two factors from among the variables used to measure the independent variables. These two variables accounted for 64.4% of the total variance explained. Cronbach's alpha for both variables was above 0.8, and the regression R-square when they were used to explain INT was 0.77. As a result, a new Smart Card Usage model in which the two new variables (DES and PEC) predict INT was proposed as shown in Chapter 4, Figure 13 (p101).

Ajzen and Fishbein (2004) claim that the TPB does not suggest that ATT, SN and PBC "will each make a significant contribution to the prediction of intention" (p432) in every case. Other researchers such as Miniard and Cohen (1979) found that measures of normative influence were vulnerable to "attitudinal contamination" (p109). They suggest that a clear distinction be made between attitudinal and normative influences. While Ryan (1982) observed crossover relationships among attitudinal and normative variables, Miniard and Cohen (1983) observed double counting effects in the normative and attitudinal components. The DES variable identified in this study suggests that ATT and SN may be difficult to separate in societies with strong normative values such as Singapore.

6.3   Implications of the study

This study was undertaken to understand and measure the intention (INT) of customers to use the ez-link card for non-transit transactions. Hence, the findings could be of great interest to EZL, public transport operators and future card managers as well as to the merchant companies who would be providing the non-transit products and services to the customers.

Two important issues, which need to be addressed by parties interested in developing and expanding the non-transit business, were raised in

Chapter 1 Section 1.2, which are as follows: Are customers ready to use a contactless smart card in non-transit systems? Are non-transit merchant companies ready to sign up for commercial arrangements, and venture into a business where returns on investments are not guaranteed? This study shed light on the first of these issues.

Although this study found that about 70.3% respondents said that they would use the ez-link card for non-transit transactions, only 4% of the customers are currently using the ez-link card for non-transit transactions in Singapore. This is a far cry from the 1.2 billion transit transactions per year in Singapore. This is also a far cry from the 30% non-transit transactions of HK$29 billion (S$5.6 billion) transit transactions per year in Hong Kong. Hence, while customers in Singapore say they are ready to use a contactless smart card in non-transit systems, only 4% are currently using it for non-transit transactions.

So what could be the reason for the "gap" between the customers' intention (INT) to use and their current use of the ez-link card for non-transit transactions? In other words, **"What would encourage current transit customers to use a transit card (such as the ez-Link card) for non-transit transactions?"** This study found that respondents in each of the categories (Student, Tertiary, Adults, Senior Citizens, National Service) indicated their options for different types of non-transit transactions as well as different types of loyalty schemes. Currently, there are no such types of non-transit systems and loyalty schemes linked to the ez-link card in Singapore. Hence, it is apparent that different marketing strategies and loyalty schemes could be offered to meet the expectations, needs and desires of customers in the different categories.

The study also evolved a new Smart Card Usage model (Figure 13, p101) comprising the two new independent variables (Desirability - DES and Perceived Convenience – PEC). It was found that DES has a stronger influence (three times) than PEC on INT.

The customers in the study had a strong desire to use the ez-link card for non-transit purposes but perceived low convenience. Hence, these findings confirm that while customers in Singapore have the desire to use the ez-link card for non-transit transactions, the convenience to use the ez-link card needs to be improved significantly. The introduction of new technologies in the public transport system could be the answer as illustrated below.

Mobile phones are currently being embedded with a contactless chip called the Near Field Communication (NFC). These NFC phones could be used for both transit and non-transit systems. In fact, both EZL and NETS are currently conducting trials using the NFC phones for transit transactions in the public transport system in Singapore.

By linking with loyalty schemes and allowing top-up via phone in future, customers may find it more attractive and convenient to use the NFC phones in place of the ez-link cards in both the transit and non-transit systems. In any case, the introduction of the NFC phones will only change the medium of payment, that is, from a plastic card (ez-link) to an electronic device (NFC phone). The mode of payment which is contactless payment will remain the same.

Hence, the findings from this study confirm that customers using the public transport system in Singapore have the desire (DES) to use the ez-link card for non-transit transactions. However, the convenience (PEC) to use the ez-link card needs to be improved significantly. It is possible that with the introduction of NFC phones and good marketing strategies, customers would translate their intention (INT) into action, that is, use their transit card for non-transit transactions. The new Smart Card Model could be used to confirm this possibility in a future study.

6.4 Limitations of the study

Firstly, this study was undertaken to look at existing customers' intention (INT) to use the ez-link card for non-transit transactions. One major

weakness of this study is that, customers were asked to indicate in the questionnaire that they would use the ez-link card for non-transit transactions without actually making payment for those non-transit transactions. Hence, it cannot be confirmed that customers would actually use the ez-link card to make payment for a non-transit transaction in future.

Secondly, this study was carried out using Ajzen's (1991) TPB model. The model has its limitations where ATT and SN are highly correlated, as does the TRA on which it was built (Chapter 5, Section 5.6).

Thirdly, this study did not look at the effect of INT on behavior which could in turn, unveil other factors that could have an effect on INT. Ajzen and Krebs (1994) have pointed out that over the past 25 years, many studies which have evaluated the TRA, have found that the average correlation between INT and behavior was 0.62. However, as stated in Chapter 2, Section 2.13, it was not appropriate to focus on behavior in this study, at the time of the study, the ez-link card was not enabled for non-transit transactions.

Finally, this study used direct measurement techniques for the variables in the modified TPB. While this has produced some support for the TPB, it has also highlighted a weakness in the model. Direct measurement does not take into consideration the normative and cognitive beliefs which influence ATT and SN (Chapter 5, Section 5.6). In his studies using the indirect measurement technique for the variables, Ajzen (2002) observed that intentions could be formed by beliefs. However, it is important to take note of the problem of crossover relationships and double counting effects when using beliefs (normative and cognitive) to measure ATT and SN in Ajzen's (1991) TPB model.

6.5   Suggestions for future research

The TPB, which was developed and used mainly in the USA, needs to be reviewed for cultural issues before it is used in Asian countries. However,

the new Smart Card Usage model developed in Chapter 4 (Figure 13) could be used in future research in the public transport system in Singapore and possibly other Asian cities, such as Hong Kong, Seoul and Taipei.

Further study could also be undertaken using Ajzen's (2002) indirect measurement (where normative and cognitive beliefs are measured) to ascertain if the results obtained would be similar to that of the current study. Smart Card Usage model could also be further explored and tested to determine if the results can be generalized using Ajzen's (2002) direct measurement. The ability of the TPB and Smart Card Usage models to explain INT should be compared.

Variables such as age, culture and gender, which were not tested in this study, could be considered in future research. The impact of these variables on ATT, SN, PBC and behavior could be studied. A structural equation model could be used in order to understand the dependencies between these variables, and ATT, SN, PBC and behavior in the TPB and the Smart Card Usage Model.

In future research, open-ended comments could be incorporated in the questionnaire to collect valuable qualitative data. In addition, interviews with key stakeholders in the transit and non-transit systems should also be conducted to reconcile their expectations with those of their customers.

6.6   Reflections of the researcher

Before embarking on the current study, the researcher intended to look at a number of issues related to the use of a contactless smart card. For example, the researcher had initially wanted to do a comparative study of the integrated fare collection systems in Hong Kong, London, Washington and Singapore. This would have resulted in a mere technical or economic comparison of systems in different developed cities around the world.

Hence, the researcher embarked on the current study, of customers' intention (INT) to use the ez-link card for non-transit transactions. This is of current interest to the public transport industry in Singapore. Furthermore, it is a new area and not many cities around the world have fully explored it, although Hong Kong has embarked on it and is working towards achieving a higher target. .

The researcher was concerned about doing research in a new area where very little research had been carried out. However, with the assistance and support of the Research Supervisor, Prof Jane Klobas, the researcher was encouraged to pursue the study. He reviewed the models as listed in Chapter 2, and found that the TPB was suitable for the current study. However, he eventually created a new model, Smart Card Usage model, which could be used for future research, including research on the introduction of a second card manager, and new technologies.

With the revised Parliament Act in Singapore, plans are now in place for the entry of a second card manager (NETS, the clearinghouse for three major local banks) into the transit business by end 2008. This would pose a challenge for EZL, which is currently the single card manager for transit and non-transit systems in Singapore. The liberalization of a cashless payment system in Singapore will increase competition among the card managers. It will also pose a challenge for card managers in the transit (cashcard, NETS) and non-transit systems (ez-link card, EZL).

6.6 Final conclusion

The current study has revealed a number of issues that need to be considered in future research. One important lesson is that even though the TPB is well received by many researchers, it has some weaknesses that need to be reviewed as suggested in Sections 6.4 and 6.5. Changes in the business environment, government regulations and improvements in IT could also have an impact on customers wanting to adopt a

particular IT product, and this would have to be accounted for in future research.

Another important lesson learned from this study is that even though the TPB has been so widely used, it cannot be taken as the *de facto* model to carry out a particular research as in the current study. The fundamentals of the TPB must be questioned in order to identify a number of issues to be addressed when carrying out the study (for example, identifying the variables and designing the questionnaire items).

Finally, the most important question that needs to be addressed is how to encourage customers to use the ez-link card for non-transit transactions. In future research, the Smart Card Usage model should be used to evaluate intention to use the smart card for non-transit transactions in other Asian cities, such as Hong Kong, Seoul and Taipei, before the model could be generalized for any public transport system around the world.

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Cover letter for this study

The University of Western Australia
The Graduate School of Management

Dear Sir/Madam,

A Survey on the Use of EZ Link Card for Transit and Non-Transit Systems in Singapore

My student, Mr Chandra Segaran, is currently doing a Doctor of Business Administration degree at the Graduate School of Management, University of Western Australia. As part of the course requirements, he is conducting research into the acceptance of the EZ Link card for non-transit services (e.g. food court, taxi, McDonald's). At the moment there is no published research to show what would encourage people to use a single smart card for Transit and Non-Transit services.

The survey is being conducted among Public Transport users. Your cooperation in answering this questionnaire is important for successful completion of this study. The questionnaire will require about 15 minutes to complete. All your answers will be anonymous and confidential, and only summary data will be reported. The results will be reported in Mr Chandra Segaran's doctoral thesis and summary of the report will be made available to Transit Link Pte Ltd.

You can find out more about this survey from the attached Information Sheet. If you have any further questions, or if you would like a summary of the findings from this survey, you can contact Mr Segaran by phone (67799303) or e-mail (transitlink.com.sg).

Thank you in advance for your kind participation in this study, which would be greatly appreciated.

Yours sincerely,

Professor Jane Klobas
Professorial Fellow
Graduate School of Management
University of Western Australia
jklobas@ecel.uwa.edu.au

Information sheet for this study

The University of Western Australia
The Graduate School of Management

Information Sheet

A Survey on the Use of EZ Link Card for Transit and Non-Transit Systems in Singapore

You are invited to participate in a research project that will explore what are the factors that might encourage EZ Link Card users to use the same card for Transit (bus and rail) and Non-Transit (eg. McDonalds, Food Court, Taxi, etc).

This research will look into the acceptance of the EZ Link card by the general public for use in non-transit services. At the moment there is no published research to show what would encourage people to use a single smart card for Transit and Non-Transit services.

We are asking public transport users to answer a series of questions about use of the EZ Link Card and have selected you because you represent one of the groups that we recognize as important users of the EZ Link Card.

This is a simple interview questionnaire survey that should take at most 15 minutes to complete. Confidentiality is assured, as you are not required to disclose your identity.

The data from all participants will be aggregated and analysed statistically to determine the drivers of intention to use the EZ Link Card for Non-Transit services. The results will be reported in Mr Chandra Segaran's doctoral thesis and related publications. A summary of the report will be made available to Transit Link Pte Ltd. They will not be sold or shared with anyone else for commercial purposes.

If you agree to participate, we will assume that you have given your consent for your answers to be used in the research. If, at any stage during the interview, you no longer wish to continue, you are free to withdraw and ask the interviewer to destroy your data. You do not have to give any reason for withdrawal. (Because you are anonymous, we will not be able to remove your answers at a later stage.)

For more information about this research, please contact the researcher, Mr Chandra Segaran, e-mail: chandra@transitlink.com.sg, or his supervisor, Professor Jane Klobas, jklobas@ecel.uwa.edu.au.

The Human Research Ethics Committee at the University of Western Australia requires that all participants are informed that, if they have any complaint regarding the manner, in which a research project is conducted, it may be given to the researcher or, alternatively to the Secretary, Human Research Ethics Committee, Registrar's Office, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009 (telephone number +61-8-9380-3703). All study participants will be provided with a copy of this Information Sheet for their personal records.

Instruction to interviewers for pilot survey

The University of Western Australia
The Graduate School of Management

A Survey on the Use of EZ Link Card for Transit and Non-Transit Systems in Singapore

Instructions to Interviewers for the Pilot Study

This pilot study is the first stage to a more comprehensive research to determine what are the factors that would encourage existing EZ-Link customers using the same card for Transit and Non-Transit (eg. McDonalds, Food Court, Taxi, etc.) systems.

In the pilot study, a total of 20 EZ-Link customers (9 Adults, 2 Senior Citizens and 4 Students, 3 Tertiary Students and 2 National Service man) will be interviewed based on the survey form attached with these instructions. I am asking you to interview **five** categories of customers, Adult, Senior Citizen, Student aged 15 or over, Tertiary Students (Polytechnic and University) and National Service man. You will be assigned the number of customers to be interviewed.

How to identify the Customers to be interviewed

1.   We are looking for a mix of males and females in each fare category. They will need to have about 15 minutes to answer the questionnaire, so approach only those people who appear to have time to respond. Approach the person who you think will be a suitable interviewee and ask them if they would be willing to participate in an interview about the EZ-Link card for 15 minutes. If they say no, thank them for their time and wish them a pleasant day/evening.

2.   If they say yes, ask them which type of card they hold: Adult, Senior Citizen, Student, Tertiary and National Service (NS). If they do not hold a card, or if you have already interviewed someone that holds that card type, tell them that you have already interviewed your quota of people with that type of card, thank them for their time and wish them a pleasant day/evening.

3.   If the Customer is a Student cardholder, ask how old they are. If they are under 15, tell them that we are only interviewing students 15 or over at this time, thank them for their time and wish them a pleasant day/evening.

How to conduct the interview

Once the customer is identified, explain the reason why the survey is being conducted in more detail. Show them the following:

1. Letter inviting participation. Explain that the survey is being conducted on behalf of Mr Chandra Segaran who is a doctoral student at the University of Western Australia under the supervision of Professor Jane Klobas. <u>Give them time to read the letter</u>.

2. Give them the Information Sheet (this is for the participant to keep). Emphasise the key elements of the Information Sheet: that the survey should take about 15 minutes, that their replies are anonymous, that they are welcome to stop answering questions at any stage during the interview and ask that their response be destroyed, and that they can contact Mr Chandra Segaran, Professor Klobas, or the Human Research Ethics Committee at the University of Western Australia if they have any questions or comments. *Give them time to read the details in the Information sheet.*

3. Ask if there are any questions, and answer them using the words in the information sheet. If you cannot answer a question, thank the Customer for their time, and ask them to refer their question to Mr Chandra Segaran, Professor Klobas, or the UWA Ethics Committee as appropriate. Do not continue with the interview in this case.

4. Ask if they are happy to continue with the interview. If they answer no, please thank them for their time and wish them a pleasant day/evening.

5. If they answer yes, mark M (Male) or F (Female) in the appropriate box below to record the category and sex being interviewed. Remember that, for this pilot study, you need to interview one person who holds each card type.

No	Adult	Senior Citizen	Student, 15 or over	Tertiary	National Service
1	M				
3		F			

Note: Please indicate Male (M) or Female (F) after you have interviewed (see example above).

6. Now, continue to the interview. Ask the participant the questions in the survey form. Show them the answer sections of the sheet and ask them where to put their answer. Put a cross in the appropriate box to indicate the answer.

7. <u>At the end of the interview</u>, please present the participant with the pen and say "Thank You for your valuable time" and wish them a pleasant day/evening.

8. <u>After the interview</u>, complete all the summary details required on the final page before approaching another potential interviewee.

9. Once the forms are completed, please handover the form to me the <u>next day</u>. This will allow me to identify potential gaps in the completed forms. In the event, the form is partially complete, you will be required to interview another candidate. I will brief you on all the issues in the previous interview. I will discard the incomplete form.

═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Please cross <u>one </u>of the appropriate box for the preferred answer

X

Q1.   **Would you use your EZ-Link card for Non-Transit services?**

No ☐   *Go to question 6*

Yes ☐   *Continue*

Q2.   **Which type of Non-Transit services are you likely to use?**
         (<u>more than one box</u> can be crossed)

Buy Movie Ticket	
Fast Food Outlet (Mac, Burger King, KFC, etc.)	
Taxi	
Pay for Card Park Fee	
Buy Book/Stationary/Magazine/Newspaper	
Pay Entrance Fee to places of interest (Zoo, Birdpark, Sentosa, etc.)	
Purchase groceries from supermarket (eg. NTUC, 7-eleven, Econ Mini Mart, Cold storage, etc.)	
Photocopy/Photo services	
Others (specify)	

Q3.   **For up to what value would you use your EZ-Link card for Non-Transit services?**

Less than $5	Less than $10	Less than $15	Less than $20	Less than $30	Other Values (specify)

Q4.   **Would it be more attractive to use your EZ Link card for Non-Transit services if a loyalty scheme is offered for Non-Transit services?**

No ☐   **Yes** ☐   **(if yes, please indicate what type of loyalty scheme would be attractive. You may select more than one)**

Outright discount at selected stores	Bonus points for redemption of gifts	Priority booking of tickets (eg. movie, plays, etc.)	Others (specify)

════════ **Use of EZ-Link Card for Non-Transit Services** ════════

Q5. **Would you increase your remaining value in your EZ-Link card to use for Non-Transit services and by how much?**

No ☐ **Yes** ☐ **(if yes, please indicate the amount below)**

$10	$20	$30	$40	$50	Other Values (specify)

Q6. *Whether or not you believe you would use the EZ Link card for non-transit services, we are interested in what you think about the card. Please tell us what you think…*

I would find using the EZ-Link card for Non-Transit services…

Risky   **Safe**

1	2	3	4	5	6	7

Q7. **I would find using the EZ-Link card for Non-Transit services…**

Easy   **Difficult**

1	2	3	4	5	6	7

Q8. **I would find using the EZ-Link card for Non-Transit services…**

Fast   **Slow**

1	2	3	4	5	6	7

Q9. **I would find using the EZ-Link card for Non-Transit services…**

Trendy   **Not Trendy**

1	2	3	4	5	6	7

Q10. **I would find using the EZ-Link card for Non-Transit services….**

Useful   **Not Useful**

1	2	3	4	5	6	7

═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Q11. **Using the EZ-Link card for Non-Transit services should be….**

The Norm						Not the Norm
1	2	3	4	5	6	7

Q12. **Most people who are important to me think that _____ use the EZ-Link card for the Non-Transit services.**

I should						I should not
1	2	3	4	5	6	7

Q13. **It is expected of me to use the EZ-Link card for Non-Transit services.**

Strongly agree						Strongly disagree
1	2	3	4	5	6	7

Q14. **The people in my life whose opinions I value would _____ of me using the EZ-Link card for Non-Transit services.**

Approve						Disapprove
1	2	3	4	5	6	7

Q15. **For me to use the EZ-Link card for Non-Transit services would be _____ .**

Impossible						Possible
1	2	3	4	5	6	7

Q16. **If I wanted to I could use the EZ-Link card for Non-Transit services.**

Definitely true						Definitely false
1	2	3	4	5	6	7

═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Q17. **How much control do you believe you have over the use of EZ-Link card for Non-Transit services?**

No control						Complete control
1	2	3	4	5	6	7

Q18. **It is mostly up to me whether or not to use the EZ-Link card for Non-Transit services.**

Strongly agree						Strongly disagree
1	2	3	4	5	6	7

Q19. **I want to use the EZ-Link card for Non-Transit services.**

Extremely unlikely						Extremely likely
1	2	3	4	5	6	7

Q20. **I hope to use the EZ-Link card for Non-Transit services.**

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Q21. **I will use the EZ-Link card for Non-Transit services only.**

Strongly disagree						Strongly agree
1	2	3	4	5	6	7

Q22. **What is your Occupation?**

Office Worker	Field Worker	Shift Worker	Homemaker	Retiree	Student	Others (Specify)

Q23. **In which age group are you?**

15 to 18 years	19 to 22 years	25 to 35 years	36 to 59 years	60 and above

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══════ **Use of EZ-Link Card for Non-Transit Services** ══════

Q24. **What type of EZ-Link Card are you using?**

Adult	Senior Citizen	Student	Tertiary	National Service

Q25. **In which income group are you?**

Below $1,000	Below $3,000	Below $5,000	Above $5,000	Not Applicable

Hand the interviewee the pen and thank them for their time.

Now, complete the following information:

Gender of interviewee

Male	Female

Interviewer : _____

Location : _____

Day : _____

Date : _____

Time of day : _____

Additional Instructions for Pilot Study – 18 Dec 04 to 22 Dec 04:

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Michael

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		M		M		M	
2	F		F		F					
3	M									
4	F									
5	M									

JP Yeo

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		M		F		M	
2	F				F		M			
3	M									
4	F									

Appendix 6

The University of Western Australia
The Graduate School of Management

A Survey on the Use of EZ Link Card for Transit and Non-Transit Systems in Singapore

Who will be carrying out the Survey Interview

I will be assigning Transit Link Technicians who are currently maintaining all the sales machines at MRT stations and bus interchanges. They are familiar with the Transit environment and it would be easy to instruct them to conduct the pilot survey interview. The 10 MRT stations (Raffles Place, City Hall, Pasir Ris, Tampines, Bedok, Orchard, Ang Mo Kio, Bishan, Sengkang and Yishun) will provide a good representation of views from the general Singaporeans since the stations selected are at regional/satellite towns, business district and shopping district.

A total of 300 customers will be interviewed. I will engage a total 10 Technicians to carry out the interview. I will be assigning the number of customers to be interviewed by each Technician.

Instructions to Interviewer for the Final Survey

Based on the pilot study and refinement to the questionnaire, if necessary, a final survey interview will be carried out on 300 Transit Customers to determine what are the factors that would encourage existing EZ-Link customers to use the same card for Non-Transit (eg. MacDonald, Food Court, Taxi, etc.) services.

In the final survey, a total of 300 EZ-Link customers (200 Adults, 15 Senior Citizens, 50 Students, 20 Tertiary Students and 15 National Service men) will be interviewed based on the survey form attached with these instructions. I am asking you to interview **five** categories of customers, Adult, Senior Citizen, Student aged 15 or over, Tertiary Students (Polytechnic / University) and National Service man. You will be assigned the number of customers to be interviewed

How to identify the different categories of EZ-Link Customers?

1. We are looking for a mix of males and females in each fare category. They will need to have about 15 minutes to answer the questionnaire, so approach only those people who appear to have time to respond. Approach the person who you think will be a suitable interviewee and ask them if they would be willing to participate in an interview about the EZ

Link card for 15 minutes. If they say no, thank them for their time and wish them a pleasant day/evening.

2.   If they say yes, ask them which type of card they hold: Adult, Senior Citizen, Student, Tertiary and National Service (NS). If they do not hold a card, or if you have already interviewed someone that holds that card type, tell them that you have already interviewed your quota of people with that type of card, thank them for their time and wish them a pleasant day/evening.

3.   If the Customer is a Student cardholder, ask how old they are. If they are under 15, tell them that we are only interviewing students 15 or over at this time, thank them for their time and wish them a pleasant day/evening.

How to conduct the interview?

Once the customer is identified, explain the reason why the survey is being conducted in more detail. Show them the following:

1.   Letter inviting participation. Explain that the survey is being conducted on behalf of Mr Chandra Segaran who is a doctoral student at the University of Western Australia under the supervision of Professor Jane Klobas. Give them time to read the letter.

2.   Give them the Information Sheet (this is for the participant to keep). Emphasise the key elements of the Information Sheet: that the survey should take about 15 minutes, that their replies are anonymous, that they are welcome to stop answering questions at any stage during the interview and ask that their response be destroyed, and that they can contact Mr Chandra Segaran, Professor Klobas, or the Human Research Ethics Committee at the University of Western Australia if they have any questions or comments. *Give them time to read the details in the Information   Sheet.*
Ask if there are any questions, and answer them using the words in the information sheet. If you cannot answer a question, thank the Customer for their time, and ask them to refer their question to Mr Chandra Segaran, Professor Klobas, or the UWA Ethics Committee as appropriate. Do not continue with the interview in this case.

3.   Ask if they are happy to continue with the interview. If they answer no, please thank them for their time and wish them a pleasant day/evening.

4. If they answer yes, mark M (Male) or F (Female) in the appropriate box below to record the category and sex being interviewed. Remember that, for this pilot study, you need to interview one person who holds each card type.

No	Adult	Senior Citizen	Student, 15 or over	Tertiary	National Service
1	M				
20		F			

Note: Please indicate Male (M) or Female (F) after you have interviewed (see example above)

5. Now, continue to the interview. Ask the participant the questions in the survey form. Show them the answer sections of the sheet and ask them where to put their answer. Put a cross in the appropriate box to indicate the answer.

6. <u>At the end of the interview</u>, please present the participant with the pen and say "Thank You for your valuable time" and wish them a pleasant day/evening.

7. <u>After the interview</u>, complete all the summary details required on the final page before approaching another potential interviewee.

8. Once the forms are completed, please handover the form to me <u>within 3 days</u>. This will allow me to identify potential gaps in the completed forms. In the event, the form is partially complete, you will be required to interview another candidate. I will brief you on all the issues in the previous interview. I will discard the incomplete form.
.

Additional Instructions for Final Survey (2nd batch: 28 Jan to 5 Feb 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Michael

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		M		M		M	
2	F		F		F					
3	M									
4	F									
5	M									

JP Yeo

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		M		F		M	
2	F				F					
3	M									
4	F									
5	M									

Din

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		M		M		M	
2	F				F		F			
3	M									
4	F									
5	M									

Poh

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		M		M		M	
2	F									
3	M									
4	F									
5	M									

Zyed

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		F		F			
2	F									
3	M									
4	F									
5	M									
6	M									

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Additional Instructions for Final Survey (3<u>rd</u> batch: 17 Feb 05 – 24 Feb 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Michael

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service		
1	M		M		M						
2	F		F		F						
3	M		M		M						
4	F		F		F						
5	M										
6	M										
7	F										
8	M										
9	F										
10	M										

JP Yeo

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service		
1	M		F		M						
2	F		M		F						
3	M				M						
4	F				F						
5	M										
6	F										
7	M										
8	F										
9	M										
10	F										

Din

No	Adult	Senior Citizen	Student, 15 or over	Tertiary	National Service
1	M	M	M		M
2	F	F	F		
3	M		M		
4	F		F		
5	M				
6	F				
7	M				
8	F				
9	M				
10	F				

Poh

No	Adult	Senior Citizen	Student, 15 or over	Tertiary	National Service
1	M	F	M	M	M
2	F	M	F	F	
3	M				
4	F				
5	M				
6	F				
7	M				
8	F				
9	M				
10	F				

Zyed

No	Adult	Senior Citizen	Student, 15 or over	Tertiary	National Service
1	M	M	F	F	
2	F	F	M	M	
3	M				
4	F				
5	M				
6	M				
7	M				
8	F				
9	M				
10	F				
11	M				
12	M				

Additional Instructions for Final Survey (4th batch: 25 Feb 05 to 7 Mar 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Michael

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M				M					
2	F									
3	M									
4	F									
5	M									
6	M									
7	F									
8	M									
9	F									
10	M									
11	M									
12	F									
13	M									
14	F									
15	M									
16	M									
17	F									
18	M									
19	F									
20	M									
21	F									
22	M									

Additional Instructions (4th - 25 Feb 05 to 7 Mar 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

JP Yeo

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M				M					
2	F									
3	M									
4	F									
5	M									
6	M									
7	F									
8	M									
9	F									
10	M									
11	M									
12	F									
13	M									
14	F									
15	M									
16	M									
17	F									
18	M									
19	F									
20	M									
21	F									
22	M									
23	F									

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

 Din

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		M					
2	F				F					
3	M				M					
4	F									
5	M									
6	M									
7	F									
8	M									
9	F									
10	M									
11	M									
12	F									
13	M									
14	F									
15	M									
16	M									
17	F									
18	M									
19	F									
20	M									
21	F									
22	M									
23	F									
24	M									
25	F									
26	M									
27	F									

Additional Instructions (4th - 25 Feb 05 to 7 Mar 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Poh

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		M					
2	F				F					
3	M				M					
4	F				F					
5	M				M					
6	M									
7	F									
8	M									
9	F									
10	M									
11	M									
12	F									
13	M									
14	F									
15	M									
16	M									
17	F									
18	M									
19	F									
20	M									
21	F									
22	M									
23	F									
24	M									
25	F									
26	M									
27	F									

Additional Instructions (4th - 25 Feb 05 to 7 Mar 05):

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Zyed

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M		M				M	
2	F				F					
3	M				M					
4	F				F					
5	M				M					
6	M				F					
7	F									
8	M									
9	F									
10	M									
11	M									
12	F									
13	M									
14	F									
15	M									
16	M									
17	F									
18	M									
19	F									
20	M									
21	F									
22	M									
23	F									
24	M									

Additional Instructions for Final Survey (5th batch: 8 March 05 to 16 March 05)

Interview the appropriate category and sex (Male – M or Female – F) listed in the table.

After the interview, mark a tick in the appropriate boxes.

Michael

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		M							
2	F									
3	M									

JP Yeo

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		M					
2	F									
3	M									

Din

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	M		F		F					
2	F									

Poh

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1					M		M		M	
2							F			

Zyed

No	Adult		Senior Citizen		Student, 15 or over		Tertiary		National Service	
1	F				F		M		M	

Questionnaire Form For The Final Survey

═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Please cross <u>one</u> of the appropriate box for the preferred answer | X |

Q1. **Would you use your EZ-Link card for Non-Transit services?**

No ☐ *Go to question 6*

Yes ☐ *Continue*

Q2. **Which type of Non-Transit services are you likely to use?**
 (<u>more than one box</u> can be crossed)

Buy Movie Ticket	
Fast Food Outlet (Mac, Burger King, KFC, etc.)	
Taxi	
Pay for Card Park Fee	
Buy Book/Stationary/Magazine/Newspaper	
Pay Entrance Fee to places of interest (Zoo, Birdpark, Sentosa, etc.)	
Purchase groceries from supermarket (eg. NTUC, 7-eleven, Econ Mini Mart, Cold storage, etc.)	
Photocopy/Photo services	
Others (specify)	

Q3. **For up to what value would you use your EZ-Link card for Non-Transit services?**

Less than $5	Less than $10	Less than $15	Less than $20	Less than $30	Other Values (specify)

Q4. **Would it be more attractive to use your EZ Link card for Non-Transit services if a loyalty scheme is offered for Non-Transit services?**

No ☐ **Yes** ☐ **(if yes, please indicate what type of loyalty scheme would be attractive. You may select more than one)**

Outright discount at selected stores	Bonus points for redemption of gifts	Priority booking of tickets (eg. movie, plays, etc.)	Others (specify)

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═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Q5. **Would you increase your remaining value in your EZ-Link card to use for Non-Transit services and by how much?**

No ☐   **Yes** ☐ **(if yes, please indicate the amount below)**

$10	$20	$30	$40	$50	Other Values (specify)

Q6. **Whether or not you believe you would use the EZ Link card for non-transit services, we are interested in what you think about the card. Please tell us what you think…**

I would find using the EZ-Link card for Non-Transit services…

Risky   **Safe**

1	2	3	4	5	6	7

Q7. **Most people who are important to me think that _____ use the EZ-Link card for the Non-Transit services.**

I should   **I should not**

1	2	3	4	5	6	7

Q8. **For me to use the EZ-Link card for Non-Transit services would be _____.**

Impossible   **Possible**

1	2	3	4	5	6	7

Q9. **I would find using the EZ-Link card for Non-Transit services…**

Easy   **Difficult**

1	2	3	4	5	6	7

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═════════ **Use of EZ-Link Card for Non-Transit Services** ═════════

Q10. **I want to use the EZ-Link card for Non-Transit services.**

Extremely						**Extremely**
unlikely						**likely**
1	**2**	**3**	**4**	**5**	**6**	**7**

Q11. **I will not use the EZ-Link card for Non-Transit services.**

Strongly						**Strongly**
disagree						**agree**
1	**2**	**3**	**4**	**5**	**6**	**7**

Q12. **I would find using the EZ-Link card for Non-Transit services…**

Fast						**Slow**
1	**2**	**3**	**4**	**5**	**6**	**7**

Q13. **How much control do you believe you have over your use of EZ-Link card for Non-Transit services?**

						Complete
No control						**control**
1	**2**	**3**	**4**	**5**	**6**	**7**

Q14. **The people in my life whose opinions I value would _____ of me using the EZ-Link card for Non-Transit services.**

Disapprove						**Approve**
1	**2**	**3**	**4**	**5**	**6**	**7**

Q15. **I would find using the EZ-Link card for Non-Transit services…**

Not						**Trendy**
Trendy						
1	**2**	**3**	**4**	**5**	**6**	**7**

Questionnaire Form For The Final Survey

═══════ **Use of EZ-Link Card for Non-Transit Services** ═══════

Q16.   I could use the EZ-Link card for Non-Transit services, if I wanted to.

Definitely true   **Definitely false**

1	2	3	4	5	6	7

Q17.   I would find using the EZ-Link card for Non-Transit services….

Not Useful   **Useful**

1	2	3	4	5	6	7

Q18.   Using the EZ-Link card for Non-Transit services should be….

The Norm   **Not the Norm**

1	2	3	4	5	6	7

Q19.   I hope to use the EZ-Link card for Non-Transit services.

Strongly Agree   **Strongly Disagree**

1	2	3	4	5	6	7

Q20.   It is expected of me to use the EZ-Link card for Non-Transit services.

Strongly agree   **Strongly disagree**

1	2	3	4	5	6	7

Q21.   It is mostly up to me whether or not to use the EZ-Link card for Non-Transit services.

Strongly agree   **Strongly disagree**

1	2	3	4	5	6	7

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═══════ Use of EZ-Link Card for Non-Transit Services ═══════

Q22.   I will use the EZ-Link card for Non-Transit services.

Strongly disagree						Strongly agree
1	**2**	**3**	**4**	**5**	**6**	**7**

Q23   What is your Occupation?

Office Worker	Field Worker	Shift Worker	Homemaker	Retiree	Student	National Service	Others (Specify)

Q24   In which age group are you?

15 to 18 years	**19 to 24 years**	**25 to 35 years**	**36 to 59 years**	**60 and above**

Q25.   What type of EZ-Link Card are you using?

Adult	**Senior Citizen**	**Student**	**Tertiary**	**National Service**

Q26   In which income group are you?

Below $1,000	**Below $3,000**	**Below $5,000**	**Above $5,000**	**Not Applicable**

Hand the interviewee the pen and thank them for their time.

Now, complete the following information:

Gender of interviewee

Male	**Female**

Interviewer: _____   **Location:** _____

Date: _____   **Day:** _____   **Time of day:** _____

Survey Form Allocation Table to the Technicians

Name	Stages	Adult	Snr C	Student	Tertiary	NS	Total
Michael	Pilot	5	2	2	1	1	11
	2nd	5	2	2	1	1	11
	3rd	10	4	4	0	0	18
	4th	22	0	1	0	0	23
	5th	3	1	0	0	0	4
	Total	45	9	9	2	2	**67**
J P Yeo	Pilot	4	1	2	2	1	10
	2nd	5	1	2	1	1	10
	3rd	10	2	4	0	0	16
	4th	23	0	1	0	0	24
	5th	3	1	1	0	0	5
	Total	45	5	10	3	2	**65**
Din	Pilot	0	0	0	0	0	0
	2nd	5	1	2	2	1	11
	3rd	10	2	4	0	1	17
	4th	27	1	3	0	0	31
	5th	2	1	1	0	0	4
	Total	44	5	10	2	2	**63**
Poh	Pilot	0	0	0	0	0	0
	2nd	5	1	1	1	1	9
	3rd	10	2	2	2	1	17
	4th	27	1	5	0	0	33
	5th	0	0	1	2	1	4
	Total	42	4	9	5	3	**63**
Zyed	Pilot	0	0	0	0	0	0
	2nd	6	1	1	1	0	9
	3rd	12	2	2	2	0	18
	4th	24	1	6	0	1	32
	5th	1	0	1	1	1	4
	Total	43	4	10	4	2	**63**
	Pilot						**21**
	Final Survey						**300**

Feedback from the Technicians on the Final Survey

Category	Questionnaire	Language	Other issues
Senior Citizen	80% assisted by interviewer to translate - Too long & many pages - Questions appear to be repeated - Range should not be more than 5 and should be yes or no only (80% of respondent)	- Language used – Chinese (Mandarin, Toewchew, Cantonese, Hockien), Malay - Lower educated	- No objection to spend time (have time to spare) - Is the survey done by government? - Are you going to increase the transport fare? - Souvenir not useful to them - Concern of over-deduction of fare (i.e. current problem in bus) - Up to 80% prefer to use NETS instead of topping ez-link card before using it at NTA outlets
Adult	- Language used – English - Too long & many pages - Questions appear to be repeated - Range should not be more than 5 and should be yes or no only (80% of respondent) - Prefer questionnaire on one side and range by the side to reduce page - Spend 10 mins generally, 5 mins by 2% (decided what they one)	- Generally all use English - Language used – Chinese (Mandarin), Malay – about 5% with lower education such as cleaner, etc., Indian usually use English	- Try of avoid being selected (i.e. impression of insurance agent and other product survey interviewer) 10% concern of over deduction of fare (i.e. current problem in bus) - Up to 10% prefer to use NETS instead of topping ez-link card before using it at NTA outlets - No comments about the souvenir
Student & Tertiary	- Language used – English - Too long & many pages - Questions appear to be repeated - Range should not be more than 5 and should be yes or no	Generally all use English	- Souvenir very useful and this encouraged their friends to participate in the survey - About 5% asked when will the ez-link card be used in NTA
National Service	- Language used – English - Too long & many pages - Questionnaire appear to be repeated Range should not be more than 5 and should be yes or	Generally all use English	- No comments about the souvenir - Generally no time because they are going back to camp or home - They highlighted the ez-link card to be used in NTA is similar to e-mart card issued by SAF (i.e. about $200 top-up in the card for NS reservist to purchase shoe, shorts for in-camp training)

Feedback from the Technicians on the Final Survey (Con't)

Category	Questionnaire	Language	Other issues
General comments	• Alright to administer the length of questionnaire	• Generally all use English	• Easy to interview Senior Citizen • Difficult to interview Adult & NS man • Instructions to interviewer is sufficient • Interviewer felt they are not professional in the job though they have done the job well • About 5 surveys were done per day • 300 survey should be sufficient and any more could be taxing • Given the choice to select respondent anywhere in the transport system was good. • The occupation category could be further improved to include • Survey done by TL techs gives more confidence to the respondents then if other 3rd party carried it out. • Interviewers ensure the forms are completed before singing off. • Survey done during the free period when the sales machine is being brought back to service after a fault. Customer chooses to wait for the machine to be in operation and the 10 mins is sufficient to complete the questionnaire.